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INDEX TO VOLUME CXI

January 1 to June 30, 1921

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INDEX TO VOLUME CXI

January 1 to June 30, 1921

EXPLANATORY NOTE

Illustrated articles are denoted by an asterisk (*); book notices by a dagger (†).

This index is made comprehensive but concise. Pains are taken to bring together matter belonging to the same subject so that when a reader looks up an article he will be cited to related data. Series of simple page numbers following names of mines or companies usually refer to news notes. With a major entry or series of entries may be placed several minor ones, relating to the same subject in order that its history may be followed. If the author's name be known it is the simplest means of reference. Productions are indexed under names of metals and countries or states. The mere juxtaposition of a mineral and geographical name usually signifies an output but may cover other statistical or news matter. Not all news are indexed but a liberal selection of them is made.

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> "Now that the Rebellion is overthrown, and we know pretty nearly the amount of our National debt, the more gold and silver we mine we make the payment of that debt so much easier."—*Abraham Lincoln, April* 14, 1865.

"Their Prosperity Is the Prosperity of the Nation"

A FEW HOURS before Lincoln was assassinated, he sent to the miners in the West the message printed above, which, like all of Lincoln's utterances, reads like an inspired message to posterity. Lincoln was not an economist, nor yet a banker. He knew a shinplaster for what it was worth as paper and as a temporary I O U to make-shift through a period of poverty. His message continued:

"Now I am going to encourage that in every possible way. We shall have hundreds of thousands of disbanded soldiers, and many have feared that their return home in such great numbers might paralyze industry by furnishing, suddenly, a greater supply of labor than there will be demand for. I am going to try to attract them to the hidden wealth of our mountain ranges, where there is room enough for all. Immigration, which even the War has not stopped, will land upon our shores hundreds of thousands more per year from overcrowded Europe. I intend to point them to the gold and silver that wait for them in the West.

"Tell the miners for me that I shall promote their interests to the utmost of my ability; because their prosperity is the prosperity of the nation; and," said he, his eye kindling with enthusiasm, "we shall prove, in a very few years, that we are indeed the treasury of the world."

Our statesmen today would do well to ponder upon Lincoln's financial policy, and his clear conception of what constitutes money and the solid basis of finance. His words constitute a recommendation of the McFadden Bill now asking the action of Congress, and designed for the stimulation of our gold production. If our Government will now take this means to artificially stimulate a waning gold production which has been artificially diminished by the vast issues of paper money, and will take steps to see that the gold so won is not converted into jewelry, and thus hoarded so as to be useless to our finances, it will be working in the most efficient way toward a return to sound conditions, stable instead of chaotic prices, a firmer basing of commodities and wages on the law of supply and demand, and the quieting of industrial unrest. So long as we do not clearly see that a healthy condition of our finances and the world's finances depends on *less paper and more gold and silver*, we shall be treading a [illegible] path on which the clear sight of Lincoln would not have allowed him for a moment to venture.*

---

*The quotation is from [illegible] Yarns and Stories" by A. K. McClure, and was [illegible] by Mr. H. K. [illegible] of Cleveland.

The Use of Lobbies

SENATOR THOMAS, of Colorado, in a speech before the American Mining Congress in Denver, said that there were one hundred and twenty-five organized lobbies in Washington, of which the Mining Congress was one. We do not think he meant more than at most a humorous complaint in this statement, nor do we believe that it was resented by the officials of the Mining Congress.

The Federated American Engineering Societies, in their headquarters at Washington, plan, in the same sense, to carry on an organized lobby at the doors of Congress and the rest of the Federal Government. As the Mining Congress plans to furnish information to our Federal legislature concerning the conditions in the mining industry, and bring the necessities of the industry forcibly to their attention, just in the same way the Federated Engineering Societies plan to push the prominence of the engineer in government, and to "sell" the engineering idea to Congress.

Many similar essential lobbying organizations are multiplying and strengthening their positions in Washington. The farmers' organization is acquiring suitable quarters, the labor organizations have long been established with ample equipment, and the railroad workers have their elaborate establishment. Formerly, the lobbyist was the representative of some special corporation or group of corporations who sneaked down to Washington and tried to bribe a legislator into doing the right or the wrong thing, according to circumstances. This crude beginning has been organized, made open and above board, and resolved itself into an unofficial, but none the less powerful, representative of our industrial groups at Washington, surrounding and complementing our constitutional government, and, together with it, making up, as a result of this process of evolution, a new or modified form of government, which combines the idea of industrial group representation with the democratic ideal of government representation according to population, which rests on the theory that basically a man is a man before he is anything else.

What Is Interesting Mine Managers

RECENTLY we had an opportunity of listening to the manager of a large company operating a low-grade copper deposit, on the things that were of most interest to him. "I am interested," he said, as he shifted and made orderly a pile of papers on his desk, "first in human relationships, in labor and how to handle it under existing circumstances. I am also vitally interested in finding more ore." Speaking further, he called our attention to the importance of the ore supply in relation to continuing the enterprise in which he was interested.

"Do you know what this enterprise means to our workers?" he asked. "It is their living. They have established their homes with us. The continuance of our enterprise is vital to them. Fortunately for them, we have opened up new ore horizons, and I can see a good future ahead."

There are few mine managers who have not had labor troubles and who have not had to put their best thought to the solution of the intricate questions that labor organizations have raised. The maintenance of ore supply is essential to the mining industry, for without it there would be no labor or other problems. Probably no other question is so important. Scientific prospecting and persistent effort are necessary to the end that the possibilities of a given area be thoroughly exhausted. No one realizes this better than the experienced manager, and it is a common-sense directorate that will apportion a goodly share of the net proceeds toward prospecting and developing the more promising parts of its property. As the manager has said, labor has a real interest in the enterprise, and active co-operation is essentially in its own interest.

The Play Factor in Mining Efficiency

AS AN ELEMENT contributing to his success, the technical man who has cultivated latent abilities as a raconteur and entertainer has an advantage over one who is unable to be anything more than a listener. A good story will go far in making the listeners remember not only a man's name but his personality. We are of the opinion that young engineers are likely to underrate this ability. It is, however, a distinct asset.

We know one young graduate who was immediately scooped up by a mining company because he was a good baseball pitcher. His particular work was to pitch pebbles into a tube mill. Not an especially elevating task for a technical graduate, but, nevertheless, a "starting job." As a more spectacular part, he pitched ball for the company's baseball team, and succeeded in winning from the rival teams of other companies. Baseball and other athletic teams have a considerable value in affording entertainment of a kind that the workers in a lonesome mining camp appreciate.

Mark Twain said, "It's the contrast that makes the joy of living." Some foil is thus necessary, to the never-ending work that a mining camp engenders. The further away from the city, the more important does this entertainment factor become. Life must be made worth living. We do not advocate the inclusion of a new course on the art of entertaining for mining schools, but we may properly emphasize the importance of this factor to the young man entering the mining industry. American companies operating in foreign countries often make particular inquiry in respect to the candidate's "mixing" and entertaining abilities, and selection is not solely on the basis of technical ability.

The Wave of Crime

THE usual era of crime which follows great wars has long been in evidence. Even the accumulated legends of the Wild West sink into piffling insignificance beside what actually goes on daily in our great centers of population. Can you remember the time when the robbing of a country bank or the hold-up of a train made Jesse James or the Younger brothers national figures, celebrated in song and dime novels? It seems strange to look back on such pikers, and to think they distinguished themselves for what is now the customary thing. In New York since Jan. 1, 1920, there have been more than 325 hold-ups, robberies, and thefts, working a property loss of more than three and a half million dollars; and the unsolved murders alone total more than 100.

Not the least symptom of the drifting of moral anchors is the announced program of a strong organization of clergymen to revive and enforce the ancient state blue laws and to strengthen them by Federal enforcement of a strict or "blue" sabbath. All levity and amusements will result in fines and imprisonment; exercise will be prohibited; Sunday school will be made compulsory for children, and presumably church for adults. Dr. Burrell, one of the officers of the Lord's Day Alliance, and president of the Anti-Saloon League of New York, in announcing the campaign for these acts of oppression, also includes late rising on Sundays in his list of misdemeanors. "Our nights were given for sleep," he says, and adds that to lie abed Sunday mornings is "simply to rob the Lord of a portion of his time in which He has reserved a proprietary right."

What wave of planetary evil has brought forth this outbreak of madness in an ignorant and violent section of the priesthood, in the endeavor to strike at the foundation of the liberty and progress of their country? Like the Bolsheviki in Russia, it is improbable that their followers number over a few per cent of the population, yet the lesson of the Bolsheviki shows that a fanatic handful may impose their tyrannical will over a vast unprepared population.

Gold Coins at a Premium?

THE New York *Times* of Dec. 21, in commenting on the Government's policy in preventing the issue of gold pieces by banks for Christmas presents, says:

"What is being done is the exercise of reason and persuasion when people ask for gold pieces, but the little tokens are not absolutely unprocurable. In some cases, it is reported, banks have allowed clients to have the coins, but have charged a premium for each one. This, however, is not a general practice."

We have no knowledge whether or not the reported charging of a premium on gold is correct; but it is quite in line with the policy of the Government and the banks in restraining gold from circulation, and so putting on it a premium, whether or not that has been translated by some of the banks in an unwary moment into an actual quotation. The method of the bankers' exercise of "reason and persuasion" when people ask for a five-dollar gold coin reminds one of the nursery ditty:

"There was an old man, and he had an old cow,
And he had no fodder to give her;
So he took up his fiddle and played her this tune:
'Consider, good cow, consider—
This is no time for grass to grow;
Consider, good cow, consider.'"

And yet the bankers say we have too much gold already.

Paternalism at Rio Tinto

CONDITIONS at Rio Tinto, Spain, that led to the strike of last July, were described recently in the *Sun*. Apparently the question of wages was not the real cause of the labor dispute that shut down this famous camp. Rather, it was because the preponderant influence of the Rio Tinto Co. over the civil conditions of the community "resulted in a supervision over the private lives of the workers that they found particularly galling," if we may believe the news dispatch from Madrid referred to. "With the strike came inquiries as to the conditions at the mines that were revealing," says the *Sun*. "The miners lived in rows of gardenless houses, for which they paid a rent that, if capitalized, would purchase the house annually. Family events such as births, deaths and weddings had to be notified to the company, and a dweller on the company's domain had to get permission before he could invite even a relative to his house." In view of the progress that has been made in welfare or industrial relationship work, one hesitates to believe that a great company would permit such conditions to exist, particularly one employing such highly sensitive people as Spaniards are. The don has always had a reputation for being haughty, and perhaps those at Rio Tinto actually prefer starvation to paternalism, as the *Sun* put it. If the latter's report be correct, the Rio Tinto management has something to learn about handling men. However, it will probably be found that the company's side of the matter has not been fairly presented. It is difficult to determine from the report given whether the trouble had its origin in welfare work improperly conducted or in no welfare work at all.

Competition for Labor

THERE exists in California a seasonal demand for labor from the farms and horticultural areas. In the mining, petroleum, and manufacturing industry the large proportion of workers are steadily employed. The competition for labor by the industries artifically stimulated by war conditions produced great interference with the unstimulated industries. A mounting scale of wages drew workers where the demand for their services was greatest, at the expense of other industries which were not readily able to meet the new conditions. A mine with reserves of rich ores could have maintained its status by meeting the increased scale, but as many mining properties in California are essentially low-grade mines, it was impossible for most to make the necessary adjustments.

The seasonable demand for labor also raised wages. There was thus established a high level of prevailing wage scales which operated with particular hardship upon all industries where margins were small and readjustment was difficult. One large oil-producing and refining company, we are reliably informed, increased its wage scale 10 per cent over the wage scales of its competitors, with the result that it was full handed while its competitors were under the necessity of conforming to the higher scale established. Not only did this work a hardship to oil companies, but it had its influence upon other neighboring industries.

We believe in high wages but we also believe that it is unwise for one mine in a given region or one industry to increase its wage to the extent of forcing a readjustment along similar lines in other industries whether related or not. There has been a steady decrease in the number of workers in the mining industry in California. High costs and competitive demand for ordinary labor have contributed to draw the workers into other industries. It will not be easy to re-establish mine-labor crews when commodity prices have reached a low enough level to enable the mines which have suspended to resume.

Just at present unemployment is beginning to appear. In some parts of the United States it has become especially noticeable. The immediate effect of this will be to make it easier to obtain workmen. Normally there will be a necessary interval before efficient and dependable working crews have been established. This condition applies more especially to gold and copper mines and less so to the dredging industry. In spite, however, of the gloomy retrospect and the immediate difficulties of the present, the upward turn is believed to have been reached.

WHAT OTHERS THINK

Further Notes on the Gold Deposits of the Southern Appalachians

INASMUCH as I have spent the greater portion of the last six years in the southern Appalachians, H. A. Megraw's recent article on the gold situation of that region was of particular interest. His article seems to have touched the keynote of the conditions, and, in this short space, I can but second his conclusions as to the present status of gold mining there.

The gold deposits of that section of the United States fall under several different heads, but only what is popularly known as the Dahlonega gold belt will be discussed here. This belt has been traced from Alabama to Virginia and strikes North 40-50 East. It lies in the foothills southeast of the main backbone of the Blue Ridge Mountains, as the Appalachians are called in this section, varies in width from a few thousand feet to seven miles, and, in general, parallels the main folding of the range. It attains its maximum width at Dahlonega, Lumpkin County, Ga., at which place the greatest mining activity has occurred.

Fissuring took place along this belt during the uplift of the mountains. The belt itself is generally confined between two pronounced formations of hornblende gneiss, the outcroppings of which are pronounced. Between these lie the gold-bearing fissure-veins and mineralized zones which, in the main, parallel each other and the hornblende gneiss walls. These veins appear to have in general a steep dip, though the absence of deep mining operations precludes this being considered an established fact.

The occurrence of gold may be divided into four classes: Placers; free-milling quartz veins generally free from sulphides; non-free-milling veins; and mineralized zones in schist.

The placers are fluvial and most of the bottom land has been rich in these. They have been worked extensively, especially where water could be obtained easily. Dredging, I believe, has been tried only twice. In one case operation was suspended owing to the claim that gold could not be recovered because of the extreme softness of the bedrock, and from what can be learned the other operation met failure owing to the inexperience of the men conducting the work. One of the most self-evident objections to the use of a boat is the small acreage obtainable for a set-up. Most of the small placers, the secondary drainage areas and benches, are very streaky. The obvious way is to work these as the old-timers handled them, by ground sluicing. However, unless water is on the property or can be brought for other reasons than working the placers alone, the smaller placers are not of sufficient value to be exploited.

Outcroppings are not numerous, owing to the soft condition of the bedrock. Prospecting is generally done by surface panning until the lead is cornered, after which a series of open cuts is made to uncover it. The country rock has weathered in place to a depth of from fifty to two hundred feet, forming a sticky clay, and to this clay the loss of gold in milling and sluicing can be attributed, though the native blames it to flour gold. The gold is fine, 990 or better, and many handsome specimens are to be found. In White County, Ga., at the Loud mine, handsome crystallized gold nuggets are found.

In the main, the free-milling quartz veins are small, pockety, and shooty. They are free from sulphides generally, except galena. The galena occurs scattering and in small streaks, and is used as an indicator in tracing gold streaks and pockets. These veins are numerous, and in a space of one hundred feet across the belt I have counted eighteen of such leads. The stranger in the district will note the absence of intelligent prospecting, and should always bear in mind that, no matter how good a vein looks where uncovered, this is a country of pocket leads, and only a thorough test for persistency in richness and strike means anything here. Surface slipping is common, and the idea prevalent among the natives is that the deposits are shallow. This conclusion may be attributed to the fact that most of the natives are untrained, and when they have gone down on a vein it has pinched, owing to this faulting.

The sulphide veins are generally wider than the free-milling and of more even gold tenor. They carry considerable arsenopyrite. This type of ore has been a stumbling block, flouring quicksilver and sliming gold.

The last type of vein (the mineralized zone in schist) apparently is like that in the La Luz and Los Angeles mine, in Nicaragua, described in a recent copy of the *Engineering and Mining Journal.* These belt leads generally appear as a different colored "slate" in the formation. The walls are usually parallel and defined by a change in color, and may be a few inches apart or twenty feet. Within this belt is a confused mass of stringers running in all directions. These appear on the face as black etchings or at times may be small quartz veins. They generally show the presence of microscopic sand. These small stringers in some instances widen out and form pockets of coarse gold. I have sampled breasts of this type of lode that panned gold every inch across an eighteen-foot face.

As before mentioned, the softness of the country rock lends itself to hydraulic mining. Water is abundant and the rainfall sufficient to keep the local streams well supplied. The damming and ditching of streams is not expensive and water can be brought on to the property easily. One property now under development obtained ten second-feet of water under a general working head of 175 ft. by going only slightly over three miles.

The practice is to clear the surface of the ground along the outcrop, start an open cut, and follow the vein by an open pit. The hanging wall is washed away, leaving the vein lying on the foot wall, from which it is broken down, at intervals, and its entire content washed to settling boxes at the mill. The mill is generally operated by water power, and when it cannot obtain the ore by gravity, a hydraulic lift is installed to elevate water and ore from cut to mill. The general practice has been to use light, 450-lb. stamps.

Boston, Mass. JAMES FRAME.

Regarding New Caledonian Nickel

We notice the letter of the United States Nickel Co. in *Engineering and Mining Journal* of Aug. 14, commenting on some notes reprinted from our columns. So far as the firm of Ballande & Son is concerned, we had no intention of denying that M. Ballande was an "existant person"; it would be foolish on our part to do so, as the firm is well known in Australia. It is, however, the general belief, both in New Caledonia and Australia, that this firm is allied in some way with a Roman Catholic order of priests. This may be difficult to prove, but, on the other hand, the original statement was not disputed. In any case, we cannot see that it makes very much difference one way or the other.

There is one inaccuracy, a comparatively slight one, in the original statement; viz., that the nickel company "has recently taken over the electric furnaces installed by the Haut Furneaux Co. at Noumea." We understand that the nickel company, or some of its subsidiaries, took over the hydro-electric installation of the Haut Furneaux Co. The nickel company, we understand, is proceeding with its proposals for the installation of electric furnaces to produce ferronickel. The Haut Furneaux (or Ballande's) furnaces at Noumea are of the blast-furnace type. With that correction the original statements are to the best of our knowledge in order.

EDITOR,
Chemical Engineering and Mining Review.

Throttling the Prospector

In an interesting article by H. A. Megraw entitled "Gold Mining in the Southern States," which was published in *Engineering and Mining Journal* of Nov. 13, 1920, after describing the resources of the southern Appalachians in that metal, and the decadent condition of the gold-mining industry there, the writer, endeavoring to account for the latter, mentions three factors which, in his opinion, have opposed the successful carrying out of extensive operations in recent years. The first of these he states is "the law," as to which he remarks:

"The mining code [doubtless meaning the Federal Mining Law] does not exist in the South, where the landowner is also master of whatever is within or beneath it. This discourages prospecting. No one will search for mineral deposits, because, even if he finds them, he has no commercial interest in his discovery except what may be granted through the generosity of the landowner. Prospectors are not prone to depend upon that feeling. The work is of a kind that entails hardships and privations, so that the one who does it is entitled to a proportionately great reward when success crowns his efforts. Such an expectation is entirely without basis in the South, and consequently there is no systematic search for minerals."

If this is a correct estimate of the relation which the prospector bears to the metal-mining industry in its earlier stages, would it not be to the advantage of all concerned if the subject was given careful consideration by the fraternity (operators and engineers), with a view of working out some plan by which greater recognition was given to the role of the discoverer of ores, so as to increase the numbers and the activity of that class of men whose temperament inclines them to the exploration of new or unstudied areas of the earth's surface?

Of course the Federal law cannot now be made to apply in the East and South. But that it still does apply in the West, and has made that part of our country the most intensively operated mining field in the world, is worth remembering. But, as our governmental machinery increases in complexity with our increase in population and wealth, and bureaucratic tendencies multiply, it will be well to keep a jealous watch on the latter and defer as long as possible the coming of the condition—inevitable in the end—when all of the public domain will be as completely barred to the prospector as are now the privately owned lands of the East, the South, and the Mississippi Valley.

Vast areas of this domain have already been withdrawn from this line of activity. And though the several acts of Congress which have confirmed these withdrawals have in most instances—and perhaps all—reserved the rights of this class, in passing over their custody to the departments the latter have been authorized to establish rules and regulations governing their usage. Some of these practically annul the rights reserved in the acts, and others have made the path of the explorer so thorny with restrictions and rulings that he is abandoning the field. This is not a healthy condition of affairs. H. D.

The Barometer in the San Juan Region, Colorado

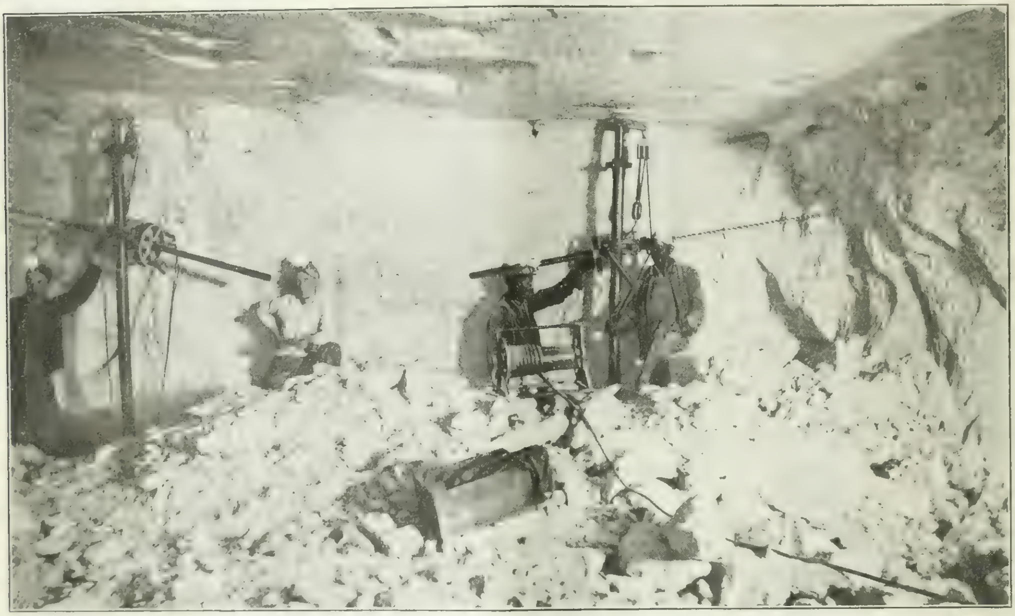
"Stale News About the Weather" in your issue of Dec. 11, 1920, puts a slight on the ordinary barometer which a resident of the San Juan Mountains of Colorado should answer. Your remarks apply to barometers in general, but not to ours in particular. A great many houses and places of business in Ouray are equipped with barometers, either mercurial or aneroid, and these are consulted religiously throughout the winter's duration.

In summer these barometers are all that you say, and are not to be depended on for aid and guidance; but when the season arrives for the severe and long-continued snowstorms which so hamper mining, the barometer is a reliable prognosticator. Close watch during clear weather will be rewarded with warning of an impending storm. I have seen the barometer begin to fall during a perfectly clear, fine day, fully twenty-four hours before the beginning of a heavy three-or-four-day snowstorm which ties up all traffic. Another great service performed by our weather indicator is the prediction of the end of a big storm. Regardless of the breaking up of clouds and apparent clearing of the weather, a long-drawn-out storm is not over until the barometer begins a steady and consistent rise; and on the other hand, such a rise, even though a storm is still in progress, almost unfailingly means a complete cessation in a short time.

This might not seem of much practical use to the outsider, but the insider, the fellow who has to operate a property at timber line here, heeds the warning and hastens to get the packtrain up with grub today, instead of tomorrow. The efficiency of the local barometer is perhaps due largely to the fact that a great many heavy snowstorms are local to the San Juan Mountains, which are a compact group of high and rugged mountains rising from a comparatively level area that surrounds them. C. R. WHITLEY.

Ouray, Col.

Salt Mining in Kansas



WORKING FACE OF STOPE AT SALT MINE OF THE AMERICAN SALT & COAL CO., LYONS, KAN.
Drills shown are electrically operated. The rooms are from 30 to 40 ft. wide and 14 ft. high. No timbering is used.

LANDING STATION AT BOTTOM OF SHAFT (994 FT. LEVEL)

Surface Energies in Flotation

An Elementary Explanation of Some of the More Important Physical Principles Underlying The Phenomena, Designed To Assist Mill Operators in Directing Experimental Work to the Best Advantage

BY FREDERICK G. MOSES
Written for Engineering and Mining Journal

SINCE the discovery of flotation and its practical application, surface tension, surface energies, and their related phenomena have been considered to possess a possibly important bearing on both the theory and practice of the art. Unfortunately, however, practical flotation men have been forced to give most of their attention to the development of commercial operations and the technique of their business, to the neglect of the more theoretical and interesting phases of the process. This attitude on the part of practical flotation operators and engineers has been a retarding factor to all phases of flotation advancement. Any trustworthy and promising theory as to the art should be founded on data which can be obtained only in commercial plants. The men who can logically furnish this sort of data are those who are in actual control of these operations. For these reasons, it is most important that a greater interest should be developed in the more theoretical side of flotation than the average busy operator or engineer has given it in the past. It is hoped that the theoretical consideration here presented will assist toward the promotion of these ends.

PRINCIPLES OF FLOTATION

Investigation of any theory of flotation implies a knowledge of physical chemistry and molecular physics. However, it is neither necessary nor desirable for flotation engineers to delve deeply enough into these subjects to become expert physical chemists, in order to take advantage of these sciences in their daily work. A superficial consideration of some of the principles of these subjects as applied in flotation is bound to give a clearer conception of practical operations to the operator, and should aid him in obtaining a more comprehensive view of his every-day problems. An understanding of some of these physical and molecular theories may also suggest new lines of investigation.

Few, if any, of the theories that are presented here are claimed to be original, and the data offered are not the result of personal experiment. The conclusions are those that have appeared from time to time in sometimes obscure places that have not been readily available to the busy engineer.

Many of the observed facts of flotation seem to indicate that some of the phenomena of the process are caused by, or closely related to, surface energies. It will be the primary object of this discussion to direct attention to some of these surface energy phenomena and to suggest their possible application.

Surface tension is the basis for all surface energy considerations. Simply defined, it is that condition of stress under which the surface of all liquids is known to be and in which all solids are assumed to be. It is generally known that the free surface of any liquid acts as if it were confined under a thin, well stretched elastic membrane. The presence of this stressed surface is demonstrated by the formation of round droplets of a liquid when it is suspended in another liquid of the same specific gravity in which it is not soluble. The manner in which a needle can be supported on the surface of water is well known. This is made possible by the supporting power of the surface film or surface tension of water.

The Laplace theory,[1] which has been advanced to explain the presence of this tension and which has been generally accepted, assumes that the molecules of a liquid attract each other with a comparatively strong force, which, however, acts over a very short distance. A proof that this force does exist is the fact that polished metal surfaces such as copper can be made to adhere quite strongly to each other. The fact that these surfaces will not adhere when the surfaces have become tarnished has been advanced to prove that these forces act over a very short distance.

Assuming, then, that the molecules of a liquid do attract each other, and that this attraction is effective over only a very short distance, it will be readily seen that those molecules of the liquid, with the exception of those in the surface layer, are under the same stress or pull in all directions, and are, therefore, in a condition of equilibrium. Those molecules in the surface layer of the liquid, however, have no attraction from above to balance that from below. They are, therefore, less free to move in all directions. This resultant phenomena is what is known as surface tension.

It is evident that this stress or strain is a form of energy. For water, it is a comparatively large force, being equal to 75 dynes per centimeter at 0 deg. C. The force necessary to produce one square centimeter of surface tension under the conditions mentioned above is, therefore, equal to 75 ergs. Undoubtedly, this is the energy that is largely responsible for most flotation phenomena.

SURFACE TENSION OF SOLIDS

The surface tension of solids is a subject that is a little difficult to visualize. The presence of the surface tension of solids has never been proved experimentally and can be conceived only by analogy or by mathematical considerations.

It is a demonstrated fact that the surface tensions of liquids increase as the temperature decreases. As the point of solidification is reached it is unreasonable to suppose that they suddenly become zero. The whole science of physics is based on the continuity of phenomena. It is more reasonable and logical for the physicist to believe that at the solidification point of the liquid the surface tension remains and in fact increases. The fact is that mathematical demonstrations have shown that solids do have surface tension and that the value of this energy is very high, when compared to certain liquids, such as water, for instance. Also, many substances, such as wax and asphalt, although hard enough to give out a resonant sound when struck, will sag and otherwise act as a liquid of very high viscosity. These substances are also known to have surface tension when liquid.

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[1] "Surface Tension and Surface Energy," Willows, R. S., and Hatschek, 2d ed., p. 8.

Surface tension of solids is of interest because it is apparently connected with the phenomena of flotation, as will be shown later.

SURFACE ENERGY

Surface tension, strictly speaking, is a unit of measurement of the energy in the surface of a liquid or a solid. It would follow that the total energy in the surface of a liquid or a solid is the product of the surface tension and area of surface exposed.

It has been suggested that surface tension is directly due to an unbalanced intermolecular attraction, and it follows that the amount of energy in the surface of the substance will be a function of the strength of the attraction between the molecules. The attraction between the like molecules of a certain substance is usually different in amount from the attraction between the like molecules of a different liquid. This is one of the reasons for the different boiling points of unlike liquids. It will, also, indicate the reason for different liquids having different surface-tension values.

This fact leads to an important phase of surface energy, that is, interfacial tensions. It has already been suggested several times, but cannot be emphasized too often, that the surfaces of liquids and solids are the seats of energy. When two liquids that are mutually insoluble are in contact, or when a liquid is in contact with a solid that is insoluble in the liquid, it will be evident that the two seats of surface energy are in contact. How will these two tensions react on each other?

The explanation of the construction of matter involves the conception of small particles of matter called molecules, surrounded on all sides by a space. This space is called the intermolecular space. Although the molecules in the surface of a liquid or a solid have been shown to be under a stress, there is no reason for believing that the intermolecular spaces do not still exist.

Now, when two mutually insoluble liquids or a liquid and an insoluble substance are in contact, it is logical to believe that the molecules of one of the substances may penetrate into the intermolecular spaces in the surface of the other material. In other words, the surface tensions of the two materials may be considered to have so intermingled as to give but one seat of surface energy. This single seat of surface energy at the contact between two liquids or a liquid and a solid is called interfacial tension.

The next point that may be raised is, "What will be the amount of energy in the interfacial tension and on what will it depend?"

It would be expected that the energy at the interface would depend on whether the molecules of the two substances attract or repel each other and on the extent of the attraction or repulsion. If there is a mutual attraction between the molecules of each substance, the amount of the unbalanced stress in the surface of the substances should be reduced in a degree corresponding to the amount of attraction. This should result in the interfacial tension containing a correspondingly low amount of energy as compared to that in the surface of either of the two materials under consideration. If, on the other hand, the molecules of the two substances repel each other, the energy in the interface of the two substances should be increased by an amount corresponding to the decreased attraction available to balance the molecules in the two surfaces. In this way, the energy in the interface will be greater than that in either of the two surfaces when considered alone.

The property of surface energy which is probably responsible for a large number of flotation phenomena is the tendency of surface energy always to reach that condition of equilibrium at which it is a minimum.

Surface tension is a stretch, and as such is always tending to make the area of the liquid a minimum. This is demonstrated by the formation of droplets of a liquid whenever possible. This reduction in surface area is one of the means by which the surface energy of a given system may be reduced, for, as has already been shown, surface tension is one of the factors in surface energy. It is not possible for this always to take place, however, especially when the surface is already a minimum, as it usually is, or when the surface involved is that of a solid. Under such conditions, if the surface energy is reduced, it must be accomplished by some other means than by a reduction in surface area. Adsorption, which will be discussed later, is the other most common way of obtaining this result.

The important point to be emphasized, however, is that this continual struggle of surface-energy equilibriums to lessen the quantity of surface energy is, undoubtedly, the cause of many of the phenomena which the flotation man takes advantage of in his every-day operations.

REINDERS' SURFACE ENERGY EQUILIBRIUMS

Several years ago, before flotation had become a practical process for concentrating sulphide ores, Reinders[2] made some investigations to determine the action of fine solid material in the presence of two immiscible liquids. The facts brought out by this work are significant when applied to modern froth flotation, and can be made the basis from which some interesting and striking conclusions can be drawn. The application of these surface-energy equilibriums to flotation was suggested by Ralston[3] and enlarged upon by Perkins and Corliss.[4]

Assuming that two immiscible liquids are present, and a finely divided solid which is insoluble in either of the liquids:

Let $T_{1,s}$ = the interfacial tension between liquid 1 and the solid.

Let $T_{2,s}$ = the interfacial tension between the liquid 2 and the solid; and

Let $T_{1,2}$ = the interfacial tension between the two liquids.

Then Reinders found that when

$T_{2,s} > T_{1,s} + T_{1,2}$ the solid will remain unchanged;

$T_{1,s} > T_{2,s} + T_{1,2}$ the solid will go entirely into liquid 2.

$T_{1,2} > T_{2,s} + T_{1,s}$ the solid will collect at the liquid-liquid interface and, if possible, separate the two liquids from each other.

"If, however, no one of the interfacial tensions are greater than the sum of the other two, then the disperse phase, (or solid,) will collect at the liquid-liquid interface, but the three phases will be at a certain contact angle."

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[2] *Kolloid Z.*, Vol. 13 (1913), p. 235; also Hoffman, *Z. Phys. Chem.*, Vol. 83 (1913), p. 381

[3] Ralston, *Min. & Sci. Press*, Oct. 23, 1915.

[4] Corliss, H. P., and Perkins, C. L., *Jour. Ind. & Eng. Chem.*, Vol. 9, No. 5, May, 1917, p. 481

The applications of these equilibriums to flotation can be readily seen, because, for a sulphide to float, it must either collect at the interface between the water in the pulp and the insoluble oil that is used, or it must collect entirely in this oil.

At this point it will be necessary to bring out clearly the action of one of the constituents of the oil that is used. It must be understood that a bubble is exactly like the surface of water which is in contact with air. A bubble is simply the surface tension of water surrounding a quantity of air. Therefore, when conditions are such as to give a contact between the oil that is used and the free surface of water, conditions must also be correct for the oil to form an interface with a bubble in the same manner as it forms an interface with, or coats, the free surface of the water. A clear understanding of this is necessary to all flotation considerations.

One of the first observations made when working with the theory of flotation was that the sulphide minerals are less easily wetted by water than are the associated, vitreous gangue minerals. It is necessary that there be a natural relation between the minerals in the ore, or it must be brought about artificially.

This relative attraction of the water for the sulphides or gangue minerals is a resultant of the surface energies of the minerals themselves, both sulphide or vitreous; the water or liquid in which they are suspended; and the air or other gas in contact with the water. In other words, the wetting of the gangue minerals and the non-wetting of the sulphides is the resultant of a set of conditions that may be changed or controlled within limits, rather than an inherent property of the minerals themselves. That these conclusions are true may be shown as follows:

Let $T_{w,a}$ = the surface tension of water or the interfacial tension between water and air.

Let $T_{s,a}$ = the interfacial tension between the solid and air.

Let $T_{s,w}$ = the interfacial tension between the solid and water. Then, when $T_{w,a} > T_{s,a} + T_{s,w}$ the water will not wet the solid. It should be noted that *solid* and *not sulphide* is mentioned. When the gangue mineral fulfills these conditions it will not be wetted, and in a flotation machine it would be found to float.

When no one of the interfacial tensions is greater than the sum of the other two, the water, air, and solid will meet at a definite contact angle. This actually means, when a sulphide which does not normally tend to be wetted is considered, that this sulphide does have some slight tendency to be wetted but that the air has an even greater affinity for the surface of the mineral, in this case a sulphide particle, than has the water.

FLOTATION WITHOUT OIL

When nature has been kind enough to give the conditions which have just been found to be necessary in order that the sulphide will not be wetted while the gangue is, and to a great enough degree, flotation can be accomplished without oil. Under these conditions the sulphide will go into the air-water interface and be supported there while the gangue will be wetted and sink, owing to its weight. Because of the inherent weakness of the air-water interface, the great problem with this sort of flotation is that of getting the sulphide in contact with this interface and supporting it there. To overcome this difficulty the so-called "skin machines" known as the Macquisten tube and the Woods were developed. In these machines the mineral was carefully placed on the surface of the water or, more scientifically speaking, in the air-water interface. The practical limitations of this type of apparatus are well known.

OILS IN FLOTATION

Oil has three functions in the usual flotation practice: (1) to assist in bringing about, in those cases where they do not naturally occur, the correct surface energy balances between the air, water, and solids, necessary to cause the gangue to be wetted and for the sulphides to remain dry; (2) either to strengthen the air-water interface or substitute a more satisfactory one, such as an oil-water interface; (3) to lower the surface tension of the water so that bubbles can be made, or, stated differently, to multiply the area of the interface which will be available to support the mineral.

When oil is considered as a factor in surface energy balances, several involved complications are encountered. However, if only the interfacial tension balance is considered, the matter may be greatly simplified.

To take the simplest case

Let $T_{s,w}$ = the interfacial tension between solid (sulphide) and water.

Let $T_{s,o}$ = the interfacial tension between solid (sulphide) and oil.

Let $T_{w,o}$ = the interfacial tension between water and oil.

When $T_{s,w} > T_{s,o} + T_{w,o}$ it is found that the solid (sulphide) will go entirely into the oil layer in contact with the air-water interfaces which may be distributed through the water. Of course, this oil may be a coating on a bubble, which is, as has been pointed out, the same as being in contact with the free surface of water.

If none of the interfacial tensions are greater than the sum of the other two, the sulphides will go entirely into the water-oil interface; or even better, at the contact between the oil and water which is the condition most generally found and the one that is always desired.

These equations were formulated for a finely divided insoluble material, and nothing is said regarding difficultly wetted sulphides. This is an important and striking fact. It is usually assumed that only sulphides which are not wetted by water can be made to go into the froth in flotation. This is not the fact: rather, any substance can be made to go into the froth provided it sets up the correct surface energy balance with the water and oil that is being used. Every practical flotation operator has, at some time, found all of the mineral in the froth, either in the form of sulphide or gangue. This is probably the explanation.

Of course, this is not saying that the sulphide surface is not necessary for practical flotation; in fact it is of paramount importance. Flotation is a method of making a separation, and this is done by causing one class of minerals to go into the froth and the other to remain in the body of the liquid, the classification being based on the character of the surfaces. The separation is obtained by setting up a surface balance such as will cause the mineral with one type of surface, usually the sulphide, to go into the froth. The sulphide is not a requisite for getting a mineral in the froth but simply for getting it in a different part of the machine than the waste material which has a surface of another type. This fact has been illustrated by the experiment of attempting to separate a sulphide mineral from fluorite by flotation. The fluorite was found in the froth and the sulphide in the tailings.

If the mineral is carried in the oil-water interface, the bubbles must be coated with a thin film of oil in order to have this oil-water interface on the bubble. These facts are evident by inspection of all flotation machines. The oil is usually spoken of as a coating on the bubbles, which are simply the surface tension of water surrounding a certain amount of air. Hence, if the surface energy equilibrium necessary to cause oil to spread in a thin layer on water can be discovered, the conditions necessary for oil to coat the bubbles made from the same water will be obtained. Of course, the term oil here refers to the insoluble constituents of the oils that may be used.

The surface-energy balances that must hold to have the oil spread on water have been determined, and it follows that the same balances must obtain to have the oil coat the bubbles. This balance is as follows:

Let $T_{w,a}$ = the interfacial tension between the water and the air.

Let $T_{o,w}$ = the interfacial tension between the oil and water.

Let $T_{a,o}$ = the interfacial tension between the air and oil.

Then, when $T_{w,a} > T_{o,w} + T_{o,a}$ the oil will spread on the water in a thin layer or on the bubbles that are formed from this water.

From this it is evident that the kind of oil to use to coat the bubbles will depend on the air-water interface or on the surface tension of the water, which in turn is a function of its purity. Impure water may therefore interfere with or assist in obtaining good flotation results and also, certain chemicals may be added to advantage.

SIZING OF MINERALS AND SURFACE ENERGIES

An attempt has been made to show the relation between surface energies and flotation results. It is evident that the total surface energy of a liquid or a solid is the product of the surface tension per unit by the number of units. On this basis, it would be expected that the size of the particles of the ore being treated by flotation would have a bearing on the results obtained, and this is true to a certain extent.

In practical operation, both the valuable and the waste minerals are found in both the tailings and the concentrates. On examination, however, it is found that the sizes of the two types of minerals are quite different in the tailings and concentrates. In the froth, for instance, will be found the sulphide from a certain maximum size to all of the smaller sizes. The maximum size of the gangue present will be much less. Cases are known, however, where the gangue will average larger in size than the valuable mineral in the concentrate.

If the surface energies are dominating factors in separation by flotation, it is reasonable to suppose that the total surface energy of certain sizes more nearly fulfills the conditions demanded by certain froths than other sizes, both as to the valuable and the gangue minerals, and hence sizing is an important factor in flotation.

The oils which have been mentioned are those which are added as a means of furnishing a *locus* in which the minerals to be floated can be collected. For this reason, these oils are known as "collectors" or "collecting oils." Nothing has been said of the so-called "frothing oils."

Stated in the most general sense, any soluble material which will lower the surface tension of the water, or the water-air interface, will cause the formation of a froth in the presence of aëration, or agitation which is, of course, simply a means of aëration. Not all substances which are soluble in water and reduce its surface tension are satisfactory forthing agents in flotation, however. The reason for this can be demonstrated.

Every surface-tension equilibrium which has been shown to be necessary for successful flotation has been an inequality. In the one which is responsible for the spreading of the oils on the bubbles, the air-water interface or surface tension makes up the left-hand side of the inequality, and if this inequality be destroyed, so also will the result. Therefore, it would follow that a successful frothing oil in flotation would be one that will reduce the surface tension of water, or the left-hand side of the inequality, and at the same time, to keep the same ratio of inequality, the frothing material must reduce the right-hand side of the inequality in the same or a greater ratio. Very few materials have the property of accomplishing this; hence, the few materials which act as satisfactory frothing agents.

ADSORPTION

A theoretical consideration of flotation could be discussed from so many ramifications and angles that, in a paper of this sort, it is possible to consider only a few of the most important. Adsorption is one of these. Adsorption is a change in the surface energy of a liquid caused by dissolving in it some material which will change the surface energy of the solvent liquid and cause an excess or deficiency of the dissolved material in the surface of the liquid, compared to the concentration in the bulk of the solution. There are two kinds of adsorption—positive and negative.

When a dissolved substance reduces the surface tension of a liquid, causing an excess of the dissolved substance in the surface of the solution over the concentration of the dissolved substance in the body of the solution, the phenomenon is called positive adsorption; when the opposite is the case, negative adsorption.

To understand the cause and meaning of positive and negative adsorption two general facts must be kept clearly in mind. The first is that all soluble substances will either increase or reduce the unit surface tension of the solvent liquid. The other, that the total surface energy of a liquid solution always tends to become a minimum.

Assume a vessel of a liquid, say pure water; the liquid will have a certain definite surface tension, and the surface energy of the system or liquid will reach equilibrium at a certain minimum value. This will be true, because it will be assumed, for simplicity, that the surface area is also a minimum. It is also true that after a soluble material which increases or reduces the surface tension is dissolved in the water the increase or reduction will be greater the more of the soluble material dissolved. Now, imagine that a certain amount of substance is dissolved which causes a certain theoretical reduction in the surface tension of the solution and which will give a certain concentration of solution. This material dissolved in water will give a system wtih a lower surface tension and, also, one the surface energy of which will at once attempt to become a minimum value. As surface energy is a product of area and surface tension the surface energy of the system could be further reduced, either by a change in the area of the surface or a further reduction in the other factor, surface tension. In the present case, however, the area was assumed already to be a minimum. Therefore, to reduce the surface energy further, the surface tension must again be lowered. This can be caused only by an increase in the quantity of the surface-tension reducing material in the surface of the solution. This is what actually happens. More of the dissolved material is found in the surface of the solution than in the bulk of the solution under the surface, a fact which can be demonstrated by experiment. This phenomenon of reducing the surface energy of a solution by an increase in the amount of the dissolved substance in the surface of the liquid over that in the rest of the liquid is positive adsorption.

When the dissolved salt has the property of increasing the surface tension, it is necessary for the surface energy to be reduced by a reduction in the quantity of the dissolved salt in the surface of the liquid or a lesser concentration of the dissolved substance in this surface than exists in the body of the liquid. This is negative adsorption.

The principal effect of adsorption in flotation is due to the manner in which the dissolved salts and their adsorption effects can vary surface energies and surface energy equilibriums. As any material which is soluble will either increase or reduce the surface tension of the solution or, in this case, the mill water, therefore, from a theoretical standpoint, any material which is soluble in water is a flotation reagent and may either be harmful or beneficial. This is one of the reasons why it is necessary to use water from the future mill supply when making preliminary laboratory flotation tests.

Under certain conditions a chemical may be of benefit to flotation and under other conditions a detriment. Adsorption may explain this. If a certain set of surface energy equilibriums is necessary for good flotation, and a reagent is introduced which, by adsorption, will upset the conditions necessary for flotation, it is evident that this reagent would be a detriment. If, on the other hand, the correct surface energy balance for good flotation does not exist, and some soluble reagent is added which will cause a closer approach to the necessary condition, that reagent, possibly the same one as in the previous case, would be a benefit.

The large number of these factors to be considered, and the involved way in which they all work together, make difficult any attempt to work out a strictly scientific theory that could have a practical application. A sensible way to attack the problem would be, if possible, to determine the surface energy involved with certain minerals and gangues, which, at least, should give possibly a rough classification of ores from the standpoint of their flotation amenabilities. It would also be feasible to work out surface-energy values for different oils and oil-water interfaces. These things can be done only by men who have had thorough and special training, but these men must also depend largely on the flotation engineers and operators for much of their data.

Mining Activities in Saltillo, Mexico

In the Saltillo mining region, Mexico, is the Providencia mine, belonging to the Compañia Minerales y Metales, producing 4,000 tons of lead-silver ore per month, which is shipped to the company's smelter at Mapimi, in Durango. This mine employs [illegible] men. La Perlita, belonging to the Compañia [illegible] Mexicana, produces a small quantity of lead-silver ore, which is handled by the company's smelter at San Luis Potosi. The Cabecillas, belonging to Guillermo Purcell y Compañia, produces a small quantity of rich lead-silver ore, also shipped to San Luis Potosi. At Higueras, northeast of Saltillo, the Compañia Minerales y Metales has another mine. This company's head office is in Monterrey and it has a branch office at Saltillo.

Movements of Metals and Minerals During October

Imports and exports of the more important metals and ores, as reported by the Department of Commerce for October, 1919, and the figures for October, 1920, as finally revised, are as follows:

IMPORTS, OCTOBER, 1919, AND OCTOBER, 1920
(In Pounds, Unless Otherwise Stated)

	Oct., 1919	Oct., 1920
Antimony ore, contents	14,054	32,452
Antimony matte, regulus or metal	2,420,025	1,621,529
Copper:		
Ore, contents	4,004,003	2,628,987
Concentrates contents	3,208,468	6,560,428
Matte regulus, etc., contents	3,256,640	437,087
Imported from (in part):		
Canada	3,051,262	1,455,614
Mexico	6,493,722	2,740,003
Cuba	221,760	2,522,934
Chile	30,223	1,632,738
Peru	166,865	1,387
Unrefined, black, blister, etc.	17,392,398	13,944,279
Refined, in bars, plates, etc.	....	9,530,951
Old, etc., for remanufacture	182,001	99,293
Composition metal, copper chief value	224,109	985,240
Lead:		
Ore, contents	3,036,568	961,092
Bullion, contents	8,285,550	2,488,556
Imported from (in part)		
Canada	885,614	579,630
Mexico	8,706,834	2,870,018
Chile	1,684,052	
Pigs, bars and old	1,721,764	20,652,897
Manganese ore, long tons	15,863	44,700
Imported from (in part):		
Cuba, long tons	32	14
Brazil, long tons	8,620	26,100
British India, long tons	2,300	7,988
Tungsten ore, long tons	592	24
Pyrites, long tons	67,155	16,908
Imported from:		
Spain, long tons	42,707	11,308
Canada, long tons	19,548	5,600
Tin ore, long tons	2,366	1,466
Tin bars, blocks, pigs, etc.	6,210,512	6,741,331
Imported from (in part)		
United Kingdom	3,226,310	1,623,788
Straits Settlements	11,611,756	3,545,977
Dutch East Indies	742,104	280,233
Australia	510,760	235,200
Zinc:		
Ore, contents	2,998,115	1,571,458
Imported from:		
Canada	220,993	2,194
Mexico	2,777,122	1,504,458
Blocks or pigs, and old	469	

EXPORTS OF COPPER, LEAD AND ZINC
(In Pounds)

	Oct., 1919	Oct., 1920
Copper:		
Ore, contents	3,000	
Concentrates, contents	46,457	
Refined, in ingots, bars, etc.	44,001,239	19,270,781
Exported to (in part)		
France	18,637,926	5,531,926
Germany		3,263,094
United Kingdom	11,233,988	4,423,793
Canada	2,689,079	1,084,171
Japan	9,128,000	
Netherlands		1,063,357
Composition metal, copper chief value	5,297	3,891
Old and scrap	2,355	64,928
Pipes and tubes	785,585	671,346
Plates and sheets	698,132	686,418
Wire, except insulated	4,112,327	2,604,500
Lead		
Pigs, bars, etc.:		
Produced from domestic ore	237,274	[illegible]
Produced from foreign ore	[illegible]	448,178
Exported to (in part)		
France	1,120,000	224,078
United Kingdom	[illegible]	
Canada	[illegible]	54,002
Argentina	[illegible]	
Brazil	[illegible]	[illegible]
China	560,143	[illegible]
Zinc:		
Dross	42,100	[illegible]
Spelter		
Produced from domestic ore	[illegible]	[illegible]
Produced from foreign ore	[illegible]	830,000
Exported to (in part)		
France	[illegible]	[illegible]
United Kingdom	[illegible]	1,082,518
Canada	[illegible]	
Mexico		214,331
Japan	[illegible]	
[illegible]	[illegible]	[illegible]

Engineering in Japan

Facilities for Technical Education Not Equal to the Demand—Absence of Practical Training A Weak Point, Resulting in Poor Supervision of Manual Workers

BY CHARLES F. MASON
Written for *Engineering and Mining Journal*

APPARENTLY the facilities for education in the engineering professions in Japan are very complete, although it is to be regretted that the schools are not large enough, or numerous enough, to accommodate all of the aspirants for educational honors. It is human nature to want what we can't get, and therefore not very surprising to find that a higher education is regarded here with almost holy reverence.

All Japanese children are required to attend the primary school, which insists on no examination, of course, and has a six-year course. Graduating from the primary school, the future engineer takes a competitive examination for the middle school. If he fails in this examination, as nine-tenths of the pupils do, of necessity, there being only room enough in the middle school for about one-tenth of the primary-school graduates, his future schooling is limited to two years in the higher primary school, which he may enter without examination. I am told that scholarship is frequently not the only consideration required in passing.

JAPANESE HIGHER EDUCATION

Having conformed with all the requirements, our pupil finds himself in the middle school, where he studies for five years, during which time he makes his acquaintance with the English language. At the end of that time he takes another competitive examination, either for a technical institute or, if he intends to enter the university, for the high school. The regular technical institute course is three years, but the medical and commercial courses require an extra year. The high school course is also three years, and it, too, can accommodate only about a tenth of the number of middle-school graduates. Upon graduating from the high school our student again competes with his classmates for the privilege of entering the university, but his chances are better this time—about one in three. His engineering course in the university takes three years, whereas law or medical courses require an extra year.

During his university course our hero (I think I may safely call him that by now) is supposed to get practical experience in the field of his future endeavors, by working in shop or mill, mine or smelter, during his summer holidays, in addition to his research work in the university shops and laboratories. But this is seldom done, and to this fact, I believe, may be traced the lack of efficiency that exists in so many of the engineering enterprises in this country. In America it is realized that no man can be really qualified to give orders unless he is capable of executing the same orders himself in a satisfactory manner. Here it is just the opposite, apparently. This statement is largely the result of my own observation, but it has the confirmation of one of the best-known engineering authorities in Japan, who is now professor of mechanical engineering in Tokyo University.

About two weeks ago one of the large copper-producing companies here decided to reduce its operating force, in view of the business and financial depression which has existed here for several months. Accordingly, the management discharged about sixty office employees. Great indignation was expressed on all sides, and the sixty discharged employees got together to do something about it. What they did was to send to the directors of the company a petition stating that they felt that a great injustice had been done; that laborers, when discharged, could find other employment, whereas they (the petitioners), being college men and therefore unable to perform manual labor, could not. The rest of the office employees are now considering a strike, as a method of securing the reinstatement of the discharged ones!

The Japanese mechanic, as I have found him, is a good workman, and as a rule his shortcomings may be directly traced to a woeful lack of supervision. If he is inclined to be a little stubborn in the matter of being allowed to do a job his own way it is probably because experience has taught him that he usually knows more about the job than the man giving the instructions. If he is inclined to slight details it is simply because usually no one checks him up. As for responsibility—well, I have yet to see a native mechanic who is responsible for anything.

MISTAKES OCCASION LAUGHTER

The following came to my personal notice: At one of the Japanese government arsenals a number of 45-deg. cast-iron elbows were needed for a 12-in. pipe line. A drawing was made by the engineering department and a blueprint sent to the engineer in charge of the foundry department. In about fifteen days notice was received that the elbows were ready, but they proved to be 135-deg. ells instead of 45. Loud and prolonged laughter. Everybody concerned was sent for, from the engineer in charge of the foundry department down to the moulder's helper. Louder and more prolonged laughter. The engineer in charge explained: Yes, he had received the blueprint and the order. He had explained carefully to the moulder what was wanted. The moulder must have misunderstood him. A rare joke. More laughter. After two or three cups of tea all round, the matter was disposed of to the satisfaction of all present by laying the blame at the door of the foreign engineer who was in such a hurry to get the pipe-line finished. A small incident, perhaps, but one may be pardoned for wondering how many of the quarter-billion dollars asked for next year's naval appropriation will go toward furnishing bases for similar jokes.

I could quote a lot more incidents involving more serious consequences than the above, but none that would illustrate more clearly the attitude of the average Japanese college-bred engineer toward his vocation. It is, after all, typically Japanese—I think Bill Shakespeare must have had Japan in mind when he wrote that line about the wish being father to the thought.

Gold Mining in California

BY C. H. FRY

Written for *Engineering and Mining Journal*

IN 1914, California produced approximately 1,000,000 oz. of fine gold. The estimated production for 1920 is 700,000 oz., a decrease of 300,000 oz. The principal reasons for this decrease are increased costs of operation, shortage of labor, inefficiency of labor, lack of electric power, and depletion of gold deposits. Were 1914 conditions existing at present, California's gold output for the year would be greater than it was in 1919, for mines which have been opened since 1913 are producing more gold than was produced in 1914 by the mines now abandoned.

Of the larger gold mines operating in 1914, five have either entirely ceased operations or are doing little work. With perhaps one exception, these mines could still operate at a profit under 1914 conditions. Many mines had large blocks of ore in reserve in 1914, and, as costs have steadily increased, these blocks of ore have become "rock in place," and have been excluded in calculating ore reserves. Two of the larger mines have been removed from the list of producers by mine fires and subsequent flooding. Despite increasing costs, there are at present two large producers that were not being operated to any extent, if at all, in 1914, and had not been operated for many years prior. These mines have ore of a grade that allows them to be operated at a profit even under existing difficulties.

The number of men employed in the gold-mining industry in the state was 4,200 in 1914, the production being 1,000,000 oz. In 1920 there were 2,600, the estimated production being 700,000 oz. This would indicate that more gold per man employed had been produced in 1920 than in 1914. This is true, not because the men were more efficient, for they were not. The explanation is that it became necessary to work higher-grade ore and gravel to meet the increased costs.

From the reports of Charles G. Yale, of the U. S. Geological Survey, three dredges were operating in 1898, the combined output being $18,887. In 1910 the number of dredges had increased to seventy-two and the output to $7,550,254. These figures refer to gold only and do not include the platinum recovered. The number of dredges gradually decreased. In 1913, the combined output of sixty-three dredges was $8,090,294. In 1914, sixty dredges were operating, and the production was $7,783,394. At present thirty-one dredges are operating, and the estimated output for 1920 is $7,000,000, or approximately one-half of the entire gold production of the state. The various types of dipper and suction dredges built in the earlier years of the dredging industry have been discarded for the close-connected bucket-line type, with bucket capacity ranging from seven to twenty cubic feet. It is interesting to note that the price of an 18 cu.ft. manganese-steel bucket which cost $490 in 1916 was $1,080 in 1920. In one instance, the cost of operations per cubic yard handled during the years 1914-17 was 4.57c. In 1919 it was 6.41c.

The larger dredges, costing from one-half to three-quarters of a million dollars, handle enormous amounts of gravel, but the initial investment is so large that the gravel deposit must be correspondingly extensive and of a value that will allow a profit and the entire amortization of the dredge. Consequently, small or low-grade deposits are not worked.

The Mother Lode section of California is today, in my opinion, one of the most promising gold districts in the United States. When costs of operations were low, large bodies of low-grade ore were profitably worked. This cannot be done now, and it has become necessary to find higher-grade ore, to mine and mill by more economical methods, or to shut down. One or more of these expedients have been adopted by the various mining companies operating in the district.

One of the oldest and best-known mining companies in the state decided that it had been "mining too cheaply." In other words, it was handling a large tonnage of low-grade ore in an attempt to keep down costs by "quantity mining." A system of mining was adopted by which a smaller tonnage of high-grade ore was mined and milled and the lower-grade ore once sent to the mill is now left in place, or, if broken down, it is sorted from the better ore and left in the mine. The plan has proved to be a success.

The experience of a number of mines proves that the Mother Lode orebodies persist to a considerable depth. Large bodies of high-grade ore, better than $10 per ton, have been found between 3,000 and 4,000 ft. below the surface. Geological conditions give no indication of reduction in grade with a reasonable extension in depth. As the depth of mining increases, the cost increases, more power and a longer time are necessary for handling men, supplies, and ore, and ventilation problems become more complicated. Timbering is a large item in costs. Most of the ground is of such a nature that heavy timbers are required, and, in addition, filling must be kept close to the "backs." The timbering must also be done by experienced men, and the number of these men available is inadequate.

There has been only a slight decrease in the cost of supplies. The large proportion of labor cost represented in the purchase of supplies signifies that wages and the cost of supplies must come down together.

It is highly improbable that the large low-grade orebodies and low-grade gravel deposits now known to exist will in this generation become as profitable as have been the large low-grade bodies of copper ore which could not be worked profitably a few years ago.

The opening of a new gold mine or the reopening of an old gold mine under present conditions demands careful investigation. After all considerations have been given due weight, a large factor of safety must be used to allow for the uncertainties of state and Federal taxation, cost of labor, supplies, electric power, and workmen's compensation.

Gold mining is a legitimate, hard, business proposition, but there is always much of the speculative side to it. Particularly is this so in the prospecting and development stages. This, together with the sentiment connected with many old gold mines, has to a large extent been responsible for the maintenance of the interest in gold mining during the last five years, and will be a not unimportant factor in the future.

Economic Minerals of Madagascar

A Résumé of the Studies of Professor Lacroix, of Paris, and Professor Duparc, Of Geneva, on the Commercially Important Mineral Products of the Colony, Including Graphite, Corundum, and the Ores Rich in Radium and Thorium

By George F. Kunz

Written for *Engineering and Mining Journal*

PROF. ALFRED LACROIX, of the Muséum National d'Histoire Naturelle, of France, and an investigator of the mineral deposits of Madagascar during the last twenty-five years, recently presented, in an address at the Muséum[1], some of the most important facts respecting them. In a previous presentation of the resources of Madagascar at the Muséum Professor Lacroix had described the deposits of gold and precious stones occurring on that island, and, in the address first referred to, he discussed other and perhaps even more valuable minerals. Among these, he especially places the graphite and corundum deposits and the ores rich in radium and thorium, and draws attention to the fact that, as the importance of many of the last-named ores has been recognized only in recent years, information about them is not always readily attainable, and is to be found only in the works of those investigators who aimed to present a thorough mineralogy of the region then studied, without respect to the apparent commercial value of the substances.

To a great extent the minerals named occur in the so-called "red-earth" of Madagascar, which covers a large part of the surface of the island, and originated from the decomposition of siliceous rocks. As a result of this decomposition, the silicates have lost their alkalies, lime and magnesia, and progressively a considerable part of their silica. The "red earth" (a lateritic clay) is readily broken up, when damp, by the spade. When dry, it becomes hard, but yields to the stroke of a hammer. It constitutes a surface crust which sheds rain water and is not turned into mud by it. The depth of the crust is often considerable, sometimes as much as sixty feet or more. In spite of its resistance, the rainfalls exercise a notable chemical effect, and, owing to consecutive dissolution, the lighter and less coherent particles are washed away, slowly but surely, leaving on the summits and flanks of the mountains and hills, or in the valleys into which they have rolled, the heavy and non-oxidizable minerals, such as quartz, the precious metals, iron ore, corundum, and other minerals. The "red earths" Prof. Lacroix designates as "eluvions," to signify the alteration in place, as distinguished from the alluvial action which bears away the fragments to deposit them elsewhere.

The deposits of graphite in Madagascar occur principally in crystalline schists. In contradistinction to the conditions that obtain in the Canadian deposits, the graphite deposits of Madagascar which have an economic value form part of the gneisses and mica schists. The graphite content varies widely and its distribution is irregular. An important peculiarity of these deposits, from a practical point of view, is that the rocks containing the graphite are always superficially altered. All the essential minerals except the graphite and the quartz are transformed into a lateritic clay, and hence the material can be exploited under the most favorable conditions. The zone of alteration is generally so thick that it can be worked for a long time, but when the solid rock is reached, the exploitation will become more costly and perhaps no longer profitable.

Geographically, the graphite deposits are widespread. At present, exploitation is principally localized in the regions easy of access. On the high plateaus, ores containing as low as 8 per cent of graphite have been exploited, and on the west coast the minimum may fall as low as 5 per cent. The rapid growth of the work is shown by the increase in the number of prospected deposits from two in 1908 to 3,775 in 1918. Methods employed in extraction have been improved from time to time. The price is determined, after a chemical analysis, by the carbon content. When the carbon is from 80 to 90 per cent of the whole, the material is worth from 10 to 15fr. per kilogram.

The graphite of Madagascar is of excellent quality, rivaling that of Ceylon in the markets of England and the United States. It has no admixture of sulphides or calcium carbonate, and is therefore well adapted for crucibles. During the war the island furnished not only France, but the Allies also, with graphite for this use. The purest kinds of graphite, 97 or 98 per cent carbon, are taken by the electrical industries, certain lots having brought in 1917 as high a price as 2,000 fr. per ton. Graphite exports from Madagascar from 1907 to 1919 inclusive are given in Table I.

TABLE I. GRAPHITE EXPORTS FROM MADAGASCAR

Year	Metric Tons	Year	Metric Tons
1907	8	1914	11,232
1908	82	1915	15,940
1909	197	1916	26,254
1910	545	1917	35,000
1911	1,247	1918	16,000
1912	5,348	1919	4,983
1913	7,997		

In the beginning of 1920, the stock of graphite on hand was 32,000 tons. Prices rose from 400fr. per ton in 1914 to as high as 1,200fr. in 1917 (in Marseilles). At present, the quotation in Marseilles is 850fr. per ton for 80 per cent carbon content.

Another mineral product of Madagascar that has been mined and exported is corundum. In its gem form, ruby or sapphire, not much has been found on the island, but the opaque or commercial corundum occurs in the disintegrated sedimentary deposits that have been described. The character of the corundum differs from that found at Craigmont, Canada, which shows no traces of mica, whereas that from Madagascar frequently exhibits mica incrustations. The exports of this mineral from Madagascar for 1910 to 1919 inclusive are given in Table II.

TABLE II. EXPORTS OF CORUNDUM FROM MADAGASCAR

Year	Metric Tons	Year	Metric Tons
1910	11	1915	327
1911	150	1916	914
1912	496	1917	739
1913	1,098	1918	178
1914	555	1919	812

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[1] [illegible] Madagascar," [illegible] at the [illegible] Naturelle, [illegible] Paris.

The small quantity exported in 1918 was due to transportation difficulties which influenced the trade of the colony for two years or more. With a little effort, it is estimated that an annual production of several thousand tons could be made. Sapphire crystals, too dark in hue to be useful as gems, occur in the sands of the Ankaratra. As they are very pure and homogenous, they can be employed in watch-making. Commercial corundum of the first quality sells for 800fr. per metric ton in Marseilles, the second quality being quoted at 750fr. Scotland and Italy are the principal importers, some corundum also being taken by Germany. Professor Lacroix remarks that although but little is used in France directly, the product is salable enough there at a higher price after it has been crushed abroad and re-imported.

Of even greater interest are the various uraniferous minerals found in the island, and also the varieties of titanite. In the mica schists of western Ambatofinandrahana (north of Matsiatra) there are interesting deposits of rutile, of which several tons, in the form of large crystals, have been extracted. During the war, this mineral was used for the manufacture of titanium chloride, which has the property of forming very dense vapors. Respecting the uranium minerals, now so much sought because of their radium content, Professor Lacroix notes that, although a deposit of autunite occurs at Vinaninkarena, south-southeast of Antsirabé, the chief radioactive minerals of the island belong to the group of titano-niobo-tantalates, among which are fergusonite, samarskite, and euxenite. The two former are rare on the island, but the latter is more frequently found. Peculiar to Madagascar are betafite, from the neighborhood of the town of Betafo; samiresite from Samiresoy, and blomstrandite and ampangabeite from Ampangabé. All these minerals are associated with potassium pegmatites containing muscovite and black tourmaline in addition to other minerals. The radioactivity of these minerals, taking the oxide U_3O_8 as unity, is given as follows: Betafite, 0.96 to 0.64; blomstrandite, 0.64; samiresite, 0.50; ampangabeite, 0.61 to 0.32; euxenite, 0.50 to 0.32; fergusonite, 0.48 to 0.27; samarskite, 0.24.

PEGMATITES CONTAINING RADIOACTIVE MINERALS ARE DECOMPOSED

These minerals can be easily exploited because of the decomposed nature of the pegmatites containing them and the abundance of the "eluvial" deposits. Most frequently they are byproducts in the exploitation of beryl. Radioactive minerals are found in Madagascar almost wherever there are pegmatites with beryl, but the deposits furnishing nearly the total of the present production are situated between Lake Itasy and Antsirabé. The richest deposit of betafite is that of Ambatofotsy. About twenty metric tons have been extracted from this deposit.

The difficulty experienced in putting these Madagascan minerals on the market is due, in the first place, to the necessity for a new and a more complicated chemical treatment than that required by autunite and carnotite, and secondly to the presence in the minerals of a small amount of thorium. Although the disintegration of thorium furnishes the radioactive mesothorium, the duration of its activity is inferior to that of radium, and therefore the radium salts containing mesothorium lose their grade of radioactivity in time, and are therefore of less commercial value. The exports of the radioactive minerals from Madagascar for the years 1912 to 1917 inclusive are given in the reports of the Service of Mines, and Table III is taken from this service.

TABLE III. EXPORTS OF RADIOACTIVE MINERALS FROM MADAGASCAR

Year	Kg.	Year	Kg
1912	11	1915	1,209
1913	5,000	1916	1,221
1914	8,801	1917	7,280

The ore is sometimes sold according to its radium content, the unit being the milligram per ton and being estimated as worth from 100 to 200fr. Some of the betafites have commanded as high a price as 15,000fr. per metric ton. The use of the thorium minerals in the making of incandescent mantles renders the deposits of these minerals in Madagascar an additional source of wealth. The great monazite deposits of Brazil, which have been worked for the last twenty-five years, are well known. In Madagascar the beryl-pegmatites contain an abundance of large crystals of monazite. However, if the island is destined to become a centre of monazite production, the mineral will be won chiefly from the river sands.

NOTABLE DEPOSITS OF ZIRCON

Another group of commercial importance are the zirconium ores. For a long time the sole source of zirconium was the silicate or zircon, but in 1893 there was simultaneously discovered in Ceylon and Brazil, small monoclinic crystals of pure zirconium, which were described under the names baddeleyite and brazilite. Pure zirconium is not known in Madagascar, but, recently, deposits of zircon have been found which on account of the abundant product they furnish cannot be compared with any other in the world. They appear to be susceptible of industrial utilization. In a deposit to the west of Solila immense crystals of zircon have been discovered, weighing up to several kilograms, and measuring 15 cm. in greatest dimension. The mineral has also been found over a region of 15,000 hectares to the north and south of Mananantanana, between Mananborona and the Ingaro, and especially on Mount Ampanobé. The perfection of the forms indicates that this is an eluvial deposit. Besides its use for crucibles, in the proportion of 90 per cent zirconium and 10 per cent magnesium, this substance is used in the construction of electric furnaces.

An extensive study of the minerals of Madagascar by Professor Lacroix is soon to be issued under the auspices of the colonial government. This work will contain everything that is known concerning the matter, and the material will be arranged in the masterly way characteristic of Lacroix's publications.

Regarding the gem minerals of Madagascar, much valuable information has been given by Prof. Louis Duparc, of Geneva.[1] The pink beryl of Maharitra, Madagascar (which has been called "morganite"), is distinguished from all the others by its high degree of refraction. The aquamarines of Ambatolampy and Teteinna, as well as the pink beryl of Tsilaisina, have a notably lower degree of refraction, and the aquamarines of Antaboko and of Tongafena form, in respect to the indices of refraction, an intermediate group between the beryl of Maharitra and the aquamarines of a pale blue color. The pink beryls of the pegmatite veins of Tsilaisina occur in fragments so large as to indicate their being parts of crystals of great size. They are of a peach-bloom pink. Sometimes the crystals are of a pale salmon color, and this latter shade is regarded by Professor Duparc as a beginning of alteration. The specific gravity averages 2.7165.

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[1] [illegible] 1912.

The deposits at Tsilaisina also furnish a great variety of tourmalines. Most of those seen by Dupare were either of a pale yellow color, or of a pronounced greenish brown. Others displayed a very light asparagus green, or were even colorless. The great majority of the crystals were zoned. In these the succession of the different hues varied greatly. Sometimes the center was dark brown, and the very narrow outer border pink. Between the nucleus and this border were a series of tints ranging from brown to greenish yellow. A contrasting arrangement, occurring even in the same pegmatite vein, showed a violet-pink nucleus with a narrow bordering of a greenish yellow, or a deep-hued brown. Some small crystals showed the asymmetrical coloration noted by Lacroix in certain types from Maharitra; for example one of Duparc's specimens was green at the pole terminated by the rhombohedron and pink at the opposite extremity, with an almost colorless zone between.[3]

A spessartite garnet is a constant accessory mineral, not only in the pegmatites of Tsilaisina but also in other deposits. The larger crystals are generally opaque or translucent, but small transparent crystals often occur. At Tsilaisina many fragments of fairly large size have been taken from the kaolin, offering transparent areas susceptible of being cut, and furnishing pretty gem stones up to one and a half carats in weight.[4]

Safety Bulletins in South America

Mine operators in South America have not been slow to recognize the value of accident prevention, and already several of the larger companies have instituted complete safety departments, which are conducted in a similar manner to those now organized in the United States. The accompanying illustrations show two of the safety or "security" bulletins which have been prepared by the safety department of the Chile Exploration Co. The warnings and instructions are printed in Spanish so that they may be understood by the greater number of the employees. The bulletin on the left applies particularly to open-pit operations, the translation being as follows: "The danger of failed shots—Keep away from the dead shot for a half hour or—you can expect this." The warning on the right, which applies to the handling of explosives, is as follows: "Do not meet explosives with a lamp. Do not forget that other lives may be sacrificed, although you may not be interested in yours."

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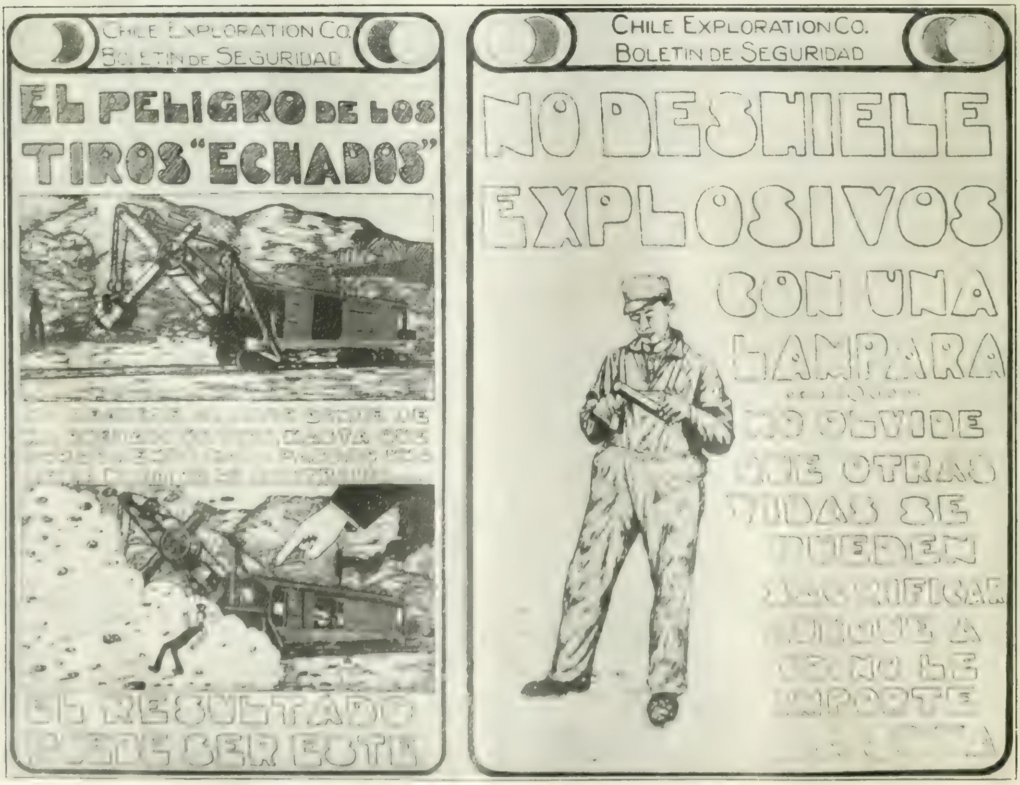
[3] Louis Duparc, *op. cit.*, pp. 389, 390.

[4] *Idem*, pp. 403, 404.



SAFETY BULLETINS USED BY THE CHILE EXPLORATION CO.

Government Officials Prominent in Mining

B. L. Johnson

BY PAUL WOOTON

B. L. JOHNSON has been designated as the head of the division of foreign mineral resources of the U. S. Geological Survey. For the last two years Mr. Johnson has been intensively engaged in a study of foreign mineral deposits. For the last eight months he has been the acting head of the division. Prior to the entry of the United States into the world war, no particular effort had been made by the Geological Survey to compile data on the mineral resources of other countries. The war brought out the absolute necessity of having accurate knowledge of this character. Just before this country entered the war, work along this line was begun under the immediate direction of J. B. Umpleby. An amount of information was gathered that was unusual considering the amount of time at the disposal of Mr. Umpleby and his staff. The collection of data was regarded of sufficient importance to justify its transposition to Paris for use during the Peace Conference. Following Mr. Umpleby's resignation, the work was taken over for a short time by Eugene Stebbinger. Mr. Stebbinger was called upon to take up some important oil work, and since that time Mr. Johnson, with the aid of a number of assistants, has been adding to the rather pretentious nucleus which was obtained during the war. It is intended to allot enough money to this research to make it possible to keep the domestic mining industry well advised as to mining activities throughout the world. Work on a considerable scale is to be done at once to gather this data.

B. L. JOHNSON

In addition to the collection and analysis of information on the geology and mineral resources of foreign countries, the section undertakes to disseminate this information where it will be most helpful to American industry. One of the great advantages which the section enjoys is an arrangement with other departments of the Government through which all official figures compiled by foreign governments are made available.

Current foreign literature covering all subjects of mining interest is scant, and pertinent items are filed. Nearly 20,000 such items are now available. They are filed by countries and by commodities. The section conducts a considerable correspondence with the mining interests of this country.

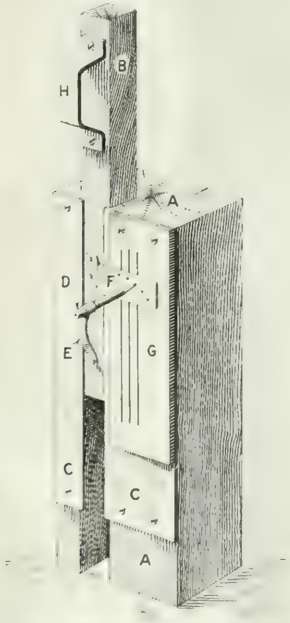
Mr. Johnson was born in Boston. His early education was obtained at the public schools of Stoneham, Mass. Later he entered the Massachusetts Institute of Technology, from which he was graduated as a mining engineer in 1905. Immediately thereafter he accepted service with the Geological Survey. His first work was in the division of underground water resources. Later he was assigned to geologic mapping in the coal fields of Wyoming. From 1909 to 1917 he did geologic work in Alaska. During Mr. Johnson's Alaskan research he discovered chalmersite ($CuFe_2S_3$) in the copper deposits of the Prince William Sound region. It occurred in massive form and in such quantities as to permit its shipment as an ore. The only other known occurrence of this mineral is in the Morro Velho mine, in Brazil. He is also credited with the recognition and subdivision of the Pleistocene terracing in the North Carolina Coastal plane. Mr. Johnson is the author of the following publications of the Geological Survey: "Pleistocene Terracing in the North Carolina Coastal Plain"; "Occurrence of Wolframite and Cassiterite in the Gold Placers of Dead Wood Creek and Birch Creek Districts of Alaska"; "Gold Deposits of the Seward Sunrise Region, Alaska"; "The Port Wells Gold Lode District"; "Mining on Prince William Sound" (1913); "Gold and Copper Deposits of the Valdez District"; "Mining on Prince William Sound" (1914); "Retreat of Barry Glacier"; "Mining on Prince William Sound" (1915); "Occurrence of Chalmersite in Alaska"; "Mining on Prince William Sound" (1916); "Copper Deposits of the Latouche Knight Island District"; "Mining in Central and Northern Kenai Peninsula"; "Mining on Prince William Sound" (1917); "Mineral Resources of Jack Bay and Vicinity"; "Geology and Mineral Resources of Latouche and Knight Island District"; "The Port Valdez and Jack Bay Districts." In addition Mr. Johnson is the joint author of many Survey publications.

HANDY KNOWLEDGE

Device for Measuring the Stamp Drop

A handy device originated by "Blanco" Whiteside, of Mogollon, N. M., for measuring the actual drop of individual stamps, without hanging up the entire stamp battery, is shown in the illustration.

The square stick *B* slides easily in the groove of the block of wood *A*, being held in by two pieces of galvanized sheet *C*. A pencil *D* is held by the spring holder *E*, which is fastened by a screw to *B*. The point of the pencil may be placed in any one of the five holes in the guide *F*, which is a piece of galvanized sheet fastened by screws to *B*. When the stick *B* travels in its groove the pencil makes a straight mark on *G*, a sheet of red gasket rubber, from which marks can be easily cleaned when desired.



DEVICE FOR MEASURING THE DROP OF INDIVIDUAL STAMPS

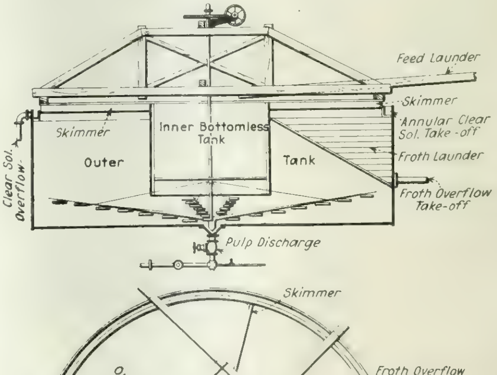
In using the device the batteryman holds the block of wood *A* with one hand on top of the moving tappet of No. 1 stamp; then, with the other hand, he brings the end of *B* up against the upper guide timber, or a horizontal timber placed at the right height for this purpose. To make the operation easier, a handle *H* may be attached to *B*. Five or six drops of the stem produces a straight line on the gasket rubber, which represents the actual height of drop of that stem under working conditions. The pencil is then shifted to the second hole in the guide *F*, the operation repeated for No. 2 stamp, and so on until the lines on the gasket rubber show graphically the drop of each stamp of the entire battery. The five lines can be measured, and the stamps hung up one at a time and tappets set in accordance with the measurements. The setting of the tappet of the feed stem is the only part of the operation which necessitates hanging up the entire battery.

Settling Flotation Concentrates

By G. L. Schmutz

Difficulty often has been experienced at concentration mills in the settling of flotation concentrates. To remedy this, a tank was designed and developed by P. A. MacEachern and L. D. MacRae, and is giving excellent results at the concentrator of the Montezuma Copper Co., at the Mina Mexico, and at the Potter & Palmer Mining Co. at Nacozari, Sonora, Mexico.

The device consists of a Dorr thickening tank, upon the vertical shaft of which is attached an inner bottomless, tank, or diaphragm, and skimmer arms. These revolve with the shaft. The feed is introduced at the top of the diaphragm, and the outer tank is charged from the bottom of the diaphragm. The inner diaphragm is approximately one-third the diameter of the thickening tank and extends downward two-thirds of



DEVICE FOR FACILITATING SETTLEMENT OF FLOTATION CONCENTRATES the depth of the outer tank. An annular stationary ring protects the clear water overflow from froth, and the skimmers discharge into a froth launder, which is shown in the illustration. Clear water, froth, and thickened concentrates are the products made. The device has been patented (No. 1,313,714).

Circulating Mud-Laden Fluid With Cable Tool Drilling*

By M. Van Couvering

The idea of circulating mud-laden fluid in oil wells drilled with cable tools, in the reverse direction from that in general use, is not a new one, but the method, embracing a number of new features, as worked out by L. R. Evans, superintendent of the Lake View No. 2 Oil Co., merits description for the benefit of operators not familiar with it.

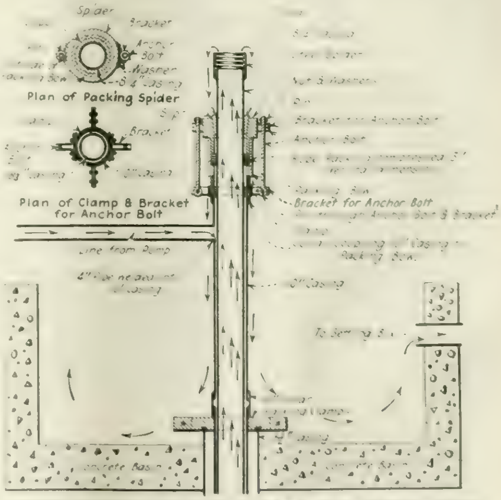
The equipment described was in use by the Lake View No. 2 Oil Co., in its well No. 25, on Section 34, T. 32 S., R. 24 E., M. B. D. and M., in the Midway field. After cementing the 10-in. casing at 2,540 ft., the 8¼ in. casing was carried to a depth of 3,190 ft., with cable tools, with continuous circulation of mud-laden fluid, and was cemented at the latter depth. In drilling from 2,540 to 3,190 ft. the 8¼-in. casing encountered loose caving shale and two strata of water sand, one of which contained flowing water, and it was, furthermore, carried past some sidetracked casing.

The principal feature of the equipment is a special packing head which permits circulation of mud-laden fluid at all times except when passing a collar of the 8¼-in. casing through the packing head. This head consists of a packing bowl containing rope packing, resting on a shoulder of the bowl, and a spider with a downward extension which compresses the packing. The 8¼-in. casing rests on slips, which, in turn, rest on the spider mentioned above. In addition, the spider is held down by a pair of anchor bolts which are attached, at their lower end, to a clamp on a 10-in. collar. This collar also serves as a coupling between the 10-in. casing and the packing bowl, which rests upon it. When it is desired to move the 8¼-in. casing, it is only necessary to remove the slips, when the packing head will be held in place by the anchor bolts.

The upper portion of the 10-in. casing consists of a short nipple, into the side of which is welded a section of 4-in. pipe. When the work has been completed the 10-in. nipple can be removed and used at other wells. The fluid is pumped into the 10-in. casing through the 4-in. pipe mentioned above. The packing head prevents its exit at the surface between the 10 and 8¼-in. casings, so it is forced downward between these casings and muds the formations exposed below the shoe of the 10-in. casing. When the shoe of the 8¼-in. casing is reached, that portion of the fluid which did not pass into the formations passes upward, inside of the 8¼-in. casing, to the surface, where it overflows and is caught in a concrete basin below the floor. The dimensions of this basin are 10 x 10 x 4 ft. deep. The walls are 10 in. and the floor is 14 in. thick. To prevent the cement from setting against the 10-in. casing when the basin was built, a joint of 15½-in. conductor pipe was placed vertically in the floor of the collar around the casing. The space between the 15½ and 10-in. casings is packed off with packing clamps. The outlet of the basin is a section of 6-in. pipe passing through the wall, about a foot below the top of the wall. From this point on the fluid is handled as in drilling with rotary tools; that is, it is discharged into a settling box leading to a tank and is then pumped back into the well.

The equipment and method described offer a number of advantages over the method in general use in mudding with cable tools. The working casing is open at all times, doing away with the casing head, including steel ring, plates, plunger, and rope clamps. Circulation can be maintained while running in, pulling out, drilling, or fishing. (Fishing for a bit was continued for five days in this well without stopping the circulation.) The only time that circulation need cease is while passing a collar through the packing head. A joint can be "circulated in" while the spider holds the pressure on the packing.

In the ordinary method of forcing the fluid upward between the casing and the walls of the hole, much of the sand and coarse material is carried with the mud, a large amount either passing into the porous formations, and thereby greatly lessening the thoroughness with which the mud fluid seals these formations, or lodging on the collars and other projections between the casing and the walls of the hole, thus interfering with the circulation and, in many cases, "freezing" the pipe. In addition to this, much coarse material remains in the bottom of the hole, to be drilled out later.



CROSS-SECTION OF CASING HEAD FOR CIRCULATING MUD-LADEN FLUID WHILE DRILLING WITH CABLE TOOLS

In the method here described the cuttings and cavings are washed up inside the working string of casing to the surface and are deposited in the concrete basin, settling box, or tank, leaving only the clean, smooth mud to be forced into the porous formations. Furthermore, there is no coarse material to clog up the space between the casing and the walls of the hole. It has been noticeable that the pump pressure necessary to maintain circulation in this well was 50 lb. per square inch, which is much lower than is usual with circulation in the opposite direction. The hole has been open and the 8¼-in. casing perfectly free at all times.

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*Excerpt from an article in August, 1920, Summary of Operations, California Oil Fields, California State Mining Bureau.

BY THE WAY

Da Capo

The last word in the famous bauxite controversy has again been uttered—this time by a writer in the *Bauxite News*, published by the American Bauxite Co. Standing secure in the knowledge that his company mines over 90 per cent of the bauxite produced in the United States, this person boldly asserts that he should have a little to say on the subject of how the name of the mineral should be pronounced. "So settled and familiar has the pronunciation of bauxite as 'box-ite' become in this section of the country," says he, "that we have had laborers come here from a distance looking for the box factory. In conclusion, we beg to serve notice on all persons either within or without the borders of the United States that we, here, have finally and irrevocably decided that the proper pronunciation of bauxite is 'box-ite'." The discussion is again closed.

Where Ignorance Is Bliss

"No use talkin', m'son," said Cap'n Dick, "a chap these days mus' 'ave some specialization a'for 'e gaws h'after a job. If 'e 'as'nt 'e's liable for to fall daown some'ow or h'other. Take tha case o' Tommy Trembath. Tommy, 'e gaws h'up an' h'asks for a job, an' at tha h'office they asks 'im if 'e can fire. Never 'ad 'e tried un, so, dam-me, 'e gets no job. Back 'e gaws to tha boardin' boss, 'oo tells un 'e shouldn't made 'imself so h'ignorant any'ow, for like as not they would 'ave 'ad a man to show 'im raoun' for a day or two. So nex' day Tommy gaws h'up an' tha boss h'asks 'e if 'e nawed 'ow to run pumps. 'Dam-me, yes,' sez Tommy, 'I been raised right 'long side one o' they.' Then tha boss h'asked Tommy, could 'e pack a pump if need there be. 'Well,' sez Tommy, 'it h'all depen's on 'ow 'eavy tha beggar be.'"

From Maelstrom to Muleback

Philip N. Moore, of the War Minerals Relief Commission, has received the following from a Democratic correspondent:

> The Republican maelstrom is over. The flotsam and jetsam sucked in will be cast out to demand performance of all the pre-election promises and many more.
>
> Among the very reasonable demands, they will demand that the price of wheat and corn shall be higher. Bread and bacon lower. The coal baron must continue to receive handsome profits, the wages of the coal miner must be increased, the price of coal must come down.
>
> The railroad, steamship and trolley lines must receive higher dividends, the people be carried for less. The excess profits must be taken off of big business, but the public must not pay more.
>
> England must be pleased. Ireland satisfied. The Turk must not butcher any more Armenians, but no American warship shall enter a Turkish port except for social purposes. We must regulate the affairs of Europe, Asia and Africa, but no American mother's son must be required to fight in foreign lands.
>
> You must satisfy the gouger and the gouged, the nigger and the Hun; the profiteer must continue to reap the golden harvest, the public to obtain things for less.
>
> It's a big job, but you wanted it, you won the Democratic Mule—now ride him. He is warranted to buck. He will do some bad acting in a few years and you are due for a trade in four years. Then we will take him back. We know how to handle the critter.

News From the Oil Fields

M. C. Trumbull, of Mansfield, La., a manufacturer of sawed and bucked tight barrel staves, headings, and hardwood lumber, is also interested, though not financially he states, in a wonderful instrument for locating oil. This is not the ordinary instrument used for the purpose but very extraordinary, indeed. It will tell approximately how big a well can be had by drilling. This marks a step forward in the design of such devices. Another improvement might be added by making it possible to tell how long it would be before salt water would come in. However, Rome was not built in a day, and Mr. Trumbull is doing very well as it is. He has worked with the instrument for over a year in Louisiana, Texas, Oklahoma, Kansas, Colorado and Wyoming without a single failure. He has seen over 200 wells brought in as the instrument has foretold. But he does not want to sell anyone even an interest in the device. Instead he wishes he had one himself. However, he will arrange to give demonstrations without cost. As reference he gives the Bank of Commerce & Trust Co. at Mansfield. Here is a chance for the enterprising one of simple mind.

The Fitchered Hole

A fitchered hole's the toughest thing I've tackled underground,
And I've gone against some rough stuff in my wanderings around;
But when it comes to meanness that will test your very soul,
There's nothing that compares to a badly fitchered hole.

Oh! there's different kinds of misery that make a miner swear,
It may be gas and powder smoke or foul and dusty air;
And carbide lamps that sputter out or choke and make a fuss
Are little incidental things that make a miner cuss.

It's bad enough to have a boss who's growling all the time,
Who kicks at this and kicks at that in going round the mine,
And the trammer has his troubles when a car goes off the track;
He swears, but gets a piece of steel and swears, but puts 'er back.

A wiggletail's a beastly thing we sometimes have to run,
And the wearing of a muzzle isn't looked upon as fun.
Oh! the eating of a sweaty lunch and drinking hard boiled tea
Has made a lot of miners say, "She's deep enough for me."

There isn't any pleasure in a hot and gassy raise,
It burns your eyes and nose and throat, your head is in a daze.
Sure there's nothing very pleasant in a wet and sloppy shaft,
And a boulder blocking up the chute will drive a mucker daft.

But these are only little things I mention by the way;
They're things a miner overcomes so he can draw his pay.
When things are going smoothly and you're getting in a round,
A fitchered hole's the meanest thing you'll tackle underground.

You'll fight and curse and sweat and work until you're all but in,
For a fitchered hole's the meanest kind of concentrated sin.
Some day you'll start for heaven, but before you reach the goal,
Saint Peter's goin' to ask you what you called a fitchered hole.

W. J. PIKE.

CONSULTATION

Literary Assistance to the Engineer's Reports

"Recently I heard from a friend that a representative of the *Engineering and Mining Journal* had stated at an editorial conference that there were certain publications of the U. S. Government which are of material assistance to engineers and others interested in the preparation of technical reports and the authors of papers on technical subjects. May I ask you to tell me in detail exactly to what publications reference was made?"

There are two Government publications which are a great help to anyone desiring to improve in technical and even in general writing. The first, the "Style Book of the Government Printing Office," is essentially a reference book on the typographic style to which Government publications are expected to conform, and goes into such matters as capitalization, abbreviation, spelling, the uses of italics, and punctuation. A pamphlet, "Extracts from the Style Book of the Government Printing Office," covers the essential features of the more voluminous compilation. The other publication to which reference was made is entitled "Suggestions to Authors of Papers Submitted for Publication by the United States Geological Survey," by George McLane Wood. Its title is suggestive of its contents, for the text clearly and excellently points out pitfalls in careless writing, and discusses the proper use of certain words, giving valuable suggestions as to expression, general relation of the items in a report, misuse of phrases, grammatical errors, and typographic style. It also describes in a practical manner the correction of proof sheets, and printers' terms and practices. The publication is by no means new, but it seems to be known to a relatively small circle. It should be of particular interest to mining engineers who have much to do with writing geologic and mine reports. The principles expounded, however, apply to any writing, and every engineer will do well to have a copy of this excellent pamphlet in his possession for guidance in his literary efforts. It can be obtained from the Superintendent of Documents, Washington, D. C., for 15c.

Tube Mills vs. Ball Mills for Fine Grinding Flotation Feed

"Please tell me why tube mills and pebble grinding are not used in flotation mills. Is it a case of greater efficiency and therefore economy, to use steel balls for grinding, or does the grinding by pebbles produce a condition of some kind in the pulp which is unfavorable for flotation? Also could pebbles be used in a ball mill constructed for steel ball grinding? What would be the effect of their use in such a mill?"

Tube mills and pebble grinding are generally used nowadays in this country if it is desired to grind exceedingly fine; that is, where none of the product must be coarser than, say, 100 mesh. Such extremely fine grinding is usually not necessary in flotation, most sulphide particles floating satisfactorily if ground to 48 or 65 mesh. For grinding to this size, ball mills, using steel balls, are more efficient, chiefly on account of their much greater capacity per unit. In some operations it may also be that abraded particles of steel act as an aid to flotation. This theory was first advanced, we believe, by Dr. Gahl, at the Inspiration mill. However, the chief reason for the use of ball mills with steel balls is that such use means a lower grinding cost. Still, the practice is not universal. At the Ray Consolidated mill, at Hayden, Ariz., for example, 10 x 7-ft. tube mills have been used, and possibly still are, for regrinding rougher table tailings for flotation. In these tube mills, both 2-in. manganoid balls and cubes of siliceous rock have been used.

Pebbles or mine rock can be used in a ball mill instead of steel balls, but steel balls cannot be used in a pebble mill for any length of time, for they would tear it to pieces. The effect of using pebbles instead of steel balls would be to cut the capacity markedly, and result in a difficulty in taking as large-sized particles in the feed as formerly; the power required to turn the mill would be much less, and probably a longer life of the mill lining per ton ground secured.

Flat vs. Round Pebbles in Tube Mills

"I wish to thank you for your very full and complete answer to my recent questions about tube-mill and ball-mill grinding.

"In describing the use of tube mills at the Ray Consolidated you speak of their using 'cubes of siliceous rock.' The imported Danish pebbles which I have seen were well rounded. In the case out of which these questions arose a so-called 'native pebble' is being used. When fed into the tube mill the pieces of rock are angular, having flat faces. Within a short time after they are fed into the mill they become well rounded. It is claimed that the angular form is a defect, and great pains are taken to hand-pick stones as well rounded as possible. Now, it seems to me that the grinding efficiency of the angular pebbles would be greater than that of the well-rounded ones. Your expression 'cubes of siliceous rock' would imply that the Ray people would choose square pebbles. What is the real difference in grinding practice between angular and well-rounded pebbles?"

The "cubes of siliceous rock" to which reference was made are used in that shape because it is cheaper to make them round in a tube mill than by other means. The ones referred to were produced by the Jasper Stone Co., of Sioux City, Iowa, and are apparently broken out of solid rock. To make them round would be an expensive process, and, anyway, they quickly wear to that shape after being put in the mill.

We cannot agree with you that the grinding efficiency of angular pebbles would be greater than of spherical, although we have no experimental data to offer to prove the point. If two cubes should impinge on each other, side to side, evenly, of course the crushing efficiency would be high, but this would rarely be the case. With angular faces meeting, the area between which the crushing or grinding action would take place would certainly be less than in the case of balls or spheres of similar weight. In grinding with balls, although there is theoretically only point contact, a considerable area exists around this contact point which comes sufficiently close to the neighboring surface to crush to the desired size or finer any particle which comes between.

THE PETROLEUM INDUSTRY

The Influence of Faulting in the Illinois Oil Fields

By H. A. Wheeler

Written for *Engineering and Mining Journal*

FOLDING and faulting have been going on since the Azoic, or the earliest period of geologic time. The primary world-wide movements of the earth's crust that are due to either the slow cooling and consequent shrinkage of our planet or the slow but never-ending emergence and submergence of continental areas result in complex folds or faults, or both, of highly variable magnitude, according to local conditions and distance from the loci of movement. Local crustal movements caused by vulcanism also result in either faulting or folding. That faulting is occurring today is evident by the resulting shocks known as earthquakes.

The relief from the excessive strains caused by the movement of the earth's crust is likely to take the form of folding where the strains are the result of gradual accumulation in areas of continental or semi-continental magnitude. If, on the contrary, the crustal movements are of local character, and especially the result of rapidly increasing strains, the relief therefrom is more apt to prevail as faults, although folding will be a prominent feature. In strains due to vulcanism, the relief through faulting is usually predominant, and folding may even be absent if the formations are of a brittle non-yielding character (limestones and sandstones).

The object of this elementary prelude on the usual origin of folds and faults is to induce the oil geologist to remember that folding and faulting, at least to some extent, are rarely if ever absent in areas of magnitude, and that they have been constantly occurring from the earliest geologic time and are still active in the present psychozoic period. The importance of folding in the concentration of oil and gas into commercial pools is so well recognized that it will not be further considered.

Effect of Faults Occasionally Beneficial

The influence of faults on oil and gas accumulations is highly important, although usually for its negative value. For in most instances faults ruin otherwise favorable structures through leakage, although occasionally they produce commercial oil pools, especially on monoclines. Where faulting has ruined favorable structures, it will usually—if not always—be found to be subsequent to the oil accumulation, whereas, when its influence is favorable, the fault usually precedes the oil and gas accumulation. The relation of the period of faulting in its influence on the oil and gas accumulation depends on the time when the main movement of the fault occurred. Most faults of magnitude are the result of repeated minor movements along a line of weakness that may represent long intervals of time—even up to the present period; and although the individual movements may have been slight, the now large fault represents the integration or accumulation of many subordinate movements.

Similarly, the accumulation of oil and gas pools of relatively recent age—say, since the Cretaceous—probably represents a long period of gradual accumulation that is undoubtedly still going on in some of the very young pools. Most of the large oil and gas pools are geologically very young, or of Tertiary or Cretaceous age, as in Mexico, the Gulf Coast country, California, Wyoming, Russia, and South America.

Gushers More Prevalent in Later Geological Periods

It is highly interesting and extremely important to note that as the older geologic periods are considered the huge gusher type of well becomes less frequent, and the average yield per acre usually shows a large decline, whereas the quality of the oil shows a marked improvement. Almost all the high-grade oil fields are at least as old as the Permian, if not considerably older. Whether this improvement in quality by age is due to slow chemical changes, similar to the well-known gradation and improvement in the solid carbonaceous or coal series through aging, or is caused by the mechanical process of filtration through clays and shales in the probably more frequent migrations that their long life has permitted, is an open question.

As animal and vegetable life has been abundant at least as far back as the Devonian, and consequently there has been ample material since that period to produce large accumulations of oil, it is not unlikely that the lower acre yield of Paleozoic oil fields has been due mainly to leakage through faulting, rather than by outcropping seepage, clogging of the pores by mineralization, or like causes. For the older the formation, broadly speaking, the longer has been the opportunity for it to be faulted.

In considering the influence of faulting in the Illinois oil fields, which in 1907 and for the seven subsequent years was the third largest oil producer in the United States, the general geology is quite simple.

Illinois is an elongated, spoon-shaped basin, the major axis of which trends about 25 deg. W. and is about parallel with the famous Cincinnati anticline or arch, which delimits the eastern boundary of the basin. Its length north and south is about 360 miles and its width at the heel of the basin in southern Illinois is about 90 miles, with a maximum width of 200 miles in the central portion, and contracts to 125 miles at the north end. This basin consists mainly of the Carboniferous or coal measures, which has a maximum thickness of 2,000 ft. in the southern part of the basin and gradually thins and feathers out in the northern part of the state, near La Salle, where the underlying Devonian and Silurian limestone and shales come to the surface. The Mississippi limestone or Sub-Carboniferous flanks the eastern, southern, and western sides of the basin.

The Illinois coal measures consist mainly of an intercalated series of shales of varying degrees of thickness with subordinate limestones, sandstones, and several coal seams. The measures thicken and increase in number toward the southern and eastern sides of the state. They are covered with a mantle of glacial drift that ranges from 50 to 200 ft. on the north and feathers out near Carbondale, in the southern part of the state, which is the extreme tip of the terminal moraine.

LA SALLE ANTICLINE HAS JUSTIFIED EARLY PREDICTIONS

On the eastern flank of the Illinois basin is a strong, persistent gently plunging anticline that takes its name from the town of La Salle along the Wabash River. This anticline dips from 50 to 75 ft. per mile in Clark County, increasing southwardly to a maximum of 250 ft. per mile in Lawrence County. It was mapped over fifty years ago by Professor Worthen, the first state geologist of Illinois, and it is nearly thirty-five years since Prof. T. B. Comstock vainly wrote so enthusiastically as to its oil and gas probabilities. Yet since J. J. Hoblitzelle, of Pennsylvania, brought in the first commercial well near Casey, in 1904, the value of the oil produced along this anticline exceeds $360,000,000.

There are two to eight producing sands in the coal measures, the underlying "Chester" and the top member of the "Big" or St. Louis limestone, that produce high-grade oils that range from 30 to 40 in gravity. Since September, 1919, wells have been found in the Trenton limestone, in Clark County, at a depth of 2,200 to 2,600 ft., that came in at 50 to 200 bbl. of dark green, high paraffin oil.

This eastern Illinois oil field is situated along the La Salle anticline, and has a length of seventy miles, with a width of usually two to four miles, except in Crawford County, where a cross anticline seemingly widens it to fifteen miles. Usually, gas is associated with the oil, and occasionally dry gassers occur, but the gas wells are of minor magnitude when compared with the high, consistent yield of the oil wells. Some of the oil sands carried no gas, especially the Bridgeport sand, and its absence in the latter so discouraged some of the old Eastern operators, who opened the field, that they hastily sold out at low prices, fearing that salt water would shortly take the wells. But the well has proved a very consistent, reliable producer, and Bridgeport is one of the few town-lot propositions that has been a real money maker.

SMALL FAULTS PROBABLY PERMIT OIL AND GAS LOSSES

The only large fault that occurs in the eastern Illinois field, as far as I know, is at St. Francisville, at the south end of the district. It is probable that small, minor faults occur, and though they have not been sufficiently large or open to cause a loss of the oil, gas seems to have escaped. In fact, the old town of Oilfield, near Casey, where considerable drilling was done about 1866, was based on oil and gas seepage, indicating at least slight faulting.

The St. Francisville fault abruptly terminates the eastern Illinois field, and although occasional spasmodic pools occur in the Indiana on the southeasterly extension of the La Salle anticline (Princeton, Oakland, Petersburg), they lack the continuity, richness, and reliability of the eastern Illinois field.

As the eastern Illinois oil field is over eighty miles from the dikes and numerous faults in Hardin County, in extreme southern Illinois, and is situated from 125 to 150 miles from the Ozark uplift of Missouri, it should be reasonably free from serious faults, and its consistent, highly satisfactory oil record confirms this opinion.

As the western Illinois oil fields are fifty to one hundred miles nearer the Ozark uplift, faulting is more prevalent and has ruined several structures that otherwise possessed the fundamental conditions for the occurence of valuable oil pools.

PROMISING ANTICLINE PROVES VALUELESS

Considering specific cases, the O'Fallon anticline was recommended as a promising structure over fifteen years ago by the Illinois Geological Survey, as the neighboring coal mines gave reliable evidence of a strong northeasterly anticline. O'Fallon is fifteen miles east of St. Louis, on the favored east and west B. & O. R.R., on which are situated some of the richest of the Illinois oil pools. Its proximity to the Belleville and St. Louis markets for gas, its excellent trolley and railroad facilities, its favorable fuel and water conditions, have caused various parties to drill twelve wells along this anticline in the last twelve years. No oil or gas was found, as a local fault has not only permitted it to escape, but it is so open that the underground water is in circulation and hence is *fresh*—at least in the Nos. 3 and 4 sands, the usual oil and gas horizons in this part of Illinois. If the water is moving so freely as to be non-saline, the oil and gas have evidently migrated with it, as there is no hope of finding oil where the water is not salty or shows circulating conditions.

At Aviston, fifteen miles east of O'Fallon, in Clinton County, is another well-defined anticline with a sharp reversal to the west of over 100 ft. that caused the drilling of eight wells in 1912, immediately after the Carlyle boom, which latter was on a milder structure about twelve miles further east. Some gas was found at the base of the glacial drift at a depth of 50 to 70 ft. and a little "dead" oil—or a remnant of dark, heavy oil—was found in the No. 3 or "Carlyle" sand, along the crest of the anticline; otherwise the holes were "dusters," but the water was salty.

The occurrence of shallow gas at the base of the glacial clays with the remnant of heavy dead oil in the No. 3 sand, together with the unusual severity of the sharp westerly reversal, strongly indicates a local fault. Though this fault has permitted the escape of the oil and gas, it is not so open as to allow of circulation of the underground waters; hence, the latter are saline.

About six miles east of Aviston is the Breece oil pool, where small amounts of oil are found in the No. 3 sand, with considerable salt water on a weak structure. Twelve miles further east is the Carlyle pool, where 1,000-bbl. wells were found in 1911, with plenty of gas, as also at Sandoval, fifteen miles still further east. It is highly probable that O'Fallon, Aviston, and Breece were rich in oil and gas, like Carlyle and Sandoval, before they were faulted. The nearer one approaches St. Louis, or comes within the influence of the Ozark uplift, the more severe has been the result of the faulting. Thus, O'Fallon is fifteen miles east of St. Louis and not only has all the oil and gas escaped but the water is no longer saline. At Aviston, thirty miles east, the water in No. 3 sand is salty, but has only remnants of oil. At Breece, thirty-six miles east, there are a few small oil wells; at Carlyle, forty-two miles east, are fine large wells, with plenty of gas, as also at Sandoval, fifty-seven miles east of St. Louis.

STRUCTURE, ONCE OIL-BEARING, NOW WITHOUT COMMERCIAL OIL

Near the town of Waterloo, twenty-five miles south of St. Louis, in Monroe County, Ill., is a heavy fault that parallels an anticlinal fold. The recent finding of a little heavy, black residual oil at 528 ft. in drilling a water well at Waterloo started leasing and drilling, especially as the Illinois Geological Survey regards the structure with favor. To me, the "dead" character and trifling amount of oil (a few gallons) found in the water well strongly suggests that though the structure was once oil bearing, the oil has long ago escaped along the fault, and this trifling remnant is merely evidence that prospecting today is perhaps a million years too late to expect oil in paying quantities. Two deep water wells (over 2,000 ft.) were drilling on a favorable location many years ago at the Waterloo brewery without finding oil or gas, and a more recent test that was drilled for oil about one and a half miles northeast of Waterloo was also unsuccessful.[1]

At Centralia, sixty miles east of St. Louis, in Marion County, there is a heavy northwest fault that breaks through an otherwise large, promising dome on the Sandoval-Irvington anticline. This dome has a westerly reversal of 20 to 40 ft., and the normal average easterly dip of 15 ft. per mile increases to 50 to 125 ft. for five miles east of the apex of the dome. Although this anticline was mapped over fourteen years ago by the Illinois Geological Survey, it was ignored until oil was struck in sinking a coal shaft at Junction City, two miles north of Centralia, on the crest of the anticline. This discovery started drilling, which developed a small pool in the Dykstra, or No. 1, sand immediately under the coal seam and in the Wilson, or No. 2, sand at 700 ft. Although the wells were small, coming in at 5 to 30 bbl., it started prospecting in every direction that opened up the Sandoval pool, four miles north, and the Centralia pool, two and a half miles southeast, of Junction City. The Sandoval pool has been one of the richest and most consistent in the state, producing 50 to 500 bbl. wells from the "Stein," or No. 3, sand at 1,425 ft. and the "Benoist," or No. 4, sand, at 1,550 ft. The wells are still producing 7 to 12 bbl. daily, although over ten years old, and few dry holes occurred inside the pool.

SURVEY WORK EXPLAINS THE IRREGULARITIES OF CENTRALIA POOL

The Centralia pool, on the contrary, has been extremely unprofitable and highly erratic, and until recent work of the Illinois Geological Survey disclosed a heavy northwest fault, it was difficult to explain its idiosyncrasies. For, on bringing in a good well in the thick (30 to 40 ft.) No. 4, or Benoist, sand (a true sandstone), drilling a ring of wells around it only one location distant would result in dry holes. Of twenty-five to thirty wells drilled on the Centralia dome, only two good (70 to 80 bbl.) and three small producers have been found. This shows that the few wells represent thick spots, "pimples," in the sand that locally trapped the oil, whereas most—perhaps over 95 per cent—of the oil has been lost through the fault (has continued migrating). This is confirmed by the fact that in the Junction City coal mine, in whose shaft the discovery seepage was found, oil floods the abandoned rooms, showing that it is still ascending the fault that is one-fourth mile east of the shaft. As this fault passes west of Sandoval, it did not affect that field, which is exceptionally rich in gas, whereas there is no gas in the Centralia or Junction City pools. This fault has a throw of over 100 ft. and where offshoots from it extend through the Centralia mine, oil seepage occurs.

At Grafton, on the western side of the state, there is a heavy easterly fault with a throw of about 500 ft. that brings up the Niagara dolomite as steep bluffs amid Mississippi limestone. As the Niagara is saturated with heavy black oil for over 100 ft. on its outcrop, it has caused considerable drilling in the vicinity. As "seeing is believing" with most people, such a strongly saturated oil rock should be underlaid with oil, according to the "tenderfeet" who drilled nine dry holes, although warned by a geologist that this fault had ruined the pool that probably existed there in preglacial times.

FAVORABLE OIL STRUCTURES SPOILED BY FAULTING

There are numerous small domes and local anticlines in the southern part of Illinois, in the heel of the spoon or basin, where the dip is ample (40 to 200 ft. per mile) to form oil and gas pools and that have caused the drilling of many wells—some of which were judiciously located on good structures. To date (December, 1920) no paying oil wells have been found, although many of the tests were deep enough to reach all the known producing horizons of Illinois. The great prevalence of faults in this district, due to its close proximity to the Ozark uplift (twenty to fifty miles), explains this lack of success and renders the future decidedly discouraging in a district otherwise more favorable than further north, from the greater number and thickness of the sandstone horizons.

The age of the Illinois faults cannot be determined closer than that they are Post-Carboniferous and Pre-Glacial, for they break through the highest members of the coal measures, but do not disturb the overlying glacial drift. As this represents a long period during which the Permian, Triassic, Jurassic, Cretaceous, and Tertiary sediments were being deposited in other portions of the continent, it leaves much room for speculation as to when the faulting occurred. Though the faulting was subsequent to the folding, it scarcely narrows the broad range during which the faulting may have occurred. I regard the heavy faults at Grafton and Waterloo as representing the accumulation of successive movements from at least Cretaceous times, if not considerably earlier, as an old line of weakness or relief, whereas the numerous small minor faults found in western Illinois are probably much younger, if not very recent in some cases.

In any event, the Illinois faulting was subsequent to the accumulation of the oil and gas pools, and hence has thus far been found to ruin—through leakage—otherwise promising structures. The Centralia fault is so recent that all the oil has not yet completely escaped, as a small amount—enough to make a few wells—still remains, and the accumulation in the worked-out rooms of the Junction City coal mine shows that the oil is still migrating.

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[1] [illegible] recently completed [illegible] on the crest of the anticline found [illegible] half a barrel of [illegible] oil

NEWS FROM THE OIL FIELDS

Boyd County, Ky., Brings in Two Wells

From Our Special Correspondent

Boyd County, Ky., is beginning to attract attention of oil prospectors and investors since the Good Loser's Oil Co. has brought in two good wells in that territory and is drilling a third. Well No. 2 was put under the pump, and in four days it pumped 82 bbl. of oil. The well on the Kirk-Queen property in the same locality has been tubed. This well is good for 20 to 25 bbl.

Another big oil well is reported from Warren County. This new strike, on the Vierling lease in the Oatsville pool at a depth of 1,652 ft., is reported to be making 600 bbl. natural flow without shooting.

The Union Gas & Oil Co. has completed its No. 1 on the C. C. Rose lease, Keaton's Fork, which is reported good for 10 bbl. This lease is in Johnson County.

On the Kendall Williams lease, at the head of Big Mud Lick, operators have brought in a well in the Berea sand, which is reported to be good for 5 to 8 bbl. This is a new wildcat well, three miles from any production, and extends the field.

Pittsburgh operators have recently opened a new oil pool in Green County. The initial well was brought in on the Gowan farm, and is reported to be good for 25 to 30 bbl. There are fourteen producing wells in Green County.

Honolulu Consolidated Oil Co. Granted Leases

Secretary Payne, on Dec. 23, authorized leases to the Honolulu Consolidated Oil Co. of its known producing wells. The company, after denial of its applications for patents last spring, applied for leases under the new Leasing Act. Its lease applications were protested by the Navy Department, the Buena Vista Land and Development Co. claiming under state selections, and by various individuals claiming under the mining laws. The Navy Department had objected to the leases on the ground that the company was not entitled to leases under the terms of the act. In addition, as to certain wells, it alleged there was no production, and that therefore those wells were not subject to lease

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It is reported that the Midwest Refining Co. is preparing to drill a well in wildcat territory fifteen miles west of Cortez, Montezuma County, Col This will be east of the San Juan, Utah, district and north of the Aztec, New Mexico field

Canada Orders Crown Reservation on Oil Locations

From Our Special Correspondent

An Order-in-Council has been issued by the Canadian government reducing the area of petroleum and natural-gas locations which may be acquired in the Mackenzie, Franklin and Keewatin districts of the Northwest territories. The maximum area which may be staked, which was formerly 1,920 acres, has been reduced to 640 acres, but it is provided that the area so located shall be divided into two equal parts, one of which shall be reserved for the Crown. The applicant is to make an affidavit that the tract selected as a Crown reservation is as favorable for the discovery of petroleum as that which he has applied to lease. Should oil be discovered in commercial quantities, the lessee of the location on which the discovery was made is entitled to a lease of the Crown reserve, provided that no other discovery has previously been made within a distance of 100 miles.

Mid-Kansas Co. Brings in a Good Well

From Our Special Correspondent

One of the most important completions in north Texas for some time was made recently by the Mid-Kansas Oil Co. in its No. 3 Hull well, in the Eliasville-Ivan district of Stephens County, making 2,500 bbl. daily. Two other wells, the Mid-Kansas G. W. Hill and the Prairie Oil & Gas Co.'s J. W. Hill, were also brought in, making 300 and 500 bbl. respectively. The G. W. Hill well is 3½ miles northeast of the Texas Co.'s wells on the Black brothers' ranch. The oil in all of them is found in a loose gray limestone like that of the Burkburnett district, and it is believed that a large field of good life will be found here.

Utah Cannel Coal Rich in Oil

From Our Special Correspondent

A possible new source of oil in Utah is suggested in cannel coal, so far proved in a 5½-ft. seam in a small area a few miles square in the Colob coal field, which exte[illegible] City south to Kamarra [illegible] southeasterly to Mount Carmel in Kane County, and estimated [illegible] Geological Survey to [illegible] tons. The particular [illegible] to is found at the [illegible] fork of the Virgin River above Zion Park. A sample of the coal taken by C. A. Allen and submitted [illegible] of Mines for analy[illegible] yield oil at the rate of [illegible]

Toll Charged on Mexican Oil Roads

From Our Special Correspondent

The Mexican Gulf Co. is now placing a toll on all hauling being done on its road from Mamez to Chinampa, and the Aguila Co. has added several new toll gates along its road to Zacamixtle.

The Mexican Gulf Co. drilled in its well on Lot 251, Amatlan, on Dec. 12, and it is said to be good for about 50,000 bbl. daily. This lot is next in line south for the encroachment of salt water, and this well will probably not last more than four months. This makes the tenth big producer on this lot.

The Company Mexican Petroleum, "El Aguila," brought in its big well which offsets the Cias del Agwi well in the Federal zone on Dec. 12 also. The well is said to be good for about 50,000 bbl. per day.

Wyoming Items

The Iowa-Wyoming Co.'s well on Sec. 10-29-81 of the Bolton Creek field, Wyoming, is making a good production of black oil by pumping.

On the Sherard Dome, Carbon County, the Kasoming Oil Co. has struck oil at 1,800 ft. in its third test in this field. The well is on Sec. 2-25-89. Two previous wells were abandoned on account of water and caving. The Blair Oil Co.'s well in the Lost Soldier field, also in Carbon County, is flowing by heads from 1,210 ft.

Drilling for oil, for the most part with light rigs or rotaries, is in progress in four widely separated Nevada fields, and only one hole has attained a depth of 1,000 ft. At Fallon a few rigs are drilling, and a little oil was taken in the bailer at a depth of 1,100 ft. The Fish Lake Valley field, west of Tonopah, reports a 900-ft. well flowing water with a little oil. At Illapah, similar conditions are reported. This field is in the extreme eastern part of the state. A standard rig has been moved to the Black Rock Desert field, in western Humboldt County.

The Standard Oil Co. of California has taken first steps to get into a position of advantage for Oriental trade and to relieve pressure upon its California supplies by drilling on the Bondoc peninsula, Island of Luzon, Philippines. Twenty-seven [illegible] from San Francisco [illegible]. The work will be d[illegible] Richmond Petroleum Co., a [illegible] which has been conducting [illegible] wildcat work in Colorado [illegible] Mexico

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Executive Board of American Engineering Council Organizes

Territorial Organization Discussed and Referred to Special Committee—Part of Engineering Council's Functions To Be Assumed—Publicity Fund Voted

Herbert Hoover, president of the Federated American Engineering Societies, presided at the executive board meeting of the American Engineering Council of that organization, held in New York City on Friday, Dec. 17. Every member of the council was present, with the exception of A. M. Greene, and two new members of the board were elected: W. B. Powell of the Buffalo Engineering Society, representing district 1 (New York and the New England states), and Gardner S. Williams, of Grand Rapids Engineering Society, representing district 2 (Michigan, Wisconsin and Minnesota).

The president appointed the following standing committees: Procedure, Calvert Townley, chairman; Herbert Hoover, ex officio; W. E. Rolfe, D. S. Kimball, J. Parke Channing, L. W. Wallace and L. P. Alford. Constitution and By-laws, W. B. Powell, chairman; C. F. Scott and D. S. Kimball. Publicity and Publications, L. P. Alford, chairman; H. W. Buck and H. E. Howe. Membership and Representation, J. F. Oberlin, chairman; L. W. Wallace and A. S. Dwight. Finance, William McClellan, chairman; E. Ludlow, C. Townley and L. W. Wallace, ex officio. Public Affairs, J. Parke Channing, chairman; Fred J. Miller and L. B. Stillwell.

In discussing the program of the council immediately under consideration Mr. Hoover stated that he had called engineers together in various cities he had visited lately and that he found that the general desire of engineers everywhere was to join in the F. A. E. S. movement, but that the general trend was for territorial organization as distinguished from national organization. One of the stumbling blocks in the way of these territorial organizations joining the national organization was the question of dues. Another complexity was that individuals hold memberships in more than one society. For example, the Western Society of Engineers has about four thousand members, of which three thousand are already members of national societies who have affiliated with the F. A. E. S. Mr. Hoover also stated that there had been some opposition to the Federation based on the constitution, but that the question of territorial organization was the most important and he suggested that a committee should be appointed to canvass and report on it. This question was discussed and referred to a special committee, which will include the six district delegates.

As a step forward in co-ordinating various intersociety activities already established the necessary action was taken to make it possible for certain of the activities of the Engineering Council to be taken over by the new organization. As soon as the United Engineering Societies have passed officially upon the proposed action of the Engineering Council to transfer and continue the work of the Engineering Council's committees which have not yet completed their work the president will appoint the necessary committees of American Engineering Council to take over this work. At the meeting of the Engineering Council held in Washington there was harmony among all the member societies in the Engineering Council to this end. In this connection action was taken to amend section 9, paragraph 6 of the by-laws so that members of committees can be selected from societies of the American Engineering Council other than those at present members of the Federation. Civil engineers and engineers in other bodies not at present affiliated with the Federated American Engineering Societies can because of this action co-operate in the committee work.

The four so-called founder societies in addition have been associated in a common employment service, and the American Engineering Council has offered to take over this service.

The American Engineering Council voted to act independently as a unit and not to affiliate with the United States Chamber of Commerce. It was the thought of the meeting that the council could make its best contribution to the public by acting independently.

The council authorized the appropriation of $1,000 as an initial fund to carry on publicity work and the committee on publicity and publications was given authority to set up a board of engineering editors.

It was voted that full expenses of members of the executive board for attendance at meetings would be paid by the Council.

A special committee reported on candidates for permanent executive secretary of the organization, but no final action was taken at the meeting.

A general feeling was expressed that the meetings of the board should be held at different centers and the place of the next meeting, which will be held on Feb. 11, was left at the discretion of the president.

The Globe Miami chapter of A. A. E. recently elected T. K. Scott, president; E. L. Evans, vice-president; R. S. Allen, secretary; C. S. Elayer and J. A. [illegible], directors.

Interesting Practical Papers Read at December Meeting of I. M. & M.

The Institution of Mining and Metallurgy held its meeting of Dec. 16, last, at the rooms of the Geological Society, Burlington House, Piccadilly, W. 1. R. E. Palmer presented interesting and suggestive "Observations on Mining by the Opencast or Stripping Method," commenting on the most economical and practical slopes for the excavation made in various materials to different depths, aiming at orebodies of various cross-sections and attitudes. He concluded with an appeal to mining engineers "for the adoption of a uniform standard unit of measurement when referring to materials removed by opencast for winning ore." For example, United Verde Copper Co. recently stated that it is to remove "twenty million *tons* of overburden to uncover five million tons of copper ore," and he asks "What is a ton of overburden?"

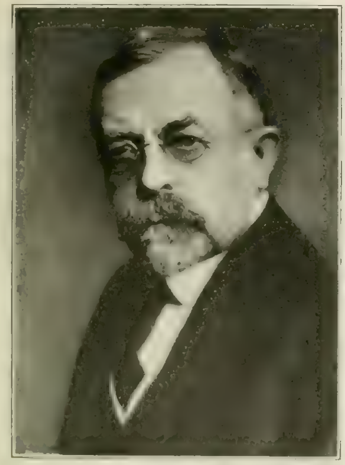
A second paper was presented by E. J. Pryor, student member, who discussed "Some Sources of Error in Alluvial Boring," drawing on his experiences in low-grade alluvial tin deposits with "Empire" and "Banka" types of drills. He finds the main sources of error in boring different ground are: Obstructing stones in the gravel; obdurate and sloping bedrock; the surge effect of the sand pump; and the human equation of the gang at work. Another small source of error is found to be the secret enriching or "salting" by the gang in order to keep the white "boss" or overseer in good temper.

Increasing Bauxite Traffic

A great impetus has recently been noted in the development of the traffic in bauxite ore from southern France, according to *The World's Markets.* Since the first of 1920 about 12,000 tons has left French ports for the United States, the analysis of the best grades of ores running well over 60 per cent alumina. There are thousands of tons of this high-grade ore lying at the base of supply, awaiting shipment, but transportation conditions are bad. This causes the rejection of lower content ores. The presence of reduction plants on the spot in the port of St. Raphael, for instance, would reduce costs of transport about 40 per cent. Both British and American interests are looking to this end. The French bauxite contains as high a content as American aluminum ores, and should the same processes of reduction be used in the French fields, it is possible that the run of low percentage content could be used. Activities in the southern French fields are greater today than ever.

MEN YOU SHOULD KNOW ABOUT

John H. Means, who has been acting chief engineer of War Minerals Relief Commission since W. R. Crane resigned, has been designated by the Secretary of the Interior to be chief engineer of that commission. The position is of particular importance at this time, owing to the fact that the commissioners will disband soon, leaving the winding up of the affairs of the commission in the hands of the chief engineer.


Harris & Ewing photo

JOHN H. MEANS

Mr. Means is a native of Vevay, Ind. He was graduated from the state university of Indiana, but received his mining education at Leland Stanford, Jr., in California. His first technical service was with the California State Mining Bureau. Later, he entered private consulting work as a mining engineer and examined many properties in California and throughout the West.

Mr. Means subsequently engaged in mining engineering work in China and Japan, after which he went to London, where he maintained an office until the outbreak of the war. He returned to the United States and took up war work for the Government. Prior to his connection with the War Minerals Relief Commission he was connected with the war minerals investigations for the Bureau of Mines.

Harry J. Wolf, of New York City, has returned from a trip to Bethlehem, Pa.

M. F. Hoster, superintendent for the E. & G. Brooke Iron Co., Saint Peters, Pa., was in New York this week.

After nine months of geologic work in South America, **E. W. Shaw** will resume his regular duties as oil geologist with the U. S. Geological Survey on Jan. 3, 1921.

George Guess, professor of metallurgy at the University of Toronto, is chairman of the Toronto branch of Canadian Institute of Mining and Metallurgy.

Gerald R. Simpson has resigned as superintendent of Standard Minerals Co., Kingman, Ariz. He will devote his attention to the manufacture of his pneumatic flotation machine.

H. Foster Bain, of Washington, D. C., addressed the New York section of Mining and Metallurgical Society on Dec. 29. His subject was "Problems Fundamental to Mining Enterprise in the Far East."

H. C. McClain, superintendent of the Liberty Bell Gold Mining Co., at Telluride, Col., has resigned that position and gone to Salida, Col. From there he will proceed to Salt Lake City, Utah, on professional business.

R. M. Wolvin, president of Dominion Steel Corporation, and **D. H. McDougall**, president of Nova Scotia Steel & Coal Co., sailed for England recently. Both are going across on the affairs of the British Empire Steel Corporation.

William P. Rutherford, managing director of the Tharsis Sulphur & Copper Co., Ltd., Glasgow, has been appointed to succeed the late Lord Glenconner as chairman of the directors of that company.

H. H. Claudet, mining engineer, of Ottawa, Canada, who has had charge of the local branch of the General Engineering Co., Inc., took over the Ottawa office and laboratory on Jan. 1, 1921. Mr. Claudet is now carrying on that business independently.

John M. Hayes, retiring after years of service as treasurer of the Utah Copper Co., was the guest of honor at a dinner at the Alta Club in Salt Lake City, Utah, on the evening of Dec. 22. A number of officials of the Utah Copper Co., of the Bingham & Garfield R.R., and other friends were present.

Max H. Barber, district superintendent, and **William R. Meyers**, assistant district superintendent, of the Mesabi iron range for the Cleveland-Cliffs Iron Co., have gone to Ishpeming, Mich., to confer with M. M. Duncan, vice-president and general manager of that company. Mr. Meyers will visit Louisville, Ky., before returning to Hibbing, Minn.

Dr. Frank Dawson Adams, dean of the faculty of Applied Science, McGill University, Montreal, since 1908, and Logan professor of geology since 1893, has been appointed vice-principal of the university in succession to Dr. C. E. Moyse, who resigned in June, 1919, after holding that position for seventeen years. Professor Adams was president of the Canadian Mining Institute in 1906, is a Fellow of the Royal Society (London) and an honorary member of the Institution of Mining and Metallurgy of Great Britain. He has devoted himself to the study of igneous rocks and metamorphic problems and has made valuable experimental research concerning the movements of rocks under great pressure.

Mining Men Visiting New York City recently included: H. Foster Bain, Washington, D. C.; E. Perry Smith, Allendale, N. J.; Roy N. McBride, Abengany, Costa Rica.; C. R. Raiter, Minneapolis, Minn.; George Fairbairns, London; J. S. Yardley, Pittsburgh, Pa.; John E. Hodge, Minneapolis, Minn.; George Lyman Clark, Lincoln, Neb.; E. W. Engelmann, Salt Lake City, Utah; David Tamor, Pittsburgh, Pa.; Lieut. James W. Rice, Edgewood Arsenal, Md.; Mortimer A. Sears, Huntington, W. Va.; Warner McLaughlin, Port Henry, N. Y.; Harold C. E. Spence, Egerton, Nova Scotia; J. M. Henderson, London; L. A. Lajat, Milltown, N. J.

George A. Parks, mining engineer, of Juneau, Alaska, recently has been chosen by the Secretary of the Interior to head an interdepartmental committee charged with the duty of stimulating the development of Alaska and the simplifying of the relations between the executive departments and the territory. One of the important things which the committee is to do is to encourage particularly those industries best calculated to furnish tonnage for the Government railroad. This means the stimulation of mining along the Alaskan line, as the hope of sufficient tonnage to make the railroad self-sustaining lies in the mining industry.

Mr. Parks was born in Denver. His early education was obtained in the public schools of that city. He was graduated from the Colorado School of Mines in 1906. Immediately thereafter he entered the employ of an English corporation and worked in the states of Jalisco, Hidalgo, and Sonora, in Mexico, and afterward went to Alaska with the same company. In 1907 he [illegible] Alaska for the General Land Office. He has held that position since, and with the exception of the time which he was in the military service during the war, he has been continuously employed in Alaska.

[illegible] photo

GEORGE A. PARKS

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

Bill for Licensing Engineers Ready for Minnesota Legislature

A bill for the registration and licensing of engineers, architects and land surveyors has been formulated by the state legislative committee of the Minnesota Joint Engineering Board after many conferences and careful study. It will be presented to the State Legislature this winter. The bill follows very closely the model bill of the Engineering Council and at present it is being presented to the various engineering societies of the state for their approval or recommendations.

The Minnesota section of the American Institute of Architects framed a bill last winter for the registration of architects which was presented to the State Legislature and passed the House of Representatives but did not come up before the Senate due to a rush of business during the last days of the session. It would come up as unfinished business at the approaching session of the Legislature had it not been recalled by the Institute of Architects. After the Minnesota section had accepted the invitation of the Minnesota Joint Engineering Board to become a member of the board and both parties realizing the many disadvantages of two registration laws, the bill presented by the Architects was recalled by them. The combined energy of all technical organizations, will be concentrated on the one bill.

The new bill provides for a registration board of seven members appointed by the governor, prescribes fees, states who may be registered with definite qualifications and who are exempt from certain provisions of the act, and permits corporations and partnerships to practice. In general the bill is considered of paramount importance. At present there are eleven states that have laws that require the licensing and registering of engineers and architects and six states have such laws under consideration. The proposed bill is not drastic or too discriminating inasmuch as it does not prohibit the designing or execution of work by any one, provided that his plans and specifications are not signed by the author as "Registered Architect," "Registered Professional Engineer" or "Registered Land Surveyor." Any unexpired certificate issued by any state or territory of the United States, or in any province of Canada will be recognized by the Minnesota law provided that the requirements for the registration of architects, professional engineers and land surveyors are of a standard satisfactory to the examining board that shall be appointed.

WEEKLY RÉSUMÉ

The petition of Karl Eilers for a writ of mandamus directing the American Smelting & Refining Co. to open to him its stock books was denied by Justice W. P. Burr, Jr., in the New York Supreme Court. Four corporations, including the National Lead and Eagle-Picher companies, have been accused before a committee in New York that is investigating the building trades of fixing the price of white lead, the manufacture of which they are said to control. Reports have been verified that the Mexican government has removed the export duty on copper and its ores and concentrates as an aid to producers, effective when copper is below 15c. and retroactive to Dec. 1. A new schedule of freight rates on Coeur d'Alene ores, agreed upon by shippers and carriers, has been disapproved by the Interstate Commerce Commission. In comparison with this is the reduction in rates recently allowed between the Mason Valley smelter and copper camps in Plumas County, Calif., in consequence of which the smelter is to be remodeled. The U. S. Supreme Court has refused to review the Star-Federal apex case. It is reported that a bill providing for the licensing of engineers is ready to be presented to the next Minnesota Legislature. In California, the Fremont Consolidated Mines have been acquired by Bulkeley Wells and associates. In Nevada, the Goldfield Development Co. has purchased the Gold Hill mine.

At Washington, the President was expected to sign the bill allowing six months' grace for assessment work, before the end of the year 1920.

Utah Companies To Seek Higher Tariff on Lead

Producers of lead in Utah are desirous that Congress shall impose a higher tariff on lead. It is felt that operation at present prices is impossible. A committee has been appointed to collect data for presentation to Congress. The members are: Ernest Bamberger, chairman; W. Mont Ferry, Frederick Cowan, E. J. Raddatz, Imer Pett and George W. Lambourne.

Control of American Smelting & Refining Co. Defended

Court Refuses To Issue Writ—Access to Stock Books Never Denied Eilers, It Is Alleged

Argument on the application of Karl Eilers for a writ of mandamus requiring the American Smelting & Refining Co. to permit him to inspect its stock books (see *Engineering and Mining Journal*, Dec. 25, 1920, p. 1229) was heard in New York on Dec. 22 by Judge William P. Burr. The petition was denied. It was specifically denied by the company that permission to inspect the books had been refused Mr. Eilers. It was further stated by counsel for the smelting company that Mr. Eilers had been given access to the books since the proceeding was brought and was even then engaged in making the desired list. The good faith of the application was challenged, the company's counsel charging that Mr. Eilers' object in seeking the writ was to "use a judicial proceeding in a campaign for votes so as to escape the consequences of libellous accusations."

Edgar L. Newhouse, chairman of the board of the American Smelting & Refining Co., made return to the petition for the writ on behalf of the corporation. Excerpts from his statement follow:

". . . The original election of Mr. Simon Guggenheim to succeed Mr. Daniel Guggenheim as president of the company on Jan. 21, 1919, represented the free and unanimous choice of the directors of the company. It is not true that the board of directors were given no opportunity to express any wish in the matter. The re-election of Mr. Simon Guggenheim as president of the company thereafter likewise represented the free and unanimous choice of the directors, save in the case of Mr. Eilers. . . .

"It is true that since their association with the company the Messrs. Guggenheim, or some of them, especially Mr. Daniel Guggenheim, Mr. Murry Guggenheim and Mr. Simon Guggenheim, have exerted a weighty influence in the counsels and management of the company. It is not true that the Messrs. Guggenheim, or any of them, dominated the directors and officers of the company in the injurious and objectionable sense in which the term is employed in the petition. Such position of influence and authority as they held was altogether due to their great abilities, their unusual knowledge of the business and their singular qualifications as directors in the enterprise. It was in no wise due to arbitrary methods or to artificial means of control. . . .

"It is not true that the Messrs. Guggenheim, though continuing to act as directors, ceased to hold stock in the company except in a negligible amount. On the contrary, they have always been substantially interested as stockholders in the company.

"The only member of the Guggenheim family who is now an officer of the company is Simon Guggenheim, who is president and is the owner of over 20,000 shares of the common stock of the company and, so far as deponent has been able to ascertain by investigation, is the largest single stockholder of the company, the total holdings of said Simon Guggenheim and his wife in common and preferred stock being in excess of 28,000 shares. Isaac and Daniel Guggenheim are directors but not officers, and draw no salaries. Their aggregate holdings of stock of the company are in excess of 8,000 shares. It is not true that any of the Messrs. Guggenheim ever received salaries from the company while not rendering commensurate service. . . . No salary is paid by the company to any of the Messrs. Guggenheim other than to the president of the company, Mr. Simon Guggenheim. . . Especially is it denied that the Messrs. Guggenheim, or any of them, during their association with the company acted in disregard of the interests of the corporation or sought to employ it to serve their own ends. . . .

TIN OPERATIONS IN BOLIVIA EXPLAINED

"The facts as to the company's activities in Bolivia are that prior to 1910 the company had never smelted tin nor had tin been smelted in the United States to any substantial extent by anyone. The company was then engaged in smelting and refining silver, copper, lead and other ores. In 1910 Messrs. Newhouse and Stewart, officers and directors of the company, went to South America for the purpose of obtaining contracts for the smelting of ores other than tin, at the company's plant at Tacoma, Wash. They did not while there investigate mining properties of any kind for purchase. While in Bolivia they became convinced that it would be to the advantage of the company to add the smelting of tin to its other smelting activities and upon their recommendation the company built a tin smelter at Perth Amboy, N. J., and entered into contracts with tin mines in Bolivia for the smelting of their ores and that business has been carried on up to the present time. It is true that a number of years later an examination of one or two tin properties in Bolivia was made for the company, but a majority of the board was opposed to the company's investing money in any tin mines in South America, and no such mines have ever been acquired by it. None of the property in Bolivia so examined for the company, or the purchase of which was considered by directors and officers of the company, was ever purchased by the Guggenheim Brothers, or by any member of that family. I deny that any demand was made by directors of the company that the company be allowed to share in Guggenheim Brothers' operations in Bolivia, or that any such demand was refused by the Messrs. Guggenheim.

INTEREST IN PREMIER BOUGHT TO SECURE SMELTING CONTRACT

"With reference to the Premier silver and gold mine in British Columbia, the company's interest in making any investment therein was primarily to insure to itself the smelting and refining of the ore from that mine. Officers and directors of the corporation, other than the Guggenheims, were opposed to the investment of a sum of money as would be required to purchase a one-fourth interest in the mine which was the interest offered to the company by owners of the property. On the other hand, it was necessary for the corporation to arrange for the purchase of at least a one-fourth interest, if any interest was to be acquired, as the sellers did not desire to sell a smaller interest. The smelting company therefore solicited, through its Mr. Guess, the head of its mining department, the Guggenheim Brothers to purchase a one-half of the one-fourth interest offered, thereby relieving the company of the necessity of purchasing more than the remaining one-half of the one-fourth and this arrangement was informally approved by all of the directors of the company except possibly Mr. Eilers, and I have no recollection of Mr. Eilers ever objecting at the time or until this action. . . .

SELLING COPPER FOR FUTURE DELIVERY NECESSARY

"The allegations of the petition in respect to sales of copper are incorrect and misleading. By far the greater amount of copper sold by all large copper producing and selling companies is sold for future delivery, and owing to the custom of the trade and the requirements of the copper market, it is impossible for any company having a large output of copper to sell more than a comparatively small part of its production by current sales, such as are possible in other metals. Moreover, the volume of copper to be sold by the company [illegible], since about the year 19[illegible] [illegible] its own copper, but also co[illegible] by it as selling agent for a [illegible] of large copper producing companies, the selling agency arrangement having been made as part of arrangements to smelt and refine the ore [illegible] companies, so that this company receives, in addition to its profit [illegible] operations upon the ore, a separate [illegible] additional commission for the sale of the copper. The selling agency [illegible] provided that the company [illegible] own copper, together with the [illegible] of the companies for which it acted as selling agent, all sales of copper being pro-rated against the total amount of copper available for sale at any particular time, including the company's own copper. The net proceeds of the commissions paid to the company for its services as selling agent for other companies amounted, in the period from Jan. 1, 1913, to Sept. 1, 1920, to a sum in excess of $10,000,000, and the conducting of such agency proved to be, during normal times, a source of large profit to the company. The existence of the agency, however, increased the necessity and volume of forward sales of the company's own copper, and particularly in the abnormal period following the outbreak of the European war it is true that some losses were suffered from this source. These quotational losses were due almost entirely to the existence of the selling agency. The statement made by Mr. Hills, the comptroller, as of Oct. 31, 1920, which is apparently the statement referred to at folio 28 of the petition, shows that from Jan. 1, 1912, to Oct. 31, 1920, the net proceeds from the selling agency amounted to $10,046,409, and that from this should be deducted quotational losses incurred during the same period amounting to $4,594,824, leaving an apparent net profit for the period on the operation of $5 451,585. But this apparent profit will at present prices of copper be more than wiped out by quotational losses which will be suffered if the present dull copper market continues.

COPPER ACCUMULATING CAUSED BY LACK OF DEMAND

"The statement that in April, 1920, as the result of a policy of withholding copper from sale, the company had on hand approximately 160,000 tons of refined copper is absolutely untrue. On May 1, 1920, the company had on hand for its own account 26,855 tons of refined copper. This accumulation was not due to any policy of withholding copper for sale, as the company had used its best efforts to sell all the copper it could, but was due, first, to lack of demand because of the fact that all consumers of copper were overstocked; second, to the fact that during the war production was greatly stimulated because of the war demand, and a large amount of copper ore came through after the signing of the Armistice in a volume much larger than during normal conditions; third, to the fact that labor and railroad conditions during the war and after the signing of the Armistice were such as to lengthen the period between the delivery of ore to the company and the [illegible] of the refined copper at tidewater; and, fourth, to the fact that the company was not free to sell its own copper, independently of the copper of the companies for whom it acted as selling agent, since, under the selling agency agreements, the company's own copper had to be sold pro rata with that of all of the companies for whom the company acted as selling agent, and the aggregate amount of [illegible] had to be sold was much greater than the market has been able to absorb during the conditions existing since the signing of the Armistice. All of these were conditions which were due to the abnormal times and for which the officers of the company were in no way responsible. The conditions experienced in these abnormal periods by this company have been common among companies in the same business.

"The officers and directors of the company have from time to time during the past two years made efforts to work out a modification of the selling agency contracts which would leave the company the profits from its commissions as selling agent in normal periods and at the same time leave it free to sell its own copper independently during times of abnormal conditions, but, although the greatest efforts were made by the company's officers to that end, this finally appeared not to be practicable, and as the end of the abnormal conditions are not yet in sight, it was determined by the board of directors during the month of November, 1920, to terminate the selling agency, which was accordingly done.

"In other words, the company's selling agency was originally attractive and profitable to it, and during normal times resulted in large net profits accruing from the selling commission. The unprecedented abnormal conditions which arose during the war and again since the signing of the Armistice have created a situation which could not have been foreseen, and the result of which has been to offset quotational losses against the profits thus accruing, and no one can now foresee when normal conditions in the industry will return. The company's board of directors has, in order to prevent further losses from this source, deemed it to the advantage of the company to terminate the selling agency, so that hereafter the company will sell merely its own copper, unrestricted by obligations to sell the copper of any other company.

"The various changes in the board of directors and in the officers of the company, referred to in the latter part of the seventh paragraph of the petition, took place, but the reasons therefor, and the inferences therefrom as stated in the petition, are wholly imaginative. . . ."

Case of Bacon vs. Neill Before Federal Court

The case of M. W. Bacon vs. R. K. Neill opened before Judge Frank H. Rudkin, U. S. District Court in Spokane on Dec. 14. The defendant, Neill, is one of the principal owners of the Premier mine near Stewart, B. C. Bacon is suing for a half interest in this property, claiming to have entered into a mining partnership with Neill just before the latter examined the Premier in June, 1916. The case has attracted wide attention by reason of the value of the property, in which the American Smelting & Refining Co. and Guggenheim interests hold a quarter interest.

Lead Companies Accused of Fixing Prices

Four Largest Manufacturers of White Lead Alleged To Have Formed Illegal Combination

Four companies control the manufacture of 95 per cent of the white lead made in the United States and fix prices through the American Institute of Lead Manufacturers, according to evidence placed on Dec. 23 before a committee in New York that has been investigating building trades conditions. These are the National Lead Co., the Eagle Picher Co., of Chicago, the Sherwin Williams Paint Co. and the du Pont de Nemours company, of Wilmington, Del. According to reliable reports of the hearings in the daily press, prices were fixed through the medium of the National Lead Co., which is said to have acted as pacemaker, and which notified the institute of changes. According to the testimony, the price of white lead has risen from 6c. a pound in 1916 to as high as 15½c. last month. The sales of this material by the National Lead Co. alone amounted to over $21,000,000 in eleven months of 1920.

I. C. C. Disapproves New Schedule for Cœur d'Alene Ores

Action Surprises Railroad Companies and Shippers—Doubt Bullion Rate Will Be Lowered

A new schedule of freight rates on ore from points in the Coeur d'Alene district to the smelters at East Helena, Mont., and Northport, Wash., which was agreed upon by the railroad companies concerned, was rejected by the Interstate Commerce Commission, much to the surprise and disappointment of the carriers, the mining companies and the people of the district generally. So certain were the railroad companies that the new freight tariff would be approved that one of them at least had supplied its agents with the printed schedule effective Dec. 27. The carriers are said to realize that a substantial reduction must be made if the mines continue in operation and they took the initative in cutting the rates on ore to the smelters. They are also working out a reduced rate on pig lead from the smelters at East Helena, Northport and Kellogg, Idaho, to the Atlantic seaboard, but the turning down of the proposed reduced ore rates makes doubtful the attitude of the Interstate Commerce Commission toward a lower rate on bullion.

Tin Smelting Company Fails

A petition in bankruptcy has been filed by American Tin Smelteries, Inc., of 10 Wall St., New York. The company's liabilities are $90,213, of which [illegible] are unsecured claims. Assets are put at $187,664, the main item of which is real estate, plant, etc., consisting of 16¼ acres in Matawan township, N. J., listed at $150,700. John S. Dickerson and Middleton S. Bosland have been appointed receivers.

Star-Federal Apex Case Not To Be Reviewed by Supreme Court

Decision of Court of Appeals Favoring Star Stands—Case Closed

The Supreme Court of the United States has refused to review the decision of the Court of Appeals at San Francisco in which that of the Federal Court for the district of Idaho was reversed in the case of the Star Mining Co. vs. the Federal Mining & Smelting Co. The Star company alleged that the Federal company, in operating the Morning mine, had entered upon the ground of the plaintiff and removed therefrom ore valued at more than $500,000, and asked for judgment for the full amount removed together with interest and costs. The trial involved the question of apex to the vein, the Federal contending that it was within the Grouse and Iron Crown claims while the Star held that it was within the Evening Star and Mary R. Fraction claims. The case was tried in Wallace, Idaho, before Judge F. S. Deitrich, of the Federal court, and both sides were represented by attorneys, mining engineers and geologists of national reputation. Judge Deitrich decided the case in favor of the Federal. The decison turned on the question of priority of location as between the Grouse and Evening Star claims, the court holding that although the fact that the Grouse was patented first did not necessarily establish its priority, the fact that the application for patent was known to the Evening Star owners and that they failed to take adverse proceedings justified the presumption that they conceded priority to the Grouse and the court so ruled. The Star company carried the case to the Court of Appeals, which reversed the lower court, holding that there was no warrant for a presumption in favor of the Grouse, since it was shown that the Evening Star was first located and had the first statutory mineral discovery. The Federal company then applied to the Supreme Court of the United States for a writ of certiorari, which has now been denied, thus affirming the decision of the appellate court.

Lake Ore Shipments in 1920

Final figures for the 1920 Lake movement of iron ore show that a total of 58,527,226 tons was transported down the lakes during the 1920 season. These figures will be augmented by about a million tons when the all-rail shipments, which will be available at an early date, are added. The December movement amounted to only 99,146 tons. The shipments by ports were as follows: Duluth, 15,479,334 tons; Two Harbors, 9,278,464; Superior, 14,812,398; Ashland, 8,180,752; Escanaba, 7,361,070; Marquette, 3,415,108. As usual, the Mesabi Range led all of the others, sending forward 34,312,880 tons, and the total for the Minnesota ranges was 37,443,028 tons. The Oliver Iron Mining Co. continues as the heaviest shipper.

Consolidated Arizona Receiver Appointed

Court Names G. M. Colvocoresses, Manager of Smelting Co.—Liabilities Over Half Million

By Wire.

G. M. Colvocoresses, general manager of the Consolidated Arizona Smelting Co. at Humboldt, Ariz., was appointed receiver for the company on Dec. 28 by the Federal District Court at Tucson. This action resulted from a petition made by F. S. Viele, of Prescott, stating that the corporation is indebted to the Prescott State Bank in the sum of $25,000 and has other obligations aggregating $500,000. One hundred and twenty destitute Mexican employees of the company at Swansea, where it was operating the Swansea Lease, have appealed to Governor Campbell for relief.

Colorado Mining Men to Convene in Denver

The annual meeting of the Colorado Metal Mining Association and the Colorado Chapter of the American Mining Congress will be held in Denver, Jan. 3, 4 and 5, 1921. Representative producers will confer with the chief officers of the railroads, smelters, and power and supply companies, to consider the problems affecting the related industries, and to determine how co-operative effort can advance the interests of all.

Oil shale men will strive to secure the most favorable location of an oil shale testing plant to be considered by the Government during the coming year. They will also formulate amendments to the placer laws regarding assessment work on oil shale locations.

Employers of labor will confer on labor and employment problems, with a view to the orderly liquidation of labor, and readjustment of wage schedules to meet changing industrial conditions.

Other subjects to come up for consideration will be proposed taxation laws, "blue sky" laws, state assistance to the U. S. Bureau of Mines for investigation of complex and low-grade ore problems, and other measures which may contribute towards the rehabilitation of the mining industry, which is admittedly in a discouraging condition.

New Railroad To Parallel Mexican Border

Material has arrived at Douglas, Ariz., for construction of a railroad in Mexico backed by the Mexican Government, that will parallel the border line and obviate the present necessity for entrance into the United States for passenger or freight traffic. The line will connect, south of Naco, with the Cananea Nogales R.R. and will be built eastward from Agua Prieta to a connection with the Sierra Madre line in Chihuahua. It is being built especially for military needs and internal development, but is expected to be of large value to the mining interests of northern Mexico.

Plan To Remodel Mason Valley Smelter

I. C. C. Grants Increased Freight Rate—Company Will Await Ratification

Officers of the Mason Valley Copper Co. have announced that their smelter at Wabuska, Nev., will be remodeled and the blast furnaces replaced by a double-unit reverberatory plant. Application to the Interstate Commerce Commission for a reduction in freight rates on ore from copper mining centres in Plumas County, Cal., to Wabuska, led to a hearing, and the Commission's examiner has granted a reduction from $8 to $3.53 per ton, 3c. above the rate asked by the company. The carriers still have power to appeal to the Commission against adoption of the new rate, and the company will take no steps toward remodeling its plant until the time for appeal has expired or the rate is ratified.

The Mason Valley company has developed a large tonnage of copper ore in a property held under option in Plumas County, and two other mines, the Engels and Walker mines, the latter owned by the Anaconda Copper Co., produce large quantities of smelting ore and copper concentrates.

Lands Under Water Yield State of Utah Income

The State of Utah for the two years just ended has received $800,000 in interest on state land grant funds, this being $100,000 in excess of the amount received for the two-year period immediately preceding. Owing to the search for asphaltic deposits, and the reclamation of salt and potash from the waters of Great Salt Lake, the state has been receiving some income from an unusual source, namely, from lands under these waters.

Utah Salduro's Application a Record Breaker

The application of the Utah Salduro Co. for 1,543 potash claims in the Great Salt Lake desert in western Tooele County, Utah, upon which patent had already been granted and paid for, is of interest as being the largest single mineral application ever made in the history of the land office, according to U. S. Land Commissioner Clay Tallman. The claims cover twenty acres each, and amount in all to 30,654 acres. The claims are placer, and instead of being grouped in associations of eight or 160 acres as could have been done, the company has preferred to do its assessment work on each claim singly to the amount of $500, making a total of $771,500 spent on the group, so that there should be no possible question as to title. The company, which has done extensive [illegible] and other work on the property, has far exceeded the sum above given and has one of the largest potash plants in the world. Patents were granted May 24, 1920, application having been made in October, 1919.

Court Decision in Utah Power Case Awaited

Argument Concluded on Appeal from Ruling of Utilities Commission Allowing Increased Rates

Arguments on the appeals of holders of special contracts with the Utah Power & Light Co. made before the Utah supreme court were concluded Dec. 22. These appeals dealt with the recent ruling of the state public utilities commission allowing increased power rates above those fixed by contract. The increase allowed by the commission would bring in about $1,000,000 yearly to the power company, but in making the allowance of higher rates it was stipulated that the power company refrain from distributing any of the added income, pending the court's decision.

These contracts were entered into a number of years before the creation of the public utilities commission, and the protestants, among them the Utah Copper and other mining companies, hold that the contracts having been entirely legal when drawn up can not be abrogated without doing violence to State and Federal constitutions. The decision will be awaited with much interest by mining men, as it is felt that increased power rates will bear heavily on the industry.

Mining in the Ray District in 1920

By A. L. Flagg

The close of 1920 finds the conditions in the Ray district of Arizona in common with other copper mining sections, far from normal. The steady decline in the market for copper has resulted in a gradual but steady reduction of forces and operations to a minimum. Practically no new development is in progress at the end of the year. The decline in price of other metals has not been without its results, though the number of properties affected has not been large.

The Ray Consolidated has been operating steadily throughout the year but with a greatly reduced force. At the concentrator in Hayden corresponding reductions have been made. Practically no new development has been done at the mine and little or no improvements have been made at the mill.

Early in the year the Arizona Hercules suspended operations altogether and the company's property is now idle except for underground pumping.

In the Ray camp proper none of the smaller companies are operating except the Ray Lead Development Co., owning the Harley [illegible] lead mine, which has a small force at work and has made one shipment. Earlier [illegible] some work was done on the [illegible] group, belonging to [illegible] of Globe, but unfavorable [illegible] brought that to a close [illegible]. In the early fall preparations were made to do some exploratory work on the Alma and [illegible] groups, which lie to the south of Ray. Up to the present time the work has not been begun.

Southwest of Ray in the Copper Butte district important changes are taking place. The property formerly owned by the Copper Butte Mines Co. has been acquired by the American Ore Corporation, of Minneapolis, Minn. During the years 1916-17-18 the Copper Butte Mines produced steadily under lease to the Arizona Hercules interests. Daily shipments to the Hayden smelter reached a maximum of over 600 tons. During the past year the new owners have made a careful study of the property, added more ground to the original holdings and mapped out an extensive development program. Active operations will be begun early in 1921. The June Bug tunnel and the Roberts shaft will both be used and some drilling will be done.

The Ray Boston Copper Co., operating the old Kelvin Sultana properties, has been prospecting most of the year with diamond drills. To the south in the Ripsey district the Ray Verde Copper Co. has been developing the Tillman property, employing a considerable force.

In the vicinity of Troy the most extensive operations have been those of the Dripping Springs Copper Co. in continuation of the development work laid out and begun two years ago. Some ore has been shipped. The Cutler-Biwater vanadium property has been operated by Ben S. Wilson under lease. A small mill was installed and some vanadium concentrates were shipped. The Gila Development Co.'s mill at Kane Springs was forced to close early in the year because of increased operating costs and water problems.

Only one new mill was built during 1920; namely, that of the White Metals Mining Co. at Pioneer. Late in the year Kennard & Bierce, of Los Angeles, completed the 75-ton flotation plant. From the operations of this plant a car of lead-silver concentrates has been shipped. Some high-grade crude ore was also shipped.

In the past Pinal County has not produced much lead. This year the Continental Commission Co., operating the 79 mine, has shipped over seventy cars of lead-silver ores. The company has done a large amount of development besides building some very expensive roads. A large tonnage of milling ore has been developed which the company has been testing with a view to installing a mill when conditions warrant.

Silver ores have caused a renewal of interest in the Saddle Mountain district south of Christmas, where little work has been done in recent years. The Little Treasure property, from which some high-grade silver ores have been shipped at times, was reported sold to a Washington syndicate. Farther south on Deer Creek lessees have made shipments from the Shepherd-Whiteman property. Other attempts at development were made in the district but only on a small scale.

There have been no changes in the wage scales throughout the year and the district has been undisturbed by labor discussions. Labor has been plentiful at all times and during the latter half of the year has gradually reached the point where there is some unemployment.

The uncertainty about the proposal to suspend annual labor requirements for the year 1920 has caused considerable anxiety among the small claim owners. In many instances claim owners have gone ahead with the required work while others are holding off in hope of obtaining further relief.

State-Owned Cement Plant for South Dakota

According to members of the South Dakota Cement Commission the first state-owned cement plant will be located at Rapid City, S. D. The commission has made a final survey of the site and taken options on tracts of land adjoining the property of the Black Hills Rock Products Co. as well as on 340 acres of shale, lime and gypsum lands and all the machinery for the proposed plant which was purchased by the B. H. R. P. Co. during the last year.

The matter of establishing a state cement plant was voted upon two years ago and since then the commission has investigated a good many sites and has finally decided to locate the first plant at the place named. The capacity of the first unit will not be large enough to handle the cement demands of the entire state, but as the practicability of the plant is thoroughly demonstrated, the facilities will be enlarged. It is also proposed to establish plants in other parts of the state as soon as the first unit is tried out.

Recent Production Reports

Granby Cons. M. S. & P. Co. produced 2,465,585 lb. copper in November against 2,293,500 in October.

NEWS FROM WASHINGTON

By **PAUL WOOTON**
Special Correspondent

Assessment Work Bill Awaiting President's Signature

Passed by Both Houses, Must Be Signed Before Year Ends—Period of Grace Not To Be Increased

Dec. 29—Although much discussion was aroused in the House of Representatives over the extension of the time for doing the 1920 assessment work on mining claims, it was occasioned largely because some of the members recalled that statements had been made last year that no further concessions of that character would be asked. When the question was put, on the final passage of the bill, extending the time to July 1 there was no vote against it. Some of the members explained that it was their idea last year to promise only that the request was not to be a continuing annual affair. There was much testimony on the part of members that there is greater need this year to excuse the assessment obligations entirely than was the case last year. This was based on the very low price of metals, the financial stringency and the difficulty in securing the necessary labor. It was very evident from the discussion that many members hope to be able to secure the suspension altogether of the 1920 assessment work. This could be done if a bill to that effect were passed before July 1. It is doubtful, however, if the Senate would agree to such a measure.

Representative Rhodes, the chairman of the Committee on Mines and Mining of the House, declared, in the course of the debate, that mining conditions throughout the United States have not been, for twenty-five years, in the plight they are today. He instanced the alarming decrease in gold production and the disastrous drop in the prices of all other metals.

Representative Vaile, of Colorado, pointed out that, while there is unemployment in some industrial centers, the same condition does not prevail in the mining sections. He also called attention to the fact that, due to the suspension of assessment work for 1917, 1918 and 1919, most of the men accustomed to earn their livelihood by this type of work had gone into other lines, and are not available now for this employment. He also said that the hand-drilling miner is about to become extinct. With the introduction of air drills and electric power, the need for old style, single-jack miners, he declared, has reached small proportions. Since it is that type of miner that is required for annual assessment work, he asserted that it is becoming increasingly difficult to get this kind of work performed. In addition, Mr. Vaile said:

"The mining industry literally is shot to pieces. The price of gold, as measured by its purchasing power, is away down. Practically all minerals bring the miner less than the cost of production. Costs of machinery, power, fuel and all supplies have not shared, to any appreciable extent, the supposed general fall of prices. Smelting charges are very high. Transportation charges have increased. Many railroad spurs and branches in mining regions have been discontinued.

"You can close a woolen mill temporarily with no great physical deterioration. The farmer, of course, derives very small comfort from the fact that his land is unimpaired even if he must sell his products at a loss, but the mine owner who is obliged to stop business would consider himself fortunate indeed if he had such a large part of the value of his property left. When a developed mine stops operating, it fills with water. Timbers rot. Earth and rock cave in. The fear of this almost total loss causes many mine owners to incur annual losses by continuing operations, even with no hope of present profit.

"May we not rely in some small degree on this great government to encourage the mining industry? Other proposals for remedial legislation will be presented to Congress. We shall ask for relief by tariff legislation, by the McFadden gold bonus bill and by other measures for this industry which has suffered more from war and war prices than has any other."

Representative Evans, of Nevada, added this thought to the discussion: "The excess profits tax, which adds a serious burden to mining, has done its full share to retard the opening of new properties and the continuation of old ones. The products of mining are in no sense an excess profit. They clearly are depletions of mine values and reserves."

In regard to securing further extension or suspension of the 1920 assessment work, Representative Wingo, the ranking minority member of the committee, said: "This should be stressed. Members from mining districts should impress upon their constituents the fact that this work must be done by July 1, as they will get no further extension from Congress. I am in favor of extending further time, but I know enough about the situation to say that this is the only bill that can be put through. I do not believe conditions will arise which will make it possible to secure further extensions and I think members should advise their constituents that they must do their assessment work by July 1, or lose their claims."

Bureau Officials Visit District of New Southern Station

Non-Metallic Survey To Be Made To Aid in Determining Problems for Study

While the principal work at the new southern experiment station of the U. S. Bureau of Mines will deal with the problems relating to iron and steel and by-product coke, attention is to be given to some of the more pressing problems in the mining of non-metals. These include the utilization of the so-called flint clays and the concentration of graphitic materials. A general survey is to be made of the non-metallics in the whole region tributary to the station so as to determine which of the important problems are to be undertaken first. After a visit to Tuscaloosa and Birmingham, Dr. F. G. Cottrell, the director of the Bureau of Mines, and Dorsey A. Lyon, the supervisor of stations, agree that there is an unlimited field in the South for the Bureau's activities.

The visit of Dr. Cottrell and Dr. Lyon and the arrival of Dr. W. R. Crane to start the work of the station was the occasion for a number of enjoyable and informative gatherings. At a dinner given by the Chamber of Commerce of Tuscaloosa, the Bureau officials were given an opportunity to meet the members of the faculty of the University of Alabama and others interested in mining development in that territory. The officials also were guests of honor at similar gatherings at Birmingham and at Anniston. At the latter place, the party was the guest of the Southern Manganese Corporation. The plant of the company was inspected. It includes two electric furnaces which are operating on ferro-phosphorus. Phosphoric acid is a by-product. It is planned to produce ammonium phosphate and other phosphorous compounds by combining the phosphoric acid with the products made in by-product coke ovens. During his stay in the South, Dr. Cottrell addressed the Alabama Technical Association.

House Mining Committee's Assistants

The Committee on Mines and Mining of the House of Representatives, under Representative Rhodes, its new chairman, is to have the advantage of the services of two assistants who are familiar with mining operations, through having been reared in mining communities. The new clerk of the committee is Miss Addie A. Hughes, of Bismarck, Mo. The committee will also be assisted by Theodore Ziske, Mr. Rhodes' private secretary, whose home is in Horine, Mo.

The total of silver purchases, under the Pittman Act, was 29,485,647 fine ounces at the close of business Dec. 24.

NEWS BY MINING DISTRICTS

Special London Letter

Gold Situation Steadily Worsening—Rand Output Continues To Fall—F. M. S. Fixes Minimum Tin Price

By W. A. Doman

London, Dec. 14—The gold party admit that there is pressing need for more gold; and yet circumstances concerning its getting are decidedly adverse. Though the Witwatersrand maintains its position as the premier gold mining district of the world the quantity of the metal produced monthly is gradually on the decline. Occasionally there is a spurt, but something seems to happen, either in a technical sense, or in connection with labor, that prevents it from being continued. For last month the output of the mines of the Transvaal was only 633,737 oz., or 44,000 oz. less than twelve months ago, and the aggregate for the eleven months of the year to date is 158,490 oz. less at 7,521,410 oz.

Although the estimated selling price is taken at the same figure as for October, i. e., £5 17s. 6d. per oz. fine, the gross value is only £3,723,000. Investors have lost that robust faith in the share market that they once had; they are, however, eagerly looking forward to the half year's dividend announcements. Returns upon capital form the [illegible] and from the standpoint of the public [illegible] it cannot be denied that the gold premium obscures the position. [illegible] are not now necessarily a [illegible] of economy in mining, [illegible] largely from extraneous [illegible]. Only the Barnato group [illegible] up to the present [illegible] and generally speaking [illegible] satisfactory. Van Ryn Deep shareholders receive 15s. per share for the year as against 9s. 6d. in 1919; Government Gold Mining Areas raises its distribution for the twelve months from 7s. 6d. to 10s., and Witwatersrand Gold doubles the last year's 2s. Larger dividends are also expected from other groups, but the public remains unmoved. To some extent this may be the result of the general trend of prices, for in every market selling preponderates.

Among the Far Eastern Rand Mines the Geduld Proprietary seems to be opening up [illegible] [illegible] [illegible] to have [illegible] value of [illegible]. The Geduld, by the way, [illegible] President Kruger's farm.

[illegible] which I have referred on previous [illegible] especially in depth [illegible] No. 14 level 13 ft. average [illegible] No. 15 level 26 ft. driven average 125 dwt.; on No. 18 level 13 ft. driven show 121 dwt., and less startling, though still good, values are obtained elsewhere. For November 5,759 tons treated yielded 7,875 oz. giving a profit of £17,987 with gold at 84s. an oz., and the present price is nearer 119s.

In regard to the efforts to stabilize tin, it is interesting to mention that the Federated Malay States has fixed, temporarily at least, the minimum price for Straits refined at $110 a picul. This is a start, but how it will work out remains to be seen. Even governments cannot overthrow the operation of economic laws.

Ever rising working costs have necessitated the rejection for the present, by the directors of the Tomboy mine, of a large quantity of ore previously included in the reserves. A cut from 888,244 tons to 500,000 is pretty drastic. Similar action is being taken in other directions.

CANADA

Ontario

To Defer Sick Benefit Scheme at Cobalt—Hollinger Treating Larger Tonnage

Cobalt—It has been decided to hold the proposed sick benefit scheme in abeyance for a time owing to the uncertain conditions now prevailing. It is thought that if the fund were put into operation at present the comparatively small number of men now employed would not provide sufficient funds to demonstrate the feasibility of the scheme. The organization will be known as "The Cobalt Mines, Mills & Power Co.'s Employees Sick Benefit Fund."

A new company, entitled the Ruby Co-operative Cobalt Mines, Ltd., has been organized with a capitalization of $1,500,000 to take over and operate the Ruby mine in Bucke Township. Clifford H. Moore, of Cobalt, is president.

Porcupine—Owing to the use of its auxiliary equipment the Hollinger Consolidated has latterly been able considerably to increase the tonnage of ore treated, as high as 2,400 tons having been handled in 24 hours, as compared with the daily average of between 1,700 and 1,800 tons in November.

The annual report of the Keora Porcupine shows that the outcropping vein had been proved up by diamond drilling to the depth of 1,000 ft., the gold content at that depth confirming the value of $6 obtained from surface sampling. In addition 2,000 ft. of diamond drilling has resulted in important discoveries.

Kirkland Lake—The Lake Shore during November treated 1,810 tons of ore with a recovery of $49,339, being an average of $27.25 per ton. The shaft had reached a depth of 564 ft. at the end of November.

Mining operations at the Teck Hughes have been suspended for a week owing to a broken hoist.

British Columbia

Trail—Shipments received at the Consolidated smelter during the week ended Dec. 14 totaled 9,093 tons. Shippers were as follows:

Mine Location	Wet Tons
Bluebell, Riondel	222
Canada Copper, Allenby	30
Florence, Princess Creek	172
Josie, Rossland	285
Knob Hill, Republic	53
North Star, Kimberley	165
Silver Bear, Zwicky	21
Society Girl, Moyie	19
Company Mines	8,126

ARIZONA

Arizona Commercial Cuts Black Hawk Vein

Douglas—The order of the Mexican government lifting export duties from ores and copper is retroactive to Dec. 1, according to advices received at Agua Prieta by Antonio G. Rivera, chief of the customs service at that point. The export duty is not to be restored as long as copper remains below 15c.

A fire in the change room of the Copper Queen smelter at Douglas did $2,000 damage recently, the destruction embracing a wooden structure and much clothing, the property of the employees.

Clifton—The property of the Sierra de Oro Mining Co. on the San Francisco River, above Clifton, has been sold under execution to Dell M. Potter, of Clifton, owner of the adjoining Consolation mines. His bid was $22,338 and costs.

Jerome—Since Dec. 13 Jerome-Superior has been idle and has filled with water to the 700 level. Most of the stock is held in Los Angeles, where, on Nov. 24, a meeting of insurgent stockholders was held that censured the management of George Mitchell as extravagant and that elected G. A. Kobold as president, L. J. Selby as secretary-treasurer, and James A. Brower, William Steel, Frank A. Flory, E. C. Joannes and Gussie Egelhoff-Rundell. Thereafter in Jerome was held a joint meeting of the factions. Of the outstanding 1,300,000 shares 1,161,479 were represented. The insurgents represented 620,495 shares but there was a split on the last day of the three-day quarrel, the Californians withdrawing, leaving the old management still in the saddle locally. This, it is claimed, left no quorum that could act with legality. Later, in Los Angeles, the old board, represented by Melville Fraser, G. D. Case and George Mitchell, claiming legally to be, respectively, president, secretary-treasurer and manager, entered suit to declare void all conclusions of the Nov. 24 meeting and to restrain the insurgents elected from assuming any title to the offices claimed. There also were made charges of conspiracy and the utterance of malicious and libelous statements concerning the old directors.

For the fourth time in as many years no quorum was mustered at the annual meeting here of the Green Monster Mining Co., which owns a very large expanse of undeveloped ground near Jerome. Nothing more than assessment work is being done.

Prescott—In the Yaeger Canyon mine of the Shannon Copper Co. development work on the 900 level is being pushed on a drift now 700 ft. long, following a good vein. A. L. Ferris is in charge.

United Arizona ground, south of Mayer, again is being diamond drilled, heavier equipment having been installed. The work under contract will continue about four months.

At the Union mine, W. H. F. Jones, in charge, states that a 50-ton reduction plant is to be purchased to replace a small plant that has not proved effective.

Phoenix—New hoisting equipment is being installed on the Ranier property, near Wenden. When this is finished the main shaft, No. 3, now 468 ft. deep, will be sunk to 800 ft. Good ore for shipment, is being taken from shaft 2.

New hoisting and compressor equipment is being planned by the Queen Creek Copper Co., of Superior, a corporation financed largely by Dundee-Arizona interests. Electric power has been contracted for to be delivered after March 1.

Globe—Arizona Commercial is reported to have cut the Black Hawk vein on the 400-ft. level and to have passed through the ore. This is said to be 10 ft. wide averaging 5½ per cent copper. It is said that this vein had not heretofore been considered to carry commercial ore in Arizona Commercial ground. The companies operations were recently suspended indefinitely.

The Continental Commission Co., operating the Seventy-nine mine near Winkelman, has shipped to El Paso 70 carloads of lead-silver ore. Lee Reagan, president of the corporation, states that the last carload netted $1,200.

COLORADO

Rich Ore Opened in Rose Nicol—U. S. Zinc Converting Smelter Into Oxide Plant

Cripple Creek—A promising orebody has been opened on the 10th level of the Rose Nicol property which is being developed by the Reva Gold Mining Co. Samples of high-grade ore assay over $1,000 a ton in gold, and about $10 in silver.

Magnolia—The shaft of the Senator Hill mine is being sunk from the 250 ft. to the 1,000-ft. level by the Utah Metals Co.

Ward—The Puzzler property has been leased to the Bond Syndicate Leasing Co., which has also remodeled the Strong mill to treat ores from mines and dump in the Ward district.

Pueblo—The United States Zinc Co. is converting its smelter into a zinc oxide plant. One unit has already been converted at an initial cost of $10,000.

If the experiment proves successful, the entire plant will be so converted.

Ouray—The Eurades company has cut its force by half because of the high cost of operating This property was being actively developed, though no ore was going to market A vein of considerable size was recently discovered and is being developed; this ore is expected to warrant the erection of a mill in the spring.

The Lundberg-Wilfley Lease at the Barstow has opened up a very good body of gold-bearing quartz associated with sulphide ore of milling grade. This ore is being stoped and further developed and will be milled in the spring. Practically all other lessees, except the Krisher lease on the Mountain Top and the Luna lease on the Wedge, have quit work, awaiting reasonable freight and treatment rates.

the extensive workings above that point and the fact that it was also necessary to unwater the adjoining Kennedy mine to a similar depth because of the two properties being connected. Upon reaching the 3,900 the fears of the management regarding caved ground were realized so some extent. At that point, the large electric hoist, a duplicate of the surface hoisting plant and the largest underground hoist on the Mother Lode, was stationed. This underground plant made possible the operations conducted successfully at greater depth. V. S. Barbarini, the newly appointed superintendent, is in charge.

San Francisco—James D. Colt, of Boston, has been appointed receiver for the New Idria Quicksilver Mining Co. This is the result of a friendly suit brought against the company, which is in financial difficulty.

a gold prospect 23 miles south of Goldfield and named by them the Gold Hill mine, but known as the Railroad Springs property. It has a wide vein showing some low-grade gold-copper ore. The Goldfield Cons. has resumed the practice of leasing on a low royalty basis.

Leadville—Fire damage in the main tunnel of the Leadville Mines Co. is being repaired, but some of the machinery must be replaced. Station sets were burned out and the blower and small hoist damaged.

Eureka—The Holly pilot mill will not be completed until spring, owing to delayed delivery of equipment, according to a recent announcement. Most of the smaller properties and prospects are closed for the winter.

OPERATIONS ON THE COMSTOCK LODE, VIRGINIA CITY, NEV

CALIFORNIA

Bulkeley Wells Closes Deal for Fremont Consolidated—Argonaut Unwatered Below 3,900 Level

Sutter Creek—The Fremont Consolidated Mines in the Drytown mining district is to be given an opportunity to prove its value The deal pending for its purchase by Bulkeley Wells has been closed and mining operations have already been started. This property lies a mile and a half north of Amador City, and comprises four mining claims, namely the Gover, North Gover, Fremont and Loyal Lode, a length of over 4,000 ft. on the lode. It has been developed by two shafts, the Gover being 1,500 ft. deep and the Fremont about 3,000 These shafts are connected on the 1,500-ft level Edwin Higgins is general manager, and B [illegible] Hoxsie superintendent.

Jackson—The water in the Argonaut mine shaft has been lowered to a point below the 3,900 ft level, which is considered very good headway considering

NEVADA

Goldfield Development Buys Railroad Springs Property—Repairing Fire Damage at Leadville

Virginia City—The number of miners employed in the Comstock district is increasing as old mines are reopened and new enterprises launched. The projected 10,000-ft. haulage tunnel of the United Comstock Mines Co. has advanced nearly 300 ft. from the portal, the compressor plant has been finished, the mill site is being prepared for construction and a spur track is being built from the Virginia & Truckee Railroad to the mill site.

Goldfield—The Goldfield Development Co. has [illegible] to the Goldfield Consolidated Mines Co. its leases on the 1,000-ton mill and the mines of the latter company. The development company, [illegible] by assessments on the [illegible], is said to have expended more than $[illegible] including $1[illegible],000 for mill repairs. The officers have purchased with funds secured from assessments

Tonopah—The latest bullion shipments reported from the mines of the Tonopah district are: Tonopah Belmont, $109,076; West End, $55,770, and Tonopah Extension, $57,000. This represents the clean-up for the latter half of November for these respective mines.

In the West End development work is being done on three veins, the West End, Ohio and Footwall veins, with no special changes Work is being performed from the 300, 400, 500, 600 and 800 levels. Active work is being done from the Ohio shaft 800 level on Tonopah "76" ground. [illegible] is favorable with [illegible] as yet. West End tonnage [illegible] was about 1,500 tons and development totaled about [illegible] ft. for the past week.

Divide—Development [illegible] on the lower levels, continues favorable at the Tonopah Divide. On the 800 level, where the vein has been drifted on southeasterly for over 150 ft., the last 80 ft. of which averaged $[illegible] per ton, crosscutting had been started to the north and south. This oreshoot does not show on the 585 level, which is the next level above, and the management is very optimistic regarding territory to the southeast of the present face. On the 1,000 level no commercial ore has as yet been found, although values up to $6 per ton are common. The development on the 165 level failed to disclose anything new of importance. Daily shipments of about 50 tons of ore of good grade are being made to the Belmont mill at Tonopah.

The Tonopah Dividend has started a crosscut from the 400 level of the new shaft to cut a vein about 100 ft. distant. If this ledge shows no values when cut the company plans to resume work from the 850 level of the old shaft.

The Kernick Divide is making fair headway in its crosscutting work from the 900 level. The south crosscut toward the Hasbrouck has made a total progress of 150 ft. in Divide breccia. This crosscut should cut the Hasbrouck vein at about 600 ft. The crosscut toward the Revert, which is being run to cut the Revert vein developed to a depth of 400 ft., has also been making excellent headway in the Divide breccia formation.

The Gold Zone is shipping about 15 tons of ore per day from a stope on the 711 level. Limited development work is being done.

Manhattan—The West orebody, recently cut on the 500 level of the White Caps mine, has been proved to be 12 ft. wide for a distance of 41 ft. with ore in the face of the drift, and an average value of $23 per ton. The ore is stated to be highly siliceous and easily treated. Crosscutting has been started from the 300 and 800 levels in an effort to pick up the upward and downward continuation of this orebody. It is stated that if developments on these levels are at all favorable milling operations will be resumed.

MONTANA

Butte & Superior's Black Rock Mill Shuts Down—Tuolumne Deepening Main Range Shaft

Butte—Old fires which have been burning in the Anaconda mine for more than twenty years broke out the past week on the 6th, 7th and 8th levels, proving stubborn for a time. They were brought under control after several days of effort.

All operations have been suspended at the Black Rock concentrator of the Butte & Superior and only development work is being done in the mine at the present time.

Operations at the East Butte mine and smelter will continue until the copper situation becomes such that the metal is unsalable when operation will be suspended, according to a statement made by Oscar Rohn, general manager. About 300 tons of ore is being hoisted daily, averaging more than 5 per cent. The East Butte employs a system of underground sorting which is proving very economical.

Sinking of the Main Range shaft of the Tuolumne Copper Co. from the 1,200-ft. level was started last week with the 2,000-ft. level as objective. The shaft is being carried down with two main working compartments and a manway. On the 1,200-ft. level the Tuolumne has a zone 50 ft. wide well seamed and streaked with fine veinlets of ore through a manganese gangue, and it is the belief of the Tuolumne's engineers that this body with depth affords a good chance of becoming commercial ore. In addition to this body the ore deposit on the 1,200 ranged in width from 8 to 20 ft.

Bullion production of the Barnes-King Development Co. for November was $22,602.97 from the Shannon mine and $2,400 from lessees who are operating the North Moccasin property. Shannon tonnage was 2,309 averaging $9.80 per ton. Breakage of the gears of the Shannon rope tramway in November stopped shipments of ore to the mill until about the middle of last month.

UTAH

Utah Copper Cuts Wages—Grand Central Shuts Down

Eureka—Shipments from the Tintic district for the week ended Dec. 18 totaled 180 cars as against 179 the week before. Work has been started by the Tintic Standard on a third shaft, to have four compartments. It will be 6 x 18 ft.

Mammoth—The Grand Central, which recently has been shipping at the rate of about a car of ore daily, has closed down, owing to unfavorable metal prices and heavy costs, which prevent profitable operation.

Salt Lake City—The Utah Copper Co. has posted an announcement of a wage reduction of $1 a day for skilled labor and 85c. for unskilled labor, effective Jan. 1.

Park City—Shipments for the week ended Dec. 18 amounted to 1,908 tons.

The 225-ton mill of the Glen-Allen is being warmed up and will begin operations, it is stated, at the rate of 100 tons a day. The foundations are finished for the flotation plant, which is to consist of five Jones-Belmont machines, and within a month or six weeks it is expected that it will be put in operation.

IDAHO

Cœur d'Alene District

Planning Railroad Extension Up Pine Creek

Pine Creek—An engineer of the O.-W. R. & N. Co. recently visited the right of way for the proposed extension of the Pine Creek branch and is quoted as saying that the railroad company had entered into an agreement with the Milwaukee Lumber Co. to extend the branch to the forks of the creek about three miles from the end of the present two miles of track, and thence up the west fork four miles to the timber holdings of the lumber company, the Milwaukee company having guaranteed a certain tonnage.

Mullan—The Midnight Mining Co. is driving a raise from its north drift to the surface, a distance of 1,100 ft. The first 200 ft. is on the vein and from that point it is being extended vertically, the total distance now accomplished being 400 ft. In the 280-ft. drift there is considerable lead-silver ore also in the raise. Crosscuts will be run to the vein every 100 ft. The Midnight is controlled by Jones & Baker, of New York.

The Gold Hunter Mining & Smelting Co. has taken a bond and lease on the Paymaster group of three claims, which joins the Hunter on the west. The Paymaster is owned by the estate of the late Thomas L. Greenough.

Big Creek—The Sunshine Mining Co., which owns what was formerly known as the Yankee Boy and Yankee Girl properties on Big Creek, has started the construction of a 50-ton mill, which is to be completed in about three months.

MINNESOTA

Mesabi Range

Minnesota Steel Co.'s Plant Ready Next Fall

Hibbing—The Mahoning Ore & Steel Co. has decided to reconsider its decision to erect twenty new dwellings at its Mahoning Location until a later date. The contract was to be let this past week but due to the weather and market conditions the company has decided that the existing conditions warrant a delay of several months. The company has already greatly improved its present houses by the addition of bathrooms and basements.

In the general uncertainty in the steel trade, it is generally believed in the Lake Superior district that ore quotations for 1921 will not be fixed for several weeks.

Duluth—It is contemplated that the completion of the Minnesota Steel Co.'s plant at Duluth will be accomplished by next fall as orders have been received from the headquarters of the United States Steel Corporation to rush the new construction work. These orders are relative to the wire, nail and sheet mills and it is rumored that a plate mill of sufficient capacity to meet the requirements of the Northwest in this product will also be included in the construction program and orders to this effect are expected in the near future. Work has also been started upon the erection of an addition to the hot-bed building and upon the extension to the power plant building. The present force employed by the steel company's plant in its operating departments and in the new construction work is close to 3,200 men. This is the largest number of men that has been employed by the company and the contractors for over three years. With the completion of the new departments, a force of approximately 4,500 men will be employed in the regular operation of the plant.

THE MARKET REPORT

Daily Prices of Metals

Dec	Copper, N. Y. net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
23	12.75@13.00	29.50	32.50@33.00	4.50@4.75	4.50@4.65	5.70
24	12.75	29.00	32.75@33.00	4.50@4.75	4.50@4.65	5.60
25	....	.....	....	....	....	....
27	12.75	29.00	32.75@33.00	4.50@4.75	4.50@4.65	5.50@5.60
28	12.50@12.75	29.50	33.00@33.50	4.50@4.75	4.50@4.65	5.65
29	12.50@12.75	30.00	33.50@34.00	4.50@4.75	4.50@4.65	5.70

*These prices correspond to the following quotations for copper, "delivered": 13@13.25, 13, 13, 12.75@13, and 12.75@13c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Dec	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
23	72¼	73	82	201	205	21½	22¼	22½	24½
24	...		.	..					
25	..							..	
27	..	..	..	..	...				...
28	71	73	82	200	205¼	21½	[illegible]	24	26
29	70½	72¼	82	200	206	22	23½	26	28

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Dec	Sterling Exchange	Silver New York, Domestic Origin	Silver New York, Foreign Origin	Silver London	Dec	Sterling Exchange	Silver New York, Domestic Origin	Silver New York, Foreign Origin	Silver London
23	352½	99½	63½	40⅝	27	351	99½	64¼	Holiday
24	351	99½	65¼	42	28	349½	99½	65	42
25	..			..	29	349¼	99½	66⅜	43

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, Dec. 29, 1920

The metal market was as dull as usual during the last week, and in general no interest was taken by either buyers or sellers. It is fashionable to lay the quietness to the holidays, and this excuse may be offered for variety. Consumers are not disposed to buy raw materials until demand for their products improves, being willing to take a chance on prices at that indefinite time. The London market was closed on Friday, the 24th, and Monday, the 27th, as well as on Christmas. When trading was resumed on Tuesday, prices held steady, with a marked advance in zinc, followed by another today.

Copper

The large producers report no business at their holding price of 14c. delivered, but feel that a reduction at this time would avail nothing, for smaller interests would cut still lower, and consumers, expecting further reductions, would continue to buy only for immediate needs. The small quantity of copper needed to supply the present demand can be obtained for 12.75c. delivered, for spot metal, and 13.25c. for delivery as late as the second quarter. Some small lots have been sold to both domestic and foreign consumers at these prices, but it is unlikely that any large amount could be [illegible] except at an advance. At auction on the N. Y. Metal Exchange [illegible] a 30 ton lot brought only 12.35c. We understand that no change in price policy is contemplated in marketing the porphyry output under the arrangements mentioned last week.

Lead

The A. S. & R. official price remains at 4.75c. New York and St. Louis.

Reports in the press continue to give lead prices as low as 4.45c. New York and St. Louis, but we are unable to confirm them, and sales even at 4.50c. are insignificant. This price is asked by one interest for spot metal, for which there is no demand. Metal for delivery as late as May has been sold for 4.75c., and one large lot (for these times) of a favorite brand was sold for January shipment at 5c. New York. The market may be said to be steady at the present prices, with a disposition to ask a slightly increasing premium for futures.

Preliminary production figures which we have compiled indicate that the United States production for 1920 will be slightly greater than that for 1919.

Zinc

With London stronger since the holiday, domestic prices have shown an upward trend after the depression of last week, which was due to threatened imports. Under present conditions the European price dominates the market. Before the advance in London, zinc from Europe for future delivery was offered in Baltimore by brokers as low as 5.45c. The amount of business done was small, however, and at the same time better prices could be secured for known domestic brands. Production continues to be curtailed, owing entirely to the fact that demand is very poor and not to any desire to stop production temporarily in order to establish a new and lower wage scale. Most of the local mushroom concerns which were established during the last two years to trade in zinc have been put out of business by the recent depression.

Tin

The tin market was hardly active enough to establish quotations, especially on Friday and Monday, when, with London closed, [illegible] were totally at sea. It is fortunate that this condition does not happen often, and it must have been a relief to local sellers to have the Tuesday cable show a slight advance. The price of 99 per cent tin declined slightly on Tuesday in the face of a rise in Straits, owing to a little competition from Chinese tin.

Straits tin for future delivery: Dec. [illegible] 29th, 34.50@35c.

Arrivals of tin, in long tons: Dec. [illegible] London, 50

Silver

For the last week the market has been very quiet, due to the holiday season, and this condition will probably continue into the new year. Prices have improved during this period despite small business, and today's London price of 43d. is the highest quotation since Dec. 8. Buying for China account is reported as responsible for the rise.

Mexican Dollars—Dec. 23d, 48½; 24th, 49⅝; 27th, 48½; 28th, 49¼; 29th, 50.

Gold

Gold in London: Dec. 23d, 115s. 8d.; 24th, 116s. 1d.; 28th, 116s. 10d.; 29th, 116s. 9d.

General stock of money in the United States, Dec. 1: Gold coin (including bullion in Treasury), $2,761,338,519; standard silver dollars, $269,857,494; subsidiary silver, $266,609,065; United States notes, $346,681,016; Federal Reserve notes, $3,663,592,795; Federal Reserve Bank notes, $239,569,800; National Bank notes, $74,010,797; total, $8,281.659,486. The principal change from Nov. 1 was in gold coin, which increased $22,294,953.

Foreign Exchange

Only slight changes have occurred in the value of foreign money during the last week, and the market has been featureless. On Tuesday, Dec. 28, francs were 5.81c.; lire, 3.34., (a new low); and marks, 1.355c. New York funds in Montreal declined from the recent high to 16½ per cent premium. The present rates are causing grave concern to Canadian importers. The balance of trade is only a little more against that country than normally, but the state of sterling exchange makes it impossible to clear unfavorable balances through London, as was done before the war. Until sterling increases in value or Canadian exports to this country more nearly balance imports, the premium on American funds is likely to continue upward. Increased shipments of gold are said to be unlikely.

Other Metals

Aluminum—Last price of 28.3@28.5c. are purely nominal. Metal may be had at 22@25c. per lb.

Antimony—Chinese and Japanese brands, 5¼@5½c.; market quiet. W.C.C. brand, 6¼@6½c. per lb. Cookson's "C" grade, 9½c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony[1] (200 mesh), 7@7¼c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 7c.

Bismuth—$2.40 per lb., 500-lb. lots, and $2.42 per lb., 100-lb. lots.

Cadmium—Nominal, $1.40 per lb.

Cobalt—Metal, $6 per lb.; black oxide, $4.10 per lb.; sulphate, $1.60.

Iridium—Nominal, $325 per oz.

Magnesium—Crude, 99 per cent, $1.35 per lb. f.o.b. Philadelphia.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Ingot, 43c.; shot, 43c.; electrolytic, 45c., f.o.b. Bayonne, N. J.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $70@$80 per troy oz.

Palladium—$75 per oz.

Platinum—Firm at $75 per oz.

Quicksilver—Nominally $50 per 75-lb. flask, with second-hands selling as low as $47 per 75-lb. flask. San Francisco wires $47@$50. Dull.

[1]**Rhodium**—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 55@60c. per unit, New York. California concentrates, 50 per cent Cr_2O_3 and upward, 60@65c.

[1]**Manganese Ore**—40@45c. per unit, seaport; chemical ore (MnO_2) $60@$65 per gross ton, lump; $75@$80 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb of contained sulphide, New York.

[1]**Tantalum Ore**—Guaranteed minimum 60 per cent tantalic acid, 40c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¾@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

[1]**Tungsten Ore**—Scheelite, 60 per cent WO_3 and over, per unit of WO_3, $4@$4.50, f.o.b. mines; wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3.50, in New York.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 5c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Dec. 24—Zinc blende, per ton, high, $36.10; basis 60 per cent zinc, premium, $32; Prime Western, $30; fines and slimes, $27.50@$25. Calamine, basis 40 per cent zinc, offerings $20; no sales. Average settling prices: Blende, $35; calamine, $28; all zinc ores, $33.88.

Lead, high, $57.90; basis 80 per cent lead, $55@$47.50; average settling price, all grades of lead, $53.75 per ton.

Shipments for the week: Blende, 10,471; calamine, 167; lead, 1,334 tons. Value, all ores the week, $442,250.

Purchases this week aggregated 1,900 tons, 600 tons on $32 and the balance on $30 basis.

A number of mines closed down last night, some to resume Monday and others will observe a week's holiday.

Platteville, Wis., Dec. 25—No zinc or lead ore market reported. Shipments are further curtailed. Shipments for the week: Blende, 165 tons. Shipments for the year: Blende, 60,506; calamine, 2,551; lead, 4,562, sulphur ore, 1,342 tons. Shipped during the week to separating plants 1,291 tons blende.

Non-Metallic Minerals

Asbestos—Crude, No. 1 $2,000@$3,500; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, $23; ground (white), $45; ground (off color) $30@$32 per net ton, less than carload lots, f.o.b. New York. Crude, first grade, $10 per ton, f.o.b. cars, Missouri; floated, $28 per ton in bbls.; $26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis.

Chalk—English, extra light, 5@5½c.; light, 5@6c.; dense, 4½@5c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$12; washed, $12@$15; powdered, $18@$22; bags extra, per net ton, f.o.b. mines, Georgia; crude, $8@$12; ground, $15@$40, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $25@$35; powdered, $30@$35, f.o.b. New York.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar—Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $25 per ton, f.o.b. Illinois mines, and $25.50, f.o.b. Kentucky; ground, suitable for acid, chem-

ical or enameling purposes, $60; lump, $17.50, f.o.b. Tonuco, N. M. In Canada 85 per cent calcium fluoride sells for $20 per ton, f.o.b. Madoc; output limited. Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines.

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[1]Furnished by Foote Mineral Co., Phila., Pa.

Fuller's Earth—$16 per ton, carload lots, f.o.b. New York.

Graphite—The 90 per cent crucible grade is held in Alabama for 9c. per lb. and 85 per cent grade, 7@9c. Lubricating grade commanding the best price is a fine flake, passing a 100@120 mesh, and running higher than 96 per cent carbon. Linotype machines use a flake passing 90 mesh and standing on a 120 screen, with 90 per cent carbon, retailing at 75c. to $1 per lb. and selling to jobbers at 11@40c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Dolomite, 1@2 man size, $1.60@$1.65; 2@8 in., $1.55@$1.65 per net ton, f.o.b. Plymouth Meeting, Pa.; fluxing, $1.65@$1.75 per net ton, f.o.b. Howellville, Pa.

Magnesite, Calcined—High-grade caustic calcined, lump form, $35@$40 per ton, carload lots, f.o.b. California points. In Chicago district, $57.70; Atlantic seaboard, $61@$63.

Dead-Burned—$38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 50c.; No. 5, $1.20 @$1.40; No. 4, $2@$3; No. 3, $4.25@ $5; No. 2, $5.50@$7; No. 1, $8. Clear block: No. 6, 55c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $10; extra large, $25; all f.o.b. New York; ground, $150 per ton, Philadelphia. Domestic, uncut, f.o.b. Franklin, N. C., as follows: Scrap, $45 @$50 per ton; punch, 10c. per lb.; circle, 15@25c.; 1½ x 2 in., 75c.; 2 x 2 in., $1.15; 2 x 3 in., $1.65; 3 x 3 in., $2.10; 3 x 4 in., $2.50; 3 x 5 in., $2.75; 3 x 6 in., $3.75; ground 165 mesh, $150 @$170 per ton; ground roofing mica, $60; mica washers, 75c.@$2 per lb.; 1¼-in. disks, No. 1, $1.40 per lb.; No. 2, $1.25. The foregoing domestic prices obtain also in the Chicago district.

Monazite—Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports, 77 per cent tricalcium phosphate, $13; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $8.35; 68 per cent, $7.85; 68@66 per cent, $7.60. Finely ground Tennessee rock sells for $8.50 per net ton for 13 per cent phosphorus content, agricultural application; for acid making, 14 per cent, $9; both prices f.o.b. Centerville, Tenn.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 16½c.; Spanish lump, 14@16c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Sand (Glass)—Dry glass sand, $4 per net ton, f.o.b. cars Mapleton, Pa. Sand, f.o.b. Ottawa, Ill., is $3 per ton; $2.50 on annual contracts. Sand at Klondike, Gray Summit and Pacific, all in Missouri, is $2.50 on contract; some outside sales have been made at $4. St. Louis, open market, at $3.50; contract price on large quantities, $2.50; on small quantities, $3.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $12@$22 per ton; roofing grades, $9.50@$15; rubber grades, $12@$18; all f.o.b. Vermont. California talc, $20@$45, talcum powder grade. Southern talc, powdered, carload lots, $12@$15 per ton; less than carload, $25, f.o.b. cars; freight to New York $5.25 per ton, carload lots; less than carload lots, $9.25. Imported, $60 @$70; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 11½@12c. per lb.; sulphide, powdered, 15@15½c. per lb. in carload lots.

Sodium Nitrate—$3 per cwt. ex vessel, Atlantic ports. Market quiet.

Sodium Sulphate—For 95 per cent material, $22 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract.

Potassium Sulphate—Domestic, $225 @$250 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrocarbontitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 16@17c. per lb. of chromium contained; 4 to 6 per cent carbon, 17@18c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $120@$125, freight allowed; $120, f.o.b. seaboard bases; resale, $115; English, $135@$140, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $60, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying [illegible] to 60 per cent molybdenum metal, with low sulphur, phosphorus and [illegible], $[illegible] per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $55@$60; 50 per cent, $75@$80; 75 per cent, $150.

Ferrotungsten—Domestic, 70 to 80 per cent W, [illegible] per lb. of contained tungsten, f.o.b. works. Foreign, 60.

Ferro-uranium—35 to 50 per cent U, $7 per lb. of U contained, f.o.b. works.

'**Ferrovanadium**—Basis 30 to 40 per cent, $6.50@$7 per lb. of V contained, according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York list price, 22½c. per lb.; wire, 16½c.

Lead Sheets—Full lead sheets, 9¾c.; cut lead sheets, 9½c. in quantity, mill lots.

Nickel Silver—Unchanged at 34¾c. per lb. for 18 per cent nickel.

Yellow Metal—Dimension sheets, 21¼c.; sheathing, 21¼c.; rods, ⅝ to 3 in., 18¾c.

Zinc Sheets—$11.50 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 11½c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr_2O_3, $55@$60 per net ton, and $65 in sacks, carload lots, f.o.b. eastern shipping points.

Fire Brick—First quality, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $45@ $50.

Magnesite Brick—9-in. straights, $110 per net ton; 9-in. arches, wedges and keys, $120; soaps and splits, $130.

Silica Brick—9-in., per 1,000: Chicago district, $65@$70; Birmingham, Ala., $56@$61; Mount Union, Pa., $55 @$60.

Iron Trade Review

Pittsburgh, Dec. 28, 1920

Nearly all the independent steel plants are closed this week, or are operating only a few departments. Pipe departments of mills are operating fairly well.

The independent rail mills have come down to the Steel Corporation or Industrial Board prices, $45 for bessemer and $47 for openhearth rails, and rail orders for 1921 will be somewhat larger in consequence, probably aggregating close to 2,000,000 tons for renewals alone. The Pennsylvania system has distributed orders for 200,000 tons.

Pig Iron—Prices are nominally unchanged at $35 for foundry and bessemer and $33 for basic, Valley basis, but these are hardly even asking prices, as there is no inquiry. In some quarters it is predicted that after the first of the year asking prices will be $31 or $32 for foundry, $[illegible] for bessemer, and $30 for basic.

Semi-finished Steel—The market is dead. Sheet bars are nominally $4[illegible].

Charcoal and Coke

Charcoal—Willow, [illegible] per bbl.; hardwood, [illegible] per lb., in 250-lb. bbl. Barrel charge to be additional.

Connellsville—Furnace, $[illegible]; foundry, $[illegible].

[illegible] by [illegible] Mineral Co., Philadelphia, Pa.

Domestic and European Zinc Conditions

The Market Has Declined Steadily, and Exports Are Relatively Small—English Zinc-Smelting Industry at a Standstill—Germany an Active Seller—Australian Producers in a Favorable Position and the United States Has Greatly Curtailed Production

THE zinc market, both abroad and in the United States, declined steadily in 1920, except for a reaction in price that occurred during the summer.

The zinc industry responded to the lower price of zinc quicker than either the lead or copper industry in curtailing operations drastically. The Anaconda Copper Mining Co. has cut its zinc production from 10,000,000 to 5,000,000 lb. monthly. Interstate-Callahan Mining Co. has shut down, Butte & Superior Mining Co. has suspended productive operations, the American Metal Co. has curtailed its output, and many other important operating companies have taken similar steps.

MONTHLY AVERAGE PRICES OF ST. LOUIS ZINC

In Cents Per Pound

1920		1920	
January..	9.133	July	7.720
February	8.708	August	7.835
March..	8.531	September..	7.661
April	8.184	October.....	7.150
May.	7.588	November...	6.247
June.	7.465		

The chief factor in the decline in the zinc market has been the condition of the European market, the practical elimination of export trade and the possibility of importing low-priced zinc into the United States. Export trade due to the favorable conditions arising out of the war held up splendidly for the first half of 1920, during which time the metal was leaving this country at the rate of from 16,000 to 17,000 tons per month. During October, however, to illustrate the sharp decline in the volume of shipments, only 1,329 tons of domestic material and 415 tons of zinc produced from foreign ores were exported. Although the record for the entire year will show up well, the tendency in the fall of 1920 does not indicate that export trade in the volume desired can be maintained.

Practically All English Zinc Smelters Shut Down

In view of the importance of the foreign situation in zinc, the recent report of the European correspondent of the American Zinc Institute is of moment. The report states that in the United Kingdom, apart from a couple of furnaces running at the New Delaville works, mainly on the retreatment of zinc residues, and one or two other furnaces, zinc smelting has been entirely suspended. Zinc smelting in Great Britain is not noted for economy in fuel consumption, and the estimate is given that slab zinc cannot be produced in England under £50 per ton (quotations on the London market are now around £25). There are still about 20,000 tons of slab zinc in the British government's hands, a stock at the present time regarded as formidable, although one that normally would be quickly absorbed by the galvanizing trade.

Belgian producers have been adversely affected by the decline in the London market. Unsold stocks of slab zinc and zinc sheets in Belgium are estimated at over 30,000 tons, which is being held for higher prices—£44 to £45 per ton, said to represent the actual producing cost for slab zinc. Conditions in Europe are awaiting a settlement of the political and industrial situation. The restoration of Europe and the devastated areas of northern France has not progressed markedly, and metals and materials in enormous quantities will be required when the work is in full swing.

As to France, the report states that few retorts are in operation, the price of coal and coke alone being a stumbling block to economical smelting.

Germany seems to be able to take advantage of the depreciation of the mark in selling zinc below £40, as German labor, coal, and supplies are paid for in paper marks, whereas the product is sold in pounds sterling. The cost of coal, for one thing, is controlled by the German government and fixed at 100 to 120 marks per ton. Figured in English currency this is equal to 7s. 6d. per ton, which, when compared with the Belgian and British actual prices of 40s. and 45s. per ton, respectively, indicates the advantage accruing to the German producer in point of lower production costs. The industrial position of Germany is far from good, and the country is near bankruptcy. German manufacturers are eagerly awaiting the day when trade with Russia will be reopened. Slab zinc unsold in Germany amounts to less than 20,000 tons, but as long as this continues to be offered, either direct or through Scandinavia, at under £40, the London market has no chance whatever of developing strength.

The new zinc plant adjacent to the Tata Steel Works, in India, is reported to be making good progress, but the opinion is ventured that zinc smelting in India cannot hope to show better results than was the case in Japan, where the industry is now almost dead. Successful zinc smelting requires suitable labor, superior coal, and good refractories, but in all three of these prerequisites India is deficient, labor being unused to charging zinc furnaces, Indian coal being of inferior quality, and the discovery of higher-class clay in India not having been announced.

Artificial Character of London Market

The zinc mines of North Africa are shut down, and the output of zinc ore in Spain is limited to the dwindling requirements of Belgium and Germany. No ore supplier will agree to contract on the basis of the London monthly market price for zinc, which dealers maintain is artificial, and applicable only as long as the weakness of the German exchange governs the situation.

The terms of the settlement of the Broken Hill strike mean a considerable reduction in Australian ore supplies, chiefly because the agreement establishes a five-day working week and the abolishment of the night shift. It is now assured that the annual quantity of zinc concentrates will fail to reach the maximum which the British government is required to accept for the next nine years under its contract with the Australian producers. Several hundred thousand tons of concentrates are stocked at Broken Hill for shipment, but steamers to carry the material at £5 per ton to Belgium are scarce because of the higher freight paid for cargoes of coal to Sweden.

The Position of Zinc-Producing Nations

Despite the favorable position of the Australian and particularly Tasmanian zinc producers, Belgium is the key to the world's zinc situation, owing to a better understanding of the technique of the industry. In the future Germany is expected to hold her own; France will re-enter with her pre-war production in about two years; Spain has greater possibilities as a producer of zinc oxide than of the metal; Russia will take years to recover; England is in a hopeless position as a zinc producer; India's efforts at zinc production are not likely to meet with greater success than Japan's, and the United States production, henceforth, must be limited to the extent of domestic requirements, as production costs will not permit of competition with European zinc.

COMPANY REPORTS

Mining Dividends for December, 1920

The following is a partial list of dividends paid by mining companies during December, 1920.

Mining and Metallurgical Companies in United States	Situation	Per Share	Total
Amer. Sm. & Ref.	U. S. & Mex	$1.00q	$609,980.00
Amer. Sm. & Ref., pfd	U. S. & Mex	1.75q	875,000.00
Calumet & Arizona, c	Ariz	1.00q	642,520.00
Cardiff Mining, l.s.	Utah	.15	75,000.00
Con. Interstate-Callahan, z.l.	Idaho	.50q	161,651.50
Daly West Mining, s.l.	Utah	.25q	62,500.00
Eagle & Blue Bell, g.s.l.	Utah	.25k	223,290.00
Federal M. & S., pfd., s.l.	Idaho	1.75q'	210,000.00
Golden Cycle, g.	Col.	.02q	30,000.00
Hecla Mining, l.	Idaho	.15qx	150,000.00
Kennecott Copper	......	.50q	1,393,530.00
Ray Consolidated Copper	Ariz.	.25q	394,294.50
St. Joseph Lead	Mo.	.50qx	704,734.00
United Verde Copper	Ariz.	1.50q	450,000.00
Utah Copper	Utah	1.50q	2,436,735.00
Mining and Metallurgical Companies in Canada, Mexico and South America			
Cerro de Pasco Copper	Peru	$1.00q	$898,229.00
Hollinger Consol., gold	Ont.	.05bm	246,000.00
St. John del Rey, g.	Brazil	9d. sa	£2,250
St. John del Rey, pfd. 10%	Brazil	1 sh. sa	£5,000
Holding Companies			
Great Northern Iron Ores	Minn.	$2.00	$3,000,000.00

bm, bi-monthly; k, irregular; q, quarterly; sa, semi-annual; x, includes extra.

The following companies passed dividends usually declared at this time: Ahmeek Mining, Arizona Copper, Chino Copper, Copper Range, Cresson Consolidated Gold, Nevada Consolidated Copper, Quincy Mining, Mining Corporation of Canada, and Yukon-Alaska Trust.

Minerals Separation North American Corporation, which is organized under Maryland laws, distributed on Dec. 31, 1920, $1 per share in 4¾ per cent Victory notes at par. National Lead Co. distributed its usual quarterly dividends of 1½ per cent on common and of 1¾ per cent on its preferred stock. New Idria Quicksilver Mining Co. consented to the appointment of a receiver, as requested by part of the stockholders, with a view to improving the organization of the company.

Chile Copper Co. Increases Income

The fifteenth quarterly report of the Chile Exploration Co. for the third quarter of 1920 states that during the quarter ended Sept. 30 there was treated 1,104,648 tons of ore, averaging 1.51 per cent copper.

The cost of copper produced during the quarter was only 11.179c. per lb., including selling and delivery expense, but excluding depreciation of Federal taxes and with no credit for miscellaneous income.

The financial statement of the Chile Copper Co. and Chile Exploration Co. combined (earnings being based on copper actually delivered), shows for the quarter ended Sept. 30, as compared with the preceding quarter, as follows:

	Third Quarter, 1920	[illegible]
Pounds copper delivered	23,962,212	[illegible]
Net profit on copper delivered	$2,10[illegible],159.58	[illegible]
Miscellaneous income	[illegible] 30,101.90	[illegible]
Interest on call loans and bank balances of the Chile Copper Co.	240,192.31	[illegible]
Total income	$2,31[illegible],249.99	[illegible]
Depreciation	604,674.91	[illegible]
[illegible] fifteen-year 6 per cent [illegible]	35,000.00	[illegible]
[illegible] Chile Copper Co.	787,203.[illegible]	[illegible]
Expenses of Chile Copper Co.	10,363.1[illegible]	[illegible]
Total charges	$1,437,241.8[illegible]	[illegible]
Balance undivided profits for quarter both companies	$878,008.1[illegible]	[illegible]

In this period of world wide disturbed [illegible] and financial readjustment, the companies had on [illegible] 15, $11,163,000, representing cash on hand and [illegible] and about $275,000 due for copper delivered but not yet paid for at that date.

Shattuck Arizona Shows Loss for Third Quarter

Copper, Lead; Arizona

The production of copper and of gold and silver from copper ores of the Shattuck Arizona Copper Co. for the quarter ending Sept. 30, 1920, was less than that of the previous quarter, owing to the fact that less copper ore was mined. The production of lead and of gold and silver from lead ores was considerably more than in the previous three month, as more tons were milled and of better grade. A summary of production for the third quarter is as follows:

Dry tons copper ores smelted	4,915
Dry tons lead concentrates smelted	4,663
Dry tons lead ores smelted	53

Metals recovered from	Copper Ore	Lead Concentrates	Lead Ore
Pounds copper	527,454	....	....
Pounds lead	...	2,398,123	7,127
Ounces gold	145	1,286	5
Ounces silver	16,953	119,534	677

The copper production for the third quarter is inventoried at 15c. per lb. The returns on lead are actual smelter settlements. The results of operations for the third quarter are as follows:

Copper ore and bullion		$79,118.10
Gold and silver		16,886.67
Lead concentrates settlements		349,056.84
Direct lead and sorted ore settlements		421.78
Interest		10,993.17
Total		$456,476.56
Copper operating expense and development	$185,015.58	
Milled lead expense	258,250.07	
Administrative expense	12,993.29	456,258.94
		$217.62
Depreciation of mine and mill equipment		19,327.06
Loss for quarter, exclusive of depletion		$1[illegible],109.4[illegible]

Lead mining and milling operations have been conducted at nearly full capacity of the concentrating plant. New development work totaled 2,150 ft.

Barnes-King Development Co.

Gold, Silver; Montana

The records of the Barnes-King Development Co. show the following operating results for the quarter ending Sept. 30, 1920:

EARNINGS		
Shannon property		$10,232.35
Kendall property		1,338.94
Interest received		[illegible]
Total		$11,[illegible].58
DEDUCT		
Loss on operations on—		
North Moccasin property	$[illegible]	
Piegan-Gloster property	[illegible]	
Black Hawk development	[illegible]	
Miscellaneous expense	2,391.47	
Total		[illegible]
Difference being net loss of operations for quarter ending Sept. 30, 1920		[illegible]

The above figures include provisions for depreciation on the various plants of the company on the same basis as has been used heretofore. Owing to the small [illegible] of ore remaining in the North Moccasin mine, and that of low grade, the directors decided during the quarter to lease the mine. Accordingly, the property was leased Sept. 24. The last production from this property, on company account, was for the month of July, when [illegible] tons of ore were milled, yielding $1,33[illegible].79 in bullion. In addition, a clean-up yielded $1,465.23, making total production for the quarter $[illegible],801.02.

As previously reported, the Piegan-Gloster mine was shut down in May, of this year, and will not be opened again while costs of operating continue as high as at present.

MINING STOCKS

Week Ended December 25, 1920

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Adventure	Boston	....	....	*50		
Ahmeek	Boston	44	40½	41	Sept.'20, Q	.50
Alaska-B.C.	N. Y. Curb.	7/16	⅜	7/16		
Allouez	Boston	18	15	17	Mar.'19,	1.00
Anaconda	N. Y.	35	30	32	Nov. '20, Q	1.00
Ariz. Com'l	Boston	6¼	5½	5½	Oct. '18,	.50
Big Ledge	N. Y. Curb.	⅜	¼	5/16		
Bingham Mines	Boston	9¼	9	9	Sept. '19, Q	.25
Calumet & Ariz	Boston	43	40	42	Dec.'20, Q	1.00
Calumet & Hecla	Boston	221	206	211	June '20, Q	5.00
Canada Copper	N. Y. Curb.	....	....	*20		
Centennial	Boston	6⅝	6½	6½	Dec. '18, SA	1.00
Cerro de Pasco	N. Y.	26¾	24½	25⅝	Dec. '20, Q	1.00
Chief Consol	Boston Curb	2½	2⅜	2⅜	Nov. '20, Q	.10
Chile Copper	N. Y.	9⅛	8¾	9⅛		
Chino	N. Y.	18⅛	16⅜	17¾	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*32½	*32	*32		
Con. Ariz.	N. Y. Curb.	....	....	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb.	2	2	2		
Copper Range	Boston	26½	25	26⅛	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*43	*40	*40		
Davis-Daly	Boston	5½	4	4	Mar. '20, Q	.25
East Butte	Boston	7	7½	7¼	Dec. '19, A	.50
First Nat'l	Boston Curb	*61	*50	*61	Feb. '19, SA	.15
Franklin	Boston	2⅜	2¼	2¼		
Gadsden Copper	N. Y. Curb.	....	....	*70		
Granby Consol	N. Y.	18	15	17½	May '19, Q	1.25
Greene Cananea	N. Y.	18	15	16¾	Nov. '20, Q	.50
Hancock	Boston	3⅛	3	3		
Houghton	Boston Curb	*35	*30	*35		
Howe Sound	N. Y. Curb.	2	2¼	2¼	Oct. '20, Q	.05
Inspiration Con	N. Y.	29	28	28	Oct. '20, Q	1.00
Iron Cap	Boston Curb	6¾	6	6	Sept. '20, K	.25
Isle Royale	Boston	17	15½	16	Sept. '19, SA	.50
Kennecott	N. Y.	17	14⅝	15¼	Dec. '20, Q	.50
Keweenaw	Boston	1¼	1¼	1¼		
Lake Copper	Boston	1¼	1	1		
La Salle	Boston	1⅜	1¼	1⅜		
Magma Chief	N. Y. Curb.	....	....	*21		
Magma Copper	N. Y. Curb.	16	16	16	Jan. '19, Q	.50
Majestic	Boston Curb	*8	*8	*8		
Mason Valley	Boston	*100	90	*90		
Mass Consol	Boston	2¼	1⅝	2	Nov. '17, Q	1.00
Mayflower-O.C.	Boston	4	3 9/16	3		
Miami	N. Y.	15⅛	14⅛	15	Nov. '20, Q	.50
Michigan	Boston	2	2	2		
Mohawk	Boston	44	42¼	42¼	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb.	5½	5½	5½		
Nevada Con	N. Y.	8	8¼	8⅝	Sept. '20, Q	.25
New Arcadian	Boston	....	....	2½		
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	14½	13¼	14	Aug. '20,	.25
Nixon Nev	N. Y. Curb.	....	....	*5		
North Butte	Boston	9 9/16	8½	9⅛	Oct. '18, Q	.25
North Lake	Boston	....	....	*25		
Ohio Copper	N. Y. Curb.	....	....	3/16		
Ojibway	Boston	1¼	1	1¼		
Old Dominion	Boston	15⅝	15	15	Dec. '18, Q	1.00
Osceola	Boston	23¼	21⅝	21⅝	June '20, Q	.50
Phelps Dodge	Open Mar.	†175	†150	....	Oct. '20, Q	2.50
Quincy	Boston	36	34½	35¾	Mar. '20, Q	1.00
Ray Con	N. Y.	11½	10⅞	11⅛	Dec. '20, Q	.25
Ray Hercules	Boston Curb			*50		
St. Mary's M. L.	Boston	29	25¼	27½	June '20, K	2.00
Seneca Copper	Boston			17½		
Shannon	Boston	0.80	0.60	0.70	Nov. '17, Q	.25
Shattuck Ariz	N. Y.	5½	4	5⅛	Jan. '20, Q	.25
South Lake	Boston	....	....	2		
South Utah	Boston	*3	*3	*3		
Superior Copper	Boston	3½	3	3½	Apr. '17,	1.00
Superior & Boston	Boston	1¾	1	1⅝		
Tenn. C. & C.	N. Y.	7½	6⅞	6⅞	May '18, I	1.00
Tuolumne	Boston	*38	*35	*38	May '13.	.10
United Verde Ex.	Boston Curb	23	20¼	23	Nov. '20, Q	.50
Utah Consol	Boston	3½	3	3	Sept. '18,	.25
Utah Copper	N. Y.	47	44¼	47¼	Sept. '20, Q	1.50
Utah M. & T.	Boston	95	85	85	Dec. '17,	.30
Victoria	Boston			1¼		
Winona	Boston	*45	*35	*35		
Wolverine	Boston	10	8	8½	Jan. '20, Q	.50
		LEAD				
Hecla Mining	N. Y. Curb.	4¼	3 11/16	3	Dec. '20, QX	.15
St. Joseph Lead	N. Y.	11¼	10	11	Dec. '20, QX	.50
Stewart	Boston Curb			*6	[illegible]	.05
Utah Apex	Boston	2⅜	2¼	2⅜	Nov. '20, K	.25
		ZINC				
Am. Z. L. & S.	N. Y.	6¼	5¼	6	May '17,	1.00
Am. Z. L. & S. pf.	N. Y.	30	27	29	[illegible] '20, Q	1.50
Butte C. & Z.	N. Y.	4¼	3¾	4	[illegible] '18, I	.50
Butte & Superior	N. Y.	8¼	8	8¼	Sept. '17,	1.25
Con. Interst. Cal.	N. Y.	5¼	4¼	4	[illegible] '20, Q	.50
New Jersey Z.	N. Y. Curb	128	127	127	[illegible] '20, Q	4.00
Success	N. Y. Curb.	*2	*1½	*2	[illegible] '16,	.03
Yellow Pine	Los Angeles	*45	*45	*45	[illegible] '20, Q	.03

*Cents per share. †Bid or asked. ‡Quotations missing. Q, Quarterly. SA, Semi-annually. BM, bi-monthly. K, Irregular. I, Initial. X, Includes extra.

Stock	Exch	High	Low	Last	Last Div.	
		GOLD				
Alaska Gold	N. Y.	1	⅝	⅞		
Alaska Juneau	N. Y.	1⅛	¾	⅞		
Carson Hill	N. Y. Curb.	....	....	22¼		
Cresson Consol. G.	N. Y. Curb.	1¼	1⅛	1¼	June '20, Q	.10
Dome Ex.	Toronto	..		*4⅛		
Dome Mines	N. Y.	10	9½	9¾	Oct. '20, Q	.25
Golden Cycle	Colo. Sprgs.	‡....	....	*73	Dec. '20, Q	.02
Goldfield Con.	N. Y. Curb.	6	*4	*5	Dec. '19,	.05
Hedley	Boston	....	....	4¼	June '19,	.10
Hollinger Con.	Toronto	5.60	5.50	5.50	Dec. '20, BM	.05
Homestake	N. Y.	50	48	50	Sept. '19,	.50
Kirkland Lake	Toronto	39¼	*39¼	*39¼		
Lake Shore	Toronto	1.06	1.06	1.06	Oct. '20, K	.02
McIntyre-Porcupine	Toronto	1.84	1.78	1.80	Sept. '20, K	.05
Porcupine Crown	Toronto			*17¼	July '17,	.03
Portland	Colo. Sprgs.	‡....	....	*60	Oct. '20, Q	.01½
Reorgan. Booth	N. Y. Curb.	*4	*2½	*3½	May, '19,	.05
Silver Pick	N. Y. Curb.	*5	*4	*5		
Teck Hughes	Toronto	*11½	*11	*11½		
Tom Reed	Los Angeles.	1.22½	1.17	1.22	Dec. '19,	.02
United Eastern	N. Y. Curb.	2⅝	2⅜	2½	Oct. '20, Q	.15
Vindicator Consol	Colo. Sprgs.	‡....	....	*18	Jan. '20, Q	.01
West Dome Consol	Toronto	*6	*5½	*5½		
White Caps Min.	N. Y. Curb.	*5½	*3	*5		
Yukon Gold	Boston Curb	....	....	1⅛	June '18,	.02½
		SILVER				
Arizona Silver	Boston Curb	*20	*18	*20	Apr. '20, M	.03
Beaver Con.	Toronto	*27½	*27	*27	May '20, K	.03
Coniagas	Toronto	....	....	2.00	Nov. '20, Q	.12½
Crown Reserve	Toronto	..	..	*15	Jan. '17,	.05
Kerr Lake	Boston	2¾	2½	2⅝	Oct. '20, K	.12½
La Rose	Toronto	*22	*22	*22	Apr. '18,	.02
McKinley-Dar	Toronto		....	*24	Oct. '20, Q	.03
Mining Corp.	Toronto	1.00	1.00	1.00	Sept. '20, Q	.12½
Nipissing	N. Y. Curb.	7⅝	7⅜	7⅝	Oct. '20, QX	.50
Ontario Silver	N. Y.	4¼	4	4⅛	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb.	7/16	⅜	7/16	Jan. '12,	.10
Peterson Lake	Toronto	....	..	*9¾	Jan. '17,	.01½
Temiskaming	Toronto	*25	*25	*25	Jan. '20, K	.04
Trethewey	Toronto	*17	*16	*16	Jan. '19,	.05
		GOLD AND SILVER				
Atlanta	N. Y. Curb.	*1½	*1	*1½		
Barnes-King	Butte	‡....	....	1.11	Aug. '20, Q	.05
Bost. & Mont.	Boston	....	....	*63		
Cashboy	N. Y. Curb.	*5½	*4	*4½		
El Salvador	N. Y. Curb.	½	⅜	½		
Jim Butler	N. Y. Curb.	*19	*14	*18	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb.	*5	*4	*5	June '16,	.05
Louisiana Con.	N. Y. Curb.	¼	⅛	¼		
MacNamara M.	N. Y. Curb.	3/16	3/16	3/16	May '10,	.02½
N.Y. Hond. Rosar.	Open Mar.	†11	†9	....	Oct. '20, QX	.50
Tonopah-Belmont	N. Y. Curb.	1½	1 3/16	1½	Oct. '20, Q	.05
Tonopah-Divide	N. Y. Curb.	1 3/16	1	1⅛		
Tonopah Ex.	N. Y. Curb.	1½	1⅜	1½	Oct. '20, Q	.05
Tonopah Mining	N. Y. Curb.	1½	1⅜	1 7/16	Oct. '20, SA	.05
West End Con.	N. Y. Curb.	15/16	⅞	15/16	Dec. '19, SA	.05
		SILVER-LEAD				
Caledonia	N. Y. Curb.	*17	*15	*16½	July '20, M	.01
Consol. M. & S.	Montreal	16¼	15¼	15¾	Oct. '20, Q	.62½
Daly Mining	Salt Lake	....	....	2.00	July '20, Q	.10
Daly-West	Boston	3¼	3½	3¾	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	....	....	2⅛	Dec. '20, K	.25
Electric Point	Spokane	*5	*4	*5	May '20, SA	.03
Fed. M. & S.	N. Y.	5½	5	5½	Jan. '09	1.50
Fed. M. & S. pf.	N. Y.	24⅞	21½	22½	Dec. '20, Q	1.75
Florence Silver	Spokane	*14	*10	*14	Apr. '19,	.01¼
Grand Central	Salt Lake	....	....	*37½	June '20, K	.03
Iron Blossom	N. Y. Curb.	¼	3/16	3/16	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	3.25	3.17½	3.17½	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb.	*8	*6	*7		
Prince Consol	N. Y. Curb.	5/16	5/16	5/16	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*7½	*6	*7½	Feb. '19,	.01
Rex Con.	N. Y. Curb.	*5	*4	*5		
South Hecla	Salt Lake	*65	*65	*65	Sept. '19, K	.15
Stand. S. L.	N. Y. Curb.	3/16	⅛	3/16	Oct. '17,	.05
Tamarack-Custer	Spokane	1.80	1.25	1.80	Dec. '19, K	.03
Tintic Standard	Salt Lake	3.37½	3.00	3.05	June '20, Q	.10
Wilbert Mining	N. Y. Curb.	*1½	*1	*1	Nov. '17,	.01
		NICKEL-COPPER				
Internat'l Nickel	N. Y.	12⅜	11⅛	12¼	Mar. '19,	.50
Internat'l Nickel, pf	N. Y.	79⅛	79	79¼	Nov. '20, Q	1.50
		QUICKSILVER				
New Idria	Boston	*76	*60	*60	Jan. '19,	.25
		TUNGSTEN				
Mojave Tungsten	Boston Curb	....	....	*5		
		VANADIUM				
Vanadium Corp.	N. Y.	37	28½	30	Oct. '20, Q	1.50
		ASBESTOS				
Asbestos Corp.	Montreal	80	64	72	Oct. '20, Q	1.50
Asbestos Corp. pf.	Montreal	85	83	83	Oct. '20, Q	1.75
		MINING, SMELTING AND REFINING				
Am. S. & R.	N. Y.	39⅛	32½	35	Dec. '20, Q	1.00
Am. S. & R. pf.	N. Y.	80⅛	74	74	Dec. '20, Q	1.75
Am. Sm. pf. A.	N. Y.			68½	Oct. '20, Q	1.50
U. S. Sm. R. & M.	N. Y.	33	31	31½	Oct. '20, Q	1.50
U. S. S. R. & M. pf.	Boston	41	40	41	Oct. '20, Q	.87½

INDUSTRIAL NOTES

China a Great Export Field for Mining Machinery

C. M. Manners, managing director of the China Mutual Trading Co., Ltd., Shanghai, while in America recently on his way to China said:

"Our company, engaged in Anglo-Chinese trade, is agent in China for Handley Page Co., and Marconi Co., of China. We also represent the Pekin Syndicate, the largest Anglo-China corporation now operating, which handles dyes, engineering supplies, and chemicals.

"China offers a tremendous field for export business, particularly in the line of mining machinery and chemicals. One thing not usually taken into account is the cheap labor. This will retard the importation of agricultural machinery to a considerable extent. Our business is handled through British banks, and we experience no difficulty in financing our trade. Reports that Chinese banks are organizing along modern lines are greatly exaggerated. Personally, I have not noticed any great change. The A. B. C. Club is wielding a great influence toward promoting good feeling among the countries concerned."

Educating Their Customers

The British official *Board of Trade Journal* recently stated that

"An educational course is being organized under the auspices of the British Consulate in Mexico City and the British Chamber of Commerce, in co-operation with the Educational Department of the Ministry of Commerce, Industry, and Labor. In this course attention is given to the study of the principal British industrial centers, and their products, Mexican centers of production, the reciprocal commercial needs of both countries, means of communication, the leading British import and export houses, general and special traffic conditions, existing freight rates, customs requirements and specifications, and in fact, the mutual benefits to be obtained from commerce between Mexico and Great Britain, and the advantages and possibilities of its development."

This illustrates one of the ways by which the businesslike government of a businesslike people goes after foreign trade—and gets it.

The "motorcade" is coming into verbal fashion to be added to such terms as camouflage and barrage, says the *Boston News Bureau*. It is coined in motordom to signify a train or caravan of motor trucks, presumably being suggested by cavalcade. Another abbreviation beginning to appear is "truckportation."

Concrete Stacks Appear Like Tile

The handsome little monthly *Concrete in Architecture and Engineering* always contains interesting illustrations of successful industrial applications of reinforced concrete construction. The following is taken from one of its recent issues:

"Good draft, fuel economy, freedom from maintenance costs, stability against wind storms and other tendencies of the elements to do damage are important in chimneys of industrial plants. In this field of construction the adaptability of concrete is displayed to good advantage, as it meets all the requirements if used after a number of successful systems of concrete stack construction. One of these systems, which to the uninitiated will not at once appear to be an application of concrete, is the Wiederholdt system as used by the Wiederholdt Construction Co., of St. Louis. On the exterior, Wiederholdt chimneys present the appearance of being of clay tile, but the tile acts merely as a mold into which reinforcing steel and concrete are placed.

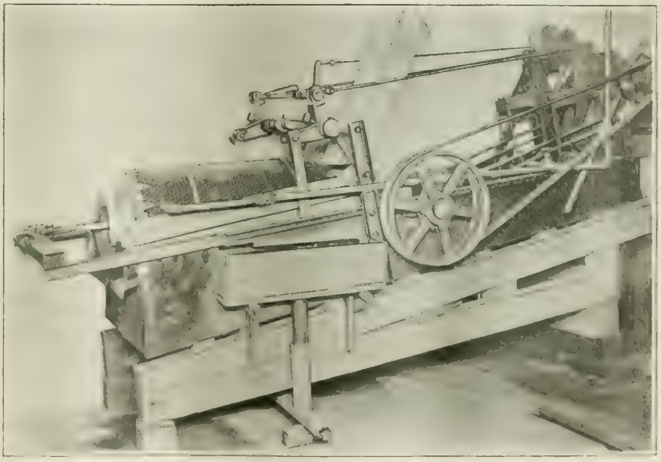
The specially designed tile used in the construction of Wiederholdt stacks is so formed that both vertical and horizontal reinforcement is easily placed and held in position. The end walls of each tile unit are knocked out after the tile is in position, so that when the concrete is in place the result is practically a [illegible] thin, reinforced concrete shell wall between an outside and inside facing of hard burned tile.

"Foundations for Wiederholdt stacks are built in the usual manner. Vertical bars tie the shell of the stack into the foundation. The tile molds and concrete stack shell are built up simultaneously and one course of tile is filled with concrete before another is added. The tile are laid up with cement mortar and the concrete filling is placed in small quantities."

New Ore Washing Device Described

Dorr Washer and Classifier Consumes Little Power—Model Tested at Minnesota School of Mines

A new device for concentrating iron ores may find an application in the silica or sand and gravel industries as well, as a result of tests at the Minnesota School of Mines. The material to be washed enters through the feed spout and falls directly into the revolving screen, where the coarse material is completely washed before being discharged over the rear end of the classifier. The material that passes through the openings in the screen enters the tank of the classifier, where the coarser and heavier particles settle to the bottom and are raked out and discharged at the upper end of the classifier. The finer and lighter particles are kept in suspension by the rakes and are discharged as tailings with the excess water admitted as a surface spray at the upper end of the tank. Two views of the device are shown by the accompanying photographs.



MODEL DORR WASHER AND CLASSIFIER—SIDE VIEW

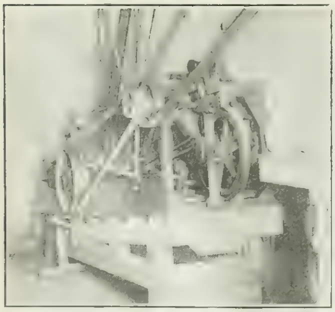
The speed of the trommel or screen is so adjusted that the material within it is subjected to a cascading action similar to the action of the material in a ball mill. The lumps of sand or gravel are carried out of the water on the side of the trommel, from which position they fall or cascade back into the water. This action continues until the material finally reaches the lower end of the trommel, where a [illegible] scoop similar to the feed scoop of a ball mill, picks up the coarse washed material and discharges it, comparatively free from water, from the machine.

In order to carry a considerable charge of material in the trommel at all times, the slope should be very small. This has the effect of causing the particles to rub together and to wear off the soft clay or [illegible]. The presence of large lumps in the trommel is therefore quite desirable, in order to increase this abrasive action and thus eliminate preliminary screenings or sizing.

By placing coarse screen or grate across the trommel near the discharge end, the coarse material is retained in the trommel, thus increasing the abrasion. This is particularly desirable when the material contains a large amount of paint rock or partly disintegrated silica. The abrasive effect may be further increased by the addition of steel balls.

The power required to operate a trommel of any given dimension is proportionate to the speed and load of material that it carries. The trommel is considered as a modification of a ball mill, and by slight alterations may be made to operate as much like a ball mill as is desired.

All the parts are slow moving, and records show that maintenance costs on machines handling as much as 100 tons of material per hour are exceptionally small. This is explained by the fact that a machine raking out one ton of ore per minute requires less than five horsepower for operation.


DORR WASHER END VIEW

This new device is known as the Dorr Washer and Classifier, and a small model was built in the Minnesota School of Mines recently and tested by Edward W. Davis. The model is 8½ by 2 ft. in dimensions and our photographs show two views of it.

Motor Show at Delhi in 1921

A motor show will be held at Delhi, India, in February, 1921, under the auspices of the local Motor Trade Association, says *U. S. Commerce Reports* of Oct. 29, 1920. It will be open only to those firms in India which are agents or recognized subagents for motor vehicles, cycles, and accessories. A motor gymkhana will be held in connection with the show, in which there will be competitions for private owners as well as for dealers.

Italian restriction on importation of motor trucks was removed, effective Oct. 29.

Trucks Provide Power for Factory During Coal Shortage

During the recent coal shortage the Duplex Truck Company again demonstrated an unusual ability to surmount serious difficulties.

Without a steam power plant and with no electric power due to the coal shortage, the Duplex Truck Company was able to operate all departments with every man on the job.

Power for the Duplex plant was found in eight big Duplex 4-wheel drive trucks and two birds were killed with one stone because in driving the machinery the trucks were tested out and gas conserved.

Realizing that the coal situation meant a complete shut down for the Duplex plant which was facing an unprecedented demand for the new "Limited" trucks far beyond any anticipation, a serious problem was confronted.

A plan was worked out whereby eight big Duplex trucks were placed conveniently to turn line shafts and two trucks to do the work of the 50-hp. electric motors run in normal times to operate the plant.

The truck motors were driven at maximum speed under governor control. The operation of the plant was less expensive with the Duplex trucks than with the electric power.

Truck motors were given a two-day test-out and then a new motor was hooked up with the shafts. The plan worked perfectly and every Duplex employee was kept on the job.

Hauck Manufacturing Company Loses Its President

Arthur E. Hauck, President of the Hauck Manufacturing Co., maker of oil-burning appliances, Brooklyn, N. Y., died at Flatbush, Brooklyn, on Oct. 30, aged forty-one years. Mr. Hauck learned copper-smithing in Germany. Before he was twenty he followed his trade in the navy and ship yards of Belgium, France, and England. He arrived in this country when twenty years old, landing at Philadelphia, where he promptly obtained employment at the Philadelphia Navy Yard. After working for three years in the Navy's eastern coppersmithies, Mr. Hauck started in the oil-burner business in 1902 with a small shop in Brooklyn. His pioneer work was the basis for many of the industrial oil-burning devices of today. Over a score of important basic patents on oil-burning devices, as well as numerous minor inventions and improvements in the applications of burning oil, testify to his continued interest and industry. One of his principal patents is the method of vaporizing kerosene in a torch with a proportioned, heat-resistant nozzle. Another is the Hauck method of atomization through proportioned pipes, openings, and composition nozzle, inducing what he termed "the internal combustion."

TRADE CATALOGS

Oil Shale Equipment—The Denver Fire Clay Co., Denver, Col., recently issued a 32-pp. bulletin, No. 251, "Oil Shale Equipment." This booklet outlines the oil-shale industry in Scotland, describes the occurrence of shales in the United States and also contains a number of illustrated methods for the preliminary or field distillation of oil shale. Description and price lists of apparatus used in this connection are also included.

Ventilation—Buffalo Forge Co., Buffalo, N. Y., illustrates and describes in its Catalog 721, various installations of its devices and systems for ventilating dyehouses and bleacheries, among which a number suggest ways in which similar devices could improve conditions in metal-working plants.

Rock Drills—The Denver Rock Drill Mfg. Co., Denver, Col., has issued a bulletin, "Waugh 'Ninety' Drills," which outlines the general specifications of this type, which has been designed for and is especially adapted to coal and iron mining. It is suitable for drilling in the softer formations where a powerful positive rotation is required, and can also be successfully applied to block-holing, hitch-cutting, trimming, or drilling in any character of rock, although not so well adapted as other drills designed for that purpose.

Detonators—Atlas Powder Co., Philadelphia, Pa., is supplying a small lightweight device for detonating that company's electric blasting caps and illustrates its advantages in a small folder. This "Davis No. 1 Blaster" is so small that it fits the average hand, but has power to fire five 30-ft. copper-wire electric caps connected in series. Advantages of electric blasting, furnished by this device, are extended to many smaller operations.

Screens—Stimpson Equipment Co., Salt Lake City, Utah, and Grand Central Palace, New York City, has issued an illustrated eighteen-page account of the Mitchell electric vibrating screen invented at Garfield, Utah. It is claimed to attain unusual efficiency with all kinds of material at very low proportionate power cost and to be practically fool-proof. Its vibrating mechanism is truly unique and peculiarly efficient.

Electric Devices—The Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has collected under an attractive, two-color cover, forty-eight pages of information concerning all its products designed "For the Mine," and given the pamphlet that title. The booklet, described as Publication 836, is well illustrated and deals with motor controllers, battery-charging equipment, electrically operated brakes, solenoids, ore separators, clutches and space heaters.

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Volume 111 New York, January 8, 1921 *Number* 2

Why Is Copper a Luxury?

PROSPERITY among copper producers cannot be expected to follow a general resumption of business activity as quickly as would be the case if the large stocks of metal were absent. These have been but little reduced during the last year, if at all, and may even be sufficient to supply the 1921 demand without further production. Plainly, then, it is to the interest of copper producers to market these stocks as rapidly as possible, and something more radical must be done than sitting in an office and waiting for a buyer to come along. This fact has been realized and already steps have been taken to institute a selling campaign which will be more productive of results.

About a year ago some of the more important copper producers and brass manufacturers formed an organization called the Copper and Brass Research Committee to investigate trade conditions. This committee has recently published a series of reports in which the reasons for the slump in copper are enumerated. Our readers are generally familiar with what these reasons are: Mainly, the general slump in business, especially in the automobile trade, and the unloading of Government stocks of copper, brass and scrap. But it is to another reason, minor and yet fundamentally important to copper men, that we wish to call attention. The use of substitutes, inspired by war necessity, has outlived war conditions. It is pointed out that the tendency is constantly increasing to use cheaper and less efficient metals than copper and its alloys for plumbing and roofing supplies; for screws, nuts, hinges, bolts, screens and kitchen utensils; in automobiles and the manufacture of pins. To counteract this tendency the committee advocates an extensive advertising campaign similar to the successful publicity work which has been carried on by the zinc and nickel producers during the last year. The sales of Monel metal have been tripled by eight months of advertising, and it is thought that the copper industry can be aided by the same means. To have a more efficient organization for the furtherance of the copper producers' interest, a Copper and Brass Institute is likely to be formed during the coming year.

We are strongly in favor of this campaign and wish those behind it the utmost success. However, we believe that a fundamental objection to the use of copper must be removed before sales can be increased to any extent by publicity methods; an objection which seems to us highly important and yet which seems to have been overlooked. That is, the seemingly extortionate prices charged for copper products. No matter how enthusiastic a home builder may be, about, let us say, copper screens, his enthusiasm will quickly be cooled and his animosity aroused when he finds that copper screens sell for 15c. a square foot compared with 3c. for iron and 4c. for galvanized iron. Now a square foot of copper screening will certainly not contain more than a few ounces of copper and the difference in intrinsic value of the metal content in the two kinds of screening will probably not exceed one or at the most two cents. Why should not copper screens sell for 5 or 6c. per square foot instead of 15? It is difficult to see how the manufacturing cost can be so much greater; in fact, were we given a block of iron and a chunk of copper and told to make one of them into a wire screen our natural dislike for unnecessary hard work would prompt us to choose the copper. Prospective customers will want reasonable prices, and if it is impossible to lower prices the first function of an advertising campaign should be to justify present quotations, for this is the stumbling block. The American people are no longer in a frame of mind to pay what they consider to be profiteering prices.

Nor are screens the only example. The same apparently ridiculous price differential exists in other copper and brass manufactures. "What," we asked our plumber, "is the difference in price between a 30-gal. hot-water tank made of copper and of galvanized iron?" "Well, there's *some* difference. Copper tanks are so expensive we don't try to sell them and advise customers against them. A galvanized iron tank will cost about $13 and a copper tank about $40." The difference in value of metal in the two is five or six dollars. Again, why?

Why are copper sheets now quoted at 10c. per pound more than copper metal, whereas in July, 1914, the differential was 5½c.? Is this differential to be permanent or is it temporary, caused by high-cost stocks of raw material and high wages?

The advantages of copper over its substitutes are many. The reason why the substitutes have been used is obvious. Before advertising the glories of copper to a discerning public, some work needs to be done either among the manufacturers, wholesalers or retailers of copper products. This, if successful, should be followed by advertising, emphasizing the fact that copper and brass are not only beautiful and more efficient than substitutes but that our idea that they are luxuries is all wrong.

The Duration of the Pittman Act

THERE is considerable doubt in some quarters as to the length of time during which the Pittman Act is likely to operate, judging from inquiries we have received and the conflicting estimates ranging from three and a half to six years, that have been made by the press. The *Wall Street Journal* early in December stated that "They [the silver miners] will have a steady market for their output for the next [illegible] years, at the fixed rate of $1 per ounce, the Government taking as much as they can produce." This estimate was evidently based on the erroneous assumption in the statement that some 355,915,083 silver *dollars* were melted under the Pittman Act and that silver production is at the rate of 56,000,000 *ounces* per year.

The actual situation is stated simply and clearly in the Annual Report of the Director of the Mint, for the fiscal year 1920, who informs us that a total of 270,121,554 dollars was melted under the Pittman Act, the metal being either shipped to India or used in the United States as subsidiary silver coinage. "The act provides for the repurchase of the same quantity as contained in the dollars melted, about 208,000,000 ounces, fine." This figure is quite out of line with the *Wall Street Journal's* estimate, but in substantial agreement with the text of the telegram of the Secretary of the Treasury to the *Engineering and Mining Journal* last June, wherein the amount of silver to be repurchased was stated as 207,000,000 ounces. The *Wall Street Journal* has evidently confused dollars and ounces in making its estimate.

During the first six months' operation of the silver repurchases about 23,000,000 fine ounces was bought by the Government. At this rate, 46,000,000 ounces annually, it would take about 4½ years to complete the purchases. This estimate does not take into consideration a possible decline in silver production due to the curtailment in the copper and lead industries and the decline in production in important silver-mining camps, conditions which would tend to lengthen the period.

We are glad to note that the Director of the Mint in his able report emphasizes the fact that "while the Government will neither gain nor lose on the sale and repurchase of the silver, the producer of the domestic silver gets the benefit of the fixed price mentioned above when the market price goes below that point, thus tending to stabilize domestic production." On the face of it, it may appear to the uninformed that the silver producer is being favored and that ill-advised legislation is compelling the Government to purchase silver at $1 when it can be readily obtained at 60c. Possibly other industries less fortunate than silver mining in this period of readjustment will point to the favorable position of the American silver producer and demand similar legislation. Opponents of the Pittman Act may raise the cry "class legislation."

The absurd and fallacious arguments that are usually advanced are readily disproved by anyone familiar with the unique history of the Pittman Act, its eminent fairness—with equivalent sales and purchase prices—and its remarkable stabilizing features. The Pittman Act stands by itself and most emphatically does not deserve being branded with the stigma of class legislation. The *Engineering and Mining Journal* has frequently pointed out why silver merited different consideration than other commodities used in the prosecution of the war, and one of the chief reasons bears frequent repetition: When the United States Government by means of the Pittman Act released 208,000,000 ounces of silver it threw upon the market the equivalent of the world's production for one year. In no other essential or unessential commodity did any government follow a similar procedure, as there was neither the means nor the incentive for accumulating such a tremendous stock of one material—whether copper or other commodity. Dumping great quantities of any material on the market in an industry would seriously disorganize it. That these silver stocks should be taken up again and the ordinary law of supply and demand then be allowed to function is but fair to the miner.

The Federated Malay States government has undertaken to purchase at a fixed price its own domestic tin production in the hope of subsequently selling the metal in a better market and tiding the tin producer over a depressed market. This is another method of stabilization, but its effect is highly problematical; in fact, of somewhat doubtful benefit in the long run. The Pittman Act of the United States does for the American silver market what is purely figurative for the Malay tin market, and unquestionably stabilizes the silver-mining industry—to say nothing of assisting lead and copper producers in reducing their costs through byproduct silver recovery, and cushioning an over-sharp readjustment.

To forestall any attempt to repeal the Pittman Act it will be well for the mining industry to be on its guard and for each and every silver producer to see that his Congressional representative is fully acquainted with the facts surrounding the repurchase of silver at $1 an ounce, so that prompt and vigorous action may be taken at Washington to quell any ill-advised and uncalled for movement for repeal.

The Interpretation of Geology

GEOLOGY is a wonderful science. We have seen it in our time, or since a little earlier than our time, first anathemized on account of its honest explorations into facts, as the enemy and opponent of religion, and later developing into one of the cornerstones of a new and far sweeter religion. We have seen the science reaching back, through its groping researches into molten magmas—beginning with volcanoes, then intrusive rocks at greater depths, as now exposed by erosion, and so on down to the deep or plutonic rocks, in which we see evidence of swirling currents, curdling, and that affinity of like for like which produces segregated minerals and the splitting of magmas into secondary magmas of different kinds. We have seen it, leagued with zoology and botany, explore back into changing animate life, trace out the leisurely process of evolution, and so back, not to where life began, but where the darkness of the erased records closes in on us. We have seen the science decipher the miraculous story of the ice age, explain our soils and the very pebbles and boulders in our soils, and so form the basis of farm and forest surveys and classifications. We have seen it explain our hills and our plains, our city terraces fit for residences, our harbor channels fit for shipping. We have seen it trace out our stones for building, our clays for brick; and those wonderful accumulations of metals we call ore deposits. In doing this last and the other things which we have already referred to, it has proved itself an essential of industry, and the first and most necessary foundation stone of intelligent mining.

Again, our reflective thought has been in the last few years turned to the influence of geology, more acutely the geologic distribution and occurrence of ores, on human history, on commerce and politics; and it has been detected as a cause for coalitions, treaties, migrations, culture, and wars of conquest or defense. We are on our way in all these things.

There is one aspect of geology that remains undeveloped—namely, the literary value of geology, or what we may call the poetry of geology. Geology is a science that is an exposition essential for the understanding of religion, of industry, of commerce, of politics, of the nature of God and of man: and how far has it taught humanity? What part does it take in our general education and culture? Nearly every child in the world is still taught that God made the world in six days and rested on the seventh, and not one individual out of a thousand, child or adult, knows even what geology is, let alone an understanding of its simplest truths.

There is a certain new "best seller," a novel called "Main Street." It is interesting but very trite: it is the view of life that you get through the eye of a fly, and pitifully narrow for a human being. It is hailed as a wonderful book, as the most important book of the year, by prominent literati. Now the fact is that this poor little book, and the poor little author of the book, and the poor little critics who applaud it, have the limited world and vision of the geese in the barnyard, and the barnyard gates are their horizon, and so the emotions and experiences of Mrs. Hen are very important. These seekers after thought and culture, with their literature, art, sociology, and Bohemian and Bolshevistic groups, are painfully myopic, and it is no wonder they resort to any morbidness or eccentricity to get out of the groove of their little circle. Take them up into a mountain and show them the stars; transport them to the depths of the earth, and let them see the secrets of eternity; and they shall lose interest in Chinese lanterns and salad dressings, and theories of communism, labor and privation discussed in fat luxury, as the means of culture and progress.

What we need next, then, is the literary geologist, who shall translate the wonders and poetry of the world's history into the vernacular, and let the hungry crowd see a solid substantial picture of the workings of the Infinite. In literature we remember only one outstanding union of geology and poetry, and that is a few verses in Tennyson's "In Memoriam." But in general, when it comes to interpretation of the mysteries, geologists are poor fish. They are bad business men; as the current phrase goes, they have absolutely failed to "sell the idea." They are pedantic and longwinded, full of strange terms to hide what thoughts they may have from the uninitiated; and the result is that they walk in a walled aisle, as secure from public notice as the devotees of Esperanto.

The truths of geology, or the lessons of the rocks, are perhaps the first things that should be imparted, in a scientific scheme of education; and this should be followed by elementary geography. This is the natural preliminary to a consideration of other studies of concrete or historical truths, such as the stories of animals and plants, which should follow. Then would naturally come man; and his physiology; next his history sketched from the earliest geologic record down to the present; next a sketch of his sociology; his forms of government. Next should come mathematics and physics and chemistry; and last of all the elements of grammar and philology, art and literature. Correct speaking of English, and such foreign tongues as may be, should be learned by imitation in early childhood, and the art of reading and the practice of simple arithmetic should accompany the first tales, which will be the primary lessons in rocks, animals, and plants.

Yet we find that this natural rock foundation of education and culture is floating high above it, in the air; geology is not taught at all anywhere below the colleges and not adequately there, and [illegible] as a fundamental branch of knowledge requisite to education.

Therefore, we repeat, we need still another type of geologist—the interpreter and translator. It is most natural, perhaps, that these should come from the ranks of teachers, where indeed this quality is most needed, but is conspicuously scarce. Probably Shaler in our day has been most successful in this, as Hugh Miller and Lyell were in a former generation. The other natural sciences have not been lacking in these interpreters. Conspicuous are wonder-books like Maeterlinck's, "The Bee," and Fabre's "The Spider." Who will write the epic of the subterranean forces?

The Efficiency of Geologist Versus Engineer

THOSE who remember the wonderful organization and attention to detail that characterized the last meeting of the American Institute of Mining and Metallurgical Engineers in the Lake Superior country, and who also attended the annual meeting of the Geological Society of America which was held in Chicago last week, cannot fail to have been struck with the contrast from the point of efficient management or organization. Scarcely any attention, in the latter case, was paid to the arrangement of details for the visiting geologists. Meetings were held in lecture rooms of the University of Chicago, and headquarters were established at the Chicago Beach Hotel, a mile and a half away, with no regular means of communication. The Chicago Beach Hotel is several miles out of the city. With these elementary details stated, visitors shifted for themselves. It is a credit to the hardiness of the geologists that under the circumstances so many of them finally remained for the meetings, but one could not help suspecting that if the weaker ones who must have been lost on the way were added, the attendance would have been considerably swelled. If any specific arrangements, accommodations, facilities, suggestions, or guides were provided except the bare designation of the meeting halls and the headquarters hotel, they did not reach the notice of most of those present.

These things would not be worth mentioning except that the contrast of this vagueness with the precision of the Institute meeting reveals the essential difference in efficiency between the academic type of geologist which is predominantly represented by the Geological Society of America, and the engineer. The academic life and seclusion begets vagueness, absent-mindedness, and what under the circumstances may be a wholesome disregard for time and place as compared with the development of reflective thought. "What was it" sighed the German professor, "that I wanted to remember to do today? I have been trying to recall it all the morning. Ah yes—I made a note to commit suicide today!"

The engineer is a scientist who applies his science to practical problems. The geologist who does this—the economic geologist—becomes an engineer, a geological engineer. In his work and methods there must develop the accuracy, the practical wide-awakeness, the thoroughness of attention to [illegible] and detail, which is bred in all engineers, civil, mechanical, or mining. Not only is this engineering habit of mind thus exhibited in mode of life, but is reflected back on the geological work, which thus becomes sharper, more detailed, more concise, less imaginative, more cautious in the absence of sufficient evidence, more bold in the presence of adequate data leading [illegible] to a certain conclusion.

WHAT OTHERS THINK

Further Thoughts on Slag Losses

May I be privileged to comment in your journal on the very interesting article recently published by Mr. Frank E. Lathe, on copper losses in slags? Mr. Lathe objects to the use of the silver nitrate method of determining suspended globules in slag on the following basis:

1. "That silver nitrate does usually dissolve copper sulphides, but not in all conditions."

Does Mr. Lathe refer to fused sulphide or to unfused minerals? *After fusion*, copper and iron sulphides tend to form a fairly uniform series of combinations ranging from low-grade matte to white metal containing dissolved metallic copper; but on cooling separate into two usual constituents, an iron sulphide saturated with copper sulphide, and a copper sulphide saturated with either iron sulphide or metallic copper. The solubility of copper sulphide in iron sulphide *at solidification* is low, so that the amount of copper dissolved and obviously insoluble in silver nitrate solution is usually negligible in dealing with small total amounts of copper in slags.

The second part of solidified matter is readily dissolved by silver nitrate. The insolubility of certain forms of *mineral* sulphides when dealing with *fused* materials is not a matter of much import.

2. "That the assumption that copper sulphide dissolved in the molten condition will not be attacked is not justified, as such sulphide would probably not be equally soluble in the solid slag, and might therefore be found in the latter as small sulphide particles readily soluble."

Does not Mr. Lathe here postulate relatively complete segregation and crystallization? It is my impression that the usual laboratory sample is chilled in taking, crystallization greatly increasing the difficulty of grinding and dissolving samples for analysis.

Moreover, inasmuch as the largest *individual* crystal (I do not here refer to segregated groups) may be micrometrically determined to be about the order of magnitude of 1/1,000 to 1/10,000 inch, the even smaller sulphide particles which might separate on cooling would probably be so minute as not to be freed by grinding to 100 or 200 mesh.

3. "That cupric oxide is slightly attacked by silver nitrate," and

4. "That cuprous oxide is readily attacked, though it does not seem to be completely soluble."

Later in his article Mr. Lathe says ". . . that copper oxide need not be expected in slags as a separate constituent. . . ."

Is it meant, then, that dilute neutral silver solution attacks the body of the slag and dissolves its oxide copper, or is Mr. Lathe referring to chemical or mineral oxides in a relatively pure form?

In this connection I would like to quote from my original publication in your journal of May 10, 1919:

"It should be understood that the method involves *no conclusions* as to the *chemical form* of suspended copper, but is an empirical method for determining between the two *physical* forms of suspended and dissolved copper."

5. "That the presence of metallic iron is not detrimental except in consuming more of the reagent."

My experience has been that a neutral silver nitrate solution, when exposed to the action of metallic iron, forms in a short time a precipitate of ferric hydrate which is at least a potential source of copper loss. This could only be redissolved by the use of acids, forming ferric salts capable of dissolving copper forms with considerable ease.

Further, Mr. Lathe bases his rejection largely on evidence as obtained by a modification of the sulphur-dioxide method for oxide copper. I do not intend at this time to enter into a criticism of this method, though a number of my acquaintances have been unable to convince themselves that it is quite all that is claimed. I must suggest, however, that anyone who has been assuming that metallic iron is harmless in this method, try the following simple experiment: To a test tube half full of water add a few drops of copper-sulphate solution, and insert a small clean piece of iron wire. Now pass in sulphur-dioxide gas, and in a very brief period of time a precipitate of *copper sulphide* is formed. (This obscure reaction has been pointed out to me by Mr. Van Arsdale, and, so far as I know, is not usually to be found in textbooks.)

Finally, in respect to analysis, may I ask why Mr. Lathe ". . . although in experiments on this material precautions had to be taken to avoid oxidation by air during filtration . . . " failed to remove magnetite crystals from his slag samples? I think some of your readers who are interested in the wet metallurgy of copper will bear me out in the statement that sulphur dioxide does not always reduce ferric iron with great rapidity, and that it is perfectly possible to have sulphur dioxide and ferric iron in the same solution.

Calculation of gold-copper ratios is at best unsatisfactory, because the very small amount of precious metal present does not permit determinations of great percentage accuracy. Moreover, one can never be sure, inasmuch as matte seems to be at least in some degree attacked by slag constituents, that one is justified in assuming no gain or loss to suspended pellets after leaving the body of the matte.

Mr. Lathe states that metallic copper usually is not found in converter slags in quantities except when overblown. He is right as to the fact, which is at least partly due to the solubility of metallics in the sulphide phase. It is my impression, however, that metallurgists usually consider metallic copper to be an intermediate stage of oxidation between the sulphide and oxide, and is it not rather curious that the matte containing little or no oxide should be a source of oxide copper in the slag without leaving considerable amounts of the intermediate state (copper) which is most assuredly the stable form under the conditions mentioned?

To any one who doubts the preponderating form of copper in converter slags to be sulphide saturated with metallic, I respectfully recommend a peek through the microscope.

CHARLES G. MAIER.

Maplewood, N. J.

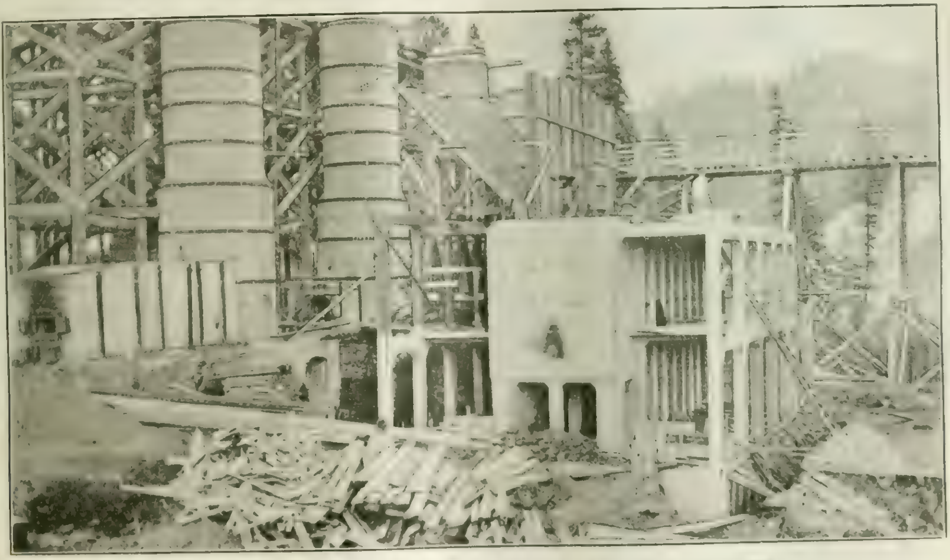
Glory Holes and Magnesite

An Untechnical Account of the Situation in That Mineral—Three Operating Companies in Stevens County, Wash., Supply the Demand of the United States for Dead-Burned Magnesite, in Competition With Imports From Austria From Deposits Owned by One of the Companies

BY RUSSELL ARDEN BANKSON

Written for *Engineering and Mining Journal*

"A GLORY HOLE," a mining engineer once told me, referring to a certain well-known property, "made it possible for us to cut the cost of production in half, and thus continue operations." "And what," I asked, "is a glory hole?" "Think of an ice-cream cone made out of a mountain," was his answer, "and you have a good idea of a glory hole. It is simply a cone-shaped hole cut from the outcrop down to a tunnel beneath. The small end of the funnel touches the underground working. The ore is mined from the sides of the open funnel and dropped downward, where it is discharged into cars and transported to the crushers, a system which reduces the process of mining."



KILNS CONSTRUCTED FOR MANUFACTURE OF PLASTIC MAGNESITE

As it happened, almost the first words I heard when I arrived at the magnesite mines referred to a glory hole. I was informed, however, and discussed the economy resulting from the use of glory holes with intelligence. "What is magnesite?" I asked. That was a fair question, and I received my answer in technical terms something like this: "Magnesite occurs in two forms, the amorphous and the crystalline. Both forms are magnesium carbonate. The raw mineral contains from 90 to 95 per cent of magnesium carbonate, the remainder being calcium carbonate, silica, alumina, ferrous oxide and sometimes a trace of manganese carbonate. The mineral, calcined to a temperature ranging from 1,450 to 1,500 deg. C., and for a sufficient time, loses its carbon dioxide gas, the resultant material being known as dead-burned magnesite, sintered magnesite, "ferromagnesite," and refractory magnesite, or simply as magnesia. In this form it is ready for the trade.

"Dead-burned magnesite is an important refractory, its principal application being in the basic open-hearth steel furnace, although it is used in the metallurgy of copper, lead, and nickel. The hearth of the steel furnace is usually built of magnesia brick with dead-burned grain magnesite spread over it to a thickness of from twelve to eighteen inches, at the center of the furnace. Magnesite brick is also used for the bridge-work of the furnace. Magnesite enters into the production of oxychloride, or sorel cement, from which exterior stucco, flooring, and other structural materials are made; fireproof paint; carbon-dioxide gas; metallic magnesium; magnesium chloride; magnesium sulphate; basic carbonate of magnesia. It is used as a heat insulator for boilers, pipes, and similar articles; as a toilet preparation; with wood pulp for the sulphite process in paper making, and in the making of other minor products."

There are but two important places in the United States where this mineral is found. The deposits of amorphous magnesite in California are difficult to mine and are not especially suited for the refractory trade. Their product supplies the miscellaneous uses, leaving the Washington deposits of crystalline magnesite to meet the demands of the refractory industry in the United States. These deposits of crystalline magnesite are found in a range of hills in Stevens County, in the northeastern part of Washington, fifty to seventy miles north of Spokane and eight to fifteen miles west of Valley and Chewelah.

Prior to the war practically all the magnesite consumed by the steel industry of the United States came from the magnesite mines of Austria, being mined, shipped as ballast, and laid down on the American seaboard at from $15 to $18 per ton. The war stopped this supply, and a hasty scramble for this essential mineral started. A world survey showed seven known magnesite localities. Four of these were eliminated at the outset, because of their location, and two of the remaining three did not supply magnesite suitable for refractory purposes. The seven localities considered were: Austria, having extensive, high-grade deposits, largely American owned and operated, but eliminated because of the war; Greece, Island of Eubœa, seized early in the war by England, to protect her own refractory interests, eliminated for the United States; Manchuria, possessing extensive deposits, American and Japanese owned, little operated, and inaccessible during the war; Venezuela, where there are extensive deposits, American owned, inaccessible during the later part of the war; California deposits, operated as a war emergency for a time for refractory requirements but supplying an unsatisfactory product for this purpose; Quebec, Canada, having limited deposits in the Grenville district, of inferior grade, worked to some extent by American interests, as a war emergency; and Washington, Stevens County, where there were large deposits, of high-grade crystalline magnesite, undeveloped.

Geological Report Basis of American Magnesite Industry

With the results of this survey before them, the refractory interests turned their attention toward the magnesite deposits of Washington at the time America entered the war. They were directed there by F. M. Handy, of Washington State College, who, knowing of a report, made many years before, by Solon Shedd, geologist at State College, and in which the deposits of Stevens County were definitely described as crystalline magnesite, made an exhaustive investigation of the deposits, hurried East, and soon had interested capital for their exploitation.

Two operating companies were promptly in the field. They were followed by numbers of less-important producers. From $18 per ton for the Austrian magnesite, the price began to soar as the demand grew. The price reached $50 per ton, $75, $100, and on until a maximum price of $160 was being paid for the dead-burned ore. Men who had no capital, no knowledge of magnesite, rushed into the hills and began to mine the rock. They hauled it away in wagons, carts, auto trucks—in any way to get it out. They burned it in crude furnaces of their own construction. They paid a premium to kiln owners to burn it for them. They were soon supplying the needs of the United States with from 10,000 to 12,000 tons of dead-burned magnesite a month.

On the day the armistice was signed, Nov. 11, 1918, the price of refractory magnesite dropped, and did not stop until it was cut in half. The day before, it was worth $160 per ton to any user. The day after hostilities ceased it was worth exactly $80 per ton. Three-fourths of the small magnesite producers stopped. The price slumped further, and those remaining quit. There was, however, a normal demand of from 10,000 to 12,000 tons of dead-burned magnesite per month. The first two producing companies organized, one with headquarters at Chewelah and the other with headquarters at Valley, having already invested several million dollars in their plants and in opening their quarries, determined to remain in the field and supply this demand.

In my visit to the magnesite district of Washington, I found that six mines and prospects were being operated for commercial purposes by three well-organized companies, a third company having entered the field since the signing of the armistice. I learned, also, that two of these companies were in competition with the third, the newcomer, on the alleged premise that it was operating as a bluff, and in reality was seeking to discredit the magnesite deposits of Washington, and the United States, to prevent Congress from passing a protective tariff upon magnesite, a life and death matter for its interests. The whole situation hinges on whether cheaply mined, foreign magnesite, especially the American-owned product of Austria, will replace the Washington magnesite, when conditions become settled, and thus relegate to the junk pile several millions of dollars' worth of equipment in Washington and make the deposits temporarily worthless. The executives, mining engineers, and magnesite experts of two of the operating companies declare that the entrance of the foreign product will close them up within a few months unless the protective tariff is authorized by Congress. This cannot possibly take place before 1921 is well advanced. The third company insists that there is no possibility of such a thing happening, because it owns the Austrian mines, and knows.

The controversy is not warfare between local competitive companies. It is not a fight between men over their private interests. It is a struggle to determine whether an existing American industry should jeopardize its future in extending a welcoming hand to a similar industry, American owned, on foreign soil. I found no bitter feelings between the heads of the various companies. They are friendly, but they are determined to hold out for respective principles which each believes is right: encouragement of Americans in developing foreign industries, or protection of American domestic industry.

The market for refractory magnesite is limited. All the advertising space in all the papers and magazines of the country could not make it any larger. There is no competition among the existing companies for business. The present demand is just about equal to their combined output. On the other hand, all the concerns using refractory magnesite must purchase it from one of two sources, either Washington or Austria. It is to the consumer's best interests to purchase refractory magnesite where he can secure it the cheapest. That is the weak link in the chain. Which source will offer the cheapest magnesite in the future?

The three operating companies in Washington are: The American Mineral Production Co., with general offices in Chicago and administrative offices and laboratories at Valley, Wash., near the mines. Howard F. Wierum, of New York, is general executive manager of the company. The company owns a six-mile standard-gage railroad running from Valley up to its mine, the Allen and Moss claims, extensively worked, with about a million tons of magnesite developed, a crusher plant, new kiln, and full equipment for a maximum capacity of 500 tons of crude magnesite a day. This company also owns the Red Marble claim, several miles south.

which has been explored but not extensively worked. The company came into existence through the efforts of Major H. H. Brunt, of the British army, in response to the war emergency. It has 4,500 stockholders, who will lose practically everything they invested should the magnesite mines be forced to close down.

The Northwest Magnesite Co., with general offices in San Francisco and administrative offices at Chewelah. Roy Bishop, of San Francisco, vice-president and general executive manager, maintains headquarters at Chewelah. This company owns a million-dollar dead-burning plant at Chewelah, the largest plant in the United States exclusively for burning magnesite; the Finch mine, the most extensively operated in the Magnesite Hills and containing a million tons; the Keystone and Midnight claims, a few miles south, not yet developed; a five-mile wire-rope tram from the Finch mine to the dead-burning plant; and general equipment which gives it a present capacity of 600 tons of crude magnesite, or 300 tons of the finished product, per day. The company is a close corporation backed by the Crocker National Bank and the Crocker interests, of San Francisco, and R. S. Talbot, of Spokane, Wash.

The American Refractories Co., with general offices in Pittsburgh, Pa., and Western offices at Chewelah, Wash., where A. F. Greaves-Walker, of New York, magnesite expert of the company, is in active charge. This company is the owner and operator of the extensive magnesite deposits of Austria, and ventured into the Washington field after the signing of the armistice. It has taken leases on two extensive magnesite claims, and options on a site for a dead-burning plant at Valley and a right of way for a tram line from the mines to the terminal site, a distance of thirteen miles. The company has erected kilns at its claims and is burning and shipping 1,200 tons of burned magnesite per month to its dead-burning plant at Harper, Ohio, where it is prepared for the trade. This company is a close corporation, and through its officers and directors is closely allied with the United States Steel Corporation and numerous other powerful interests.

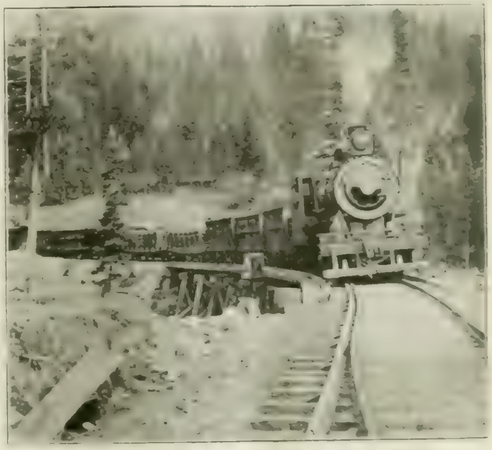
The American Mineral Production Co. and the Northwest Magnesite Co. have no magnesite interests other than the Washington deposits, upon which they depend for existence.

RESUMPTION OF FOREIGN SUPPLY

Soon after the signing of the armistice, small shipments of magnesite began to arrive from Austria, imported by the American Refractories Co. Immediately, the two operating companies in this country took warning, and asked Congress to place a tariff of $[illegible] per ton on foreign magnesite. At this move, the American Refractories Co., which had been operating in Washington only a short time, and which has its heaviest interests in Austria, immediately went before the Senate Finance Committee and protested vigorously against the passage of tariff restrictions. The Senate Finance Committee reported the bill out, but when Congress adjourned in May, 1920, it had failed to act on the measure, and it is still dormant.

Riding up to the mines of the American Mineral Production Co., in the caboose tower of the company's train, I asked Mr. Wierum what his company was going to do if the tariff was not passed. "We have existing contracts which run for some time," he answered. "After that, without a tariff . . ." He paused, glanced out of the tower of the slowly moving train, and looked toward the green valley to the east. "Well, after that the whole works will be junk. The Austrian magnesite will flood the market, at a much cheaper price than we can produce it, and we will be out."

Later, I was talking with Mr. Greaves-Walker, of the Refractories company. "What about the magnesite tariff? Will you close up your tentative operations here and turn your full attention to your extensive Austrian properties if the tariff fails of passage?" I asked him. "Not at all," he answered. "We are here to find magnesite in sufficient quantities to supply our American trade, regardless of our Austrian mines. Under the present unsettled condition in Europe it costs us more to lay Austrian magnesite down to our customers in the United States than it does to mine it here with expensive American labor, haul it thirteen miles in auto trucks over mountain roads, and ship it across the continent to our customers. We are here to find a claim with a million tons of magnesite, and, when we do that, we are ready to spend a million dollars at once in the development of it. We will then erect a dead-burning plant here, construct our trams, and develop the property to capacity."



LOADING OUT MAGNESITE FROM QUARRIES

"Why, then, did you, as representative of your company, go before the Senate Finance Committee, when it was debating the proposed tariff on magnesite, and fight against its adoption?" was my next question. "Was that because you wished to ship increased amounts of magnesite from Austria?"

"My interests are fighting a tariff because it is absurd at this time to consider a tariff. The other two operating refractory companies of this country insisted on a tariff when the magnesite of Washington is in no danger for at least two years, as Europe is in no position to supply the trade for that length of time owing to the unsettled conditions. We are now paying the European laborers in food and clothing which we are buying in the United States at prohibitive prices, and which bring the cost of the Austrian magnesite much higher than that mined out here. Because of this fact, there is no need for a tariff at this time. At the end of two years, if the American industry is threatened, because of improved conditions in Europe, it will then be more than a hypothetical [illegible] for Congress to ask for a tariff on magnesite. It will then be a concrete condition to submit. The Washington mines are getting more business and making more money than ever before in their history, yet these same interests seek a tariff to protect their already safe industry. While we have spent $3,000,000 in Austria, we will spend another million here, regardless of the former investment.

"Figures which I submitted to Congress show that approximately 80 per cent of the magnesite deposits of the world are controlled by Americans. Newspapers, magazines, banks and big business constantly urge Americans to go out into the world and grab trade for America, as the Englishman has done for England. Then when Americans do go out an immediate effort is made to put them out of business by placing a tariff against their imports, which at the same time means much more exporting from the United States.

"Our company was the first to go outside the United States for magnesite. Germany had all the available deposits in Austria and was supplying the needs of the United States refractory plants, on yearly contracts. Each year she was boosting the prices to the United States consumers, until they became prohibitive. Then our company went into Austria, opened up deposits, and began to ship, with the result that by 1908-09, through competition, we had beaten the German prices down to a reasonable figure."

INCREASING IMPORTS OF MAGNESITE

Mr. Wierum had another version of the matter in support of his stand.

"That was all brought to the attention of the Senate Finance Committee at the time it was considering the tariff," he stated. Digging into a pile of reports he showed me figures on recent shipments of magnesite. "When the armistice was signed, 12,000 tons a month of the finished product was being shipped from this district to supply the normal demand of the United States," he pointed out. "At present, shipments from this district are only 8,000 tons per month, whereas the Austrian product has crept up to 4,000 tons per month. Does that look as though we were safe for two years to come? Before the war Austrian magnesite was delivered at Baltimore at $15 per ton. From this district to the eastern market the freight charges alone are $16 per ton. We are only asking that a tariff of $15 a ton be placed on foreign magnesite, to somewhat offset our freight costs, not taking into consideration the fact that it is costing from $21.50 to $25 per ton to manufacture our material. Our figures show that the Austrian magnesite now is being laid down in the United States at about $21 per ton, which, even with the tariff, gives the Austrian mineral the advantage."

"What will become of the claims of the five thousand stockholders of your company if the American magnesite ceases to be of commercial value?" I questioned.

"There is one small hope left. That is the plastic trade. Wait until we go up to the mine and I will show you something."

At the mine I found a scene of activity. Dominating its surroundings was a large, specially designed kiln, practically complete, but yet to be "blown in." "That," he said, "may be our salvation." "It looks like all the other kilns I've seen," I replied. "But it isn't. That kiln is costing this company a considerable sum of money, but we are taking the gambler's chance that it will make us more money. In our laboratories at Valley we have made, during the last year, hundreds of tests upon magnesite—more tests than were ever before made anywhere upon this mineral. The result is that we have discovered the process by which the best grade of plastic magnesite can be developed from the Washington mineral. This necessitated the construction of a specially designed kiln, which will burn the magnesite only to a certain extent.

"There is a growing demand for plastic magnesite, which we hope eventually will consume the capacity output of our plant, making us independent of the refractory trade.

"Available data show that at present there is a consumption of 100 tons of plastic magnesite per day in the United States, and that the demand is growing steadily as the superior qualities of this product become better understood by the building trades. We have reason to anticipate that in a few months the demand will reach 200 tons per day, and that it will keep on climbing. Plastic magnesite cannot be altered by heat, except at temperatures beyond the ordinary requirements, and it is not affected by water, air, or light, and will not expand or contract. A footboard an inch thick, coated with an inch of plastic magnesite and bridged across two benches, can be sprung up and down and the magnesite will not crack or show that it has been disturbed, because of its resisting power and elasticity. In making the plastic magnesite, we take the lumps as they come out of the closely controlled kiln heat and put them through the grinding mills, where they are pulverized to a 200-mesh powder, the same fineness as the best portland cement. The product will then be shipped in boxes, sacks and barrels, in carload lots. During the war the Germans and Austrians used plastic magnesite of this kind in the construction of their pillboxes and gun bases at the front, because of the enduring qualities of the cement and the speed with which it sets. Likewise, the decks of German ships were coated with this material."

On the question of plastic magnesite Mr. Walker, of the American Refractories Co., was reticent. "We are here to supply our customers with ferromagnesite for refractory use," he said. "We have not tested the Washington magnesite for its plastic qualities, and I could not say what the prospect would be."

The Northwest Magnesite Co., according to my information, will not at this time attempt to enter the plastic trade. At present it is enlarging its operations and increasing its output of ferromagnesite.

It is generally conceded that both the American deposits and the Austrian deposits cannot at the same time be drawn on indefinitely to supply the American demand. Normal conditions in Europe will bring about cheaper labor, which will throw cheaper foreign magnesite on the American market. Deductions would seem to make it apparent that either the American magnesite industry or the American-operated magnesite industry in Austria must perish eventually. As matters now stand there are indications that the American magnesite industry needs a great glory hole to cut the cost of its production in two. The question arises: Will the tariff which the exclusively American operating magnesite companies seek be the glory hole which will save the magnesite mines of Washington? But, on the other hand, will American interests drop out of the world trade, such as has given England much of her power, because the America which has urged her citizens to reach out into the world shuts them out with a tariff when that trade is secured?

Depreciation and Obsolescence

A Review of "Bulletin F, Income Tax; Depreciation and Obsolescence; Revenue Act of 1918"*

BY H. B. FERNALD
Written for *Engineering and Mining Journal*

THE TREASURY DEPARTMENT has just published a bulletin on the subject of depreciation and obsolescence, dated Aug. 31, 1920, as indicating "the trend and tendency of official opinion in the Bureau of Internal Revenue in administering the portions of the Revenue Act of 1918 which provide for the deduction from gross income of reasonable allowances for exhaustion, wear and tear, and obsolescence of property used in trade or business."

This gathers into a pamphlet of thirty-six pages the principal Treasury decisions and rulings on this subject, with comment on the purpose and application thereof.

The general spirit of this bulletin is shown by the following extracts:

> **The Bureau does not prescribe rates to be used in computing depreciation and obsolescence, as it would be impracticable to determine rates which would be equally applicable to all property of a general class or character. For this reason no table of rates is published. The rate applicable and the adjustment of any case must depend upon the actual conditions existing in that particular case. (p. 4).**
>
> **Where it can be shown to the satisfaction of the commissioner that the reasonable expectation of the economic life of the oil or gas deposit with which the propery is connected is shorter than the normal useful life of the physical property, the amount annually deductible for depreciation may for such property be based upon the length of life of the deposit. (p. 10.)**
>
> **What the fair market price or value of property was on March 1, 1913, is a question of fact to be established by any evidence which will reasonably or adequately make it appear. (p. 20.)**
>
> **Consideration of the elements entering into depreciation and of the many problems arising therefrom, involves questions of great difficulty, the solution of which does not yield to exact determination in such a manner that precise rules of treatment can be established or theoretical formulæ deduced which can be applied to all cases or even to many. It is considered impracticable to prescribe fixed, definite rates of depreciation which would be allowable for all property of a given class or character. The rate at which property depreciates necessarily depends upon its character, locality, purpose for which used, and the conditions under which it is used. Manufacturing plants in the same locality, doing identically the same kind of business, depreciate at widely different rates, to a large extent dependent upon the management and the fidelity with which repairs are made and the property maintained; but so many other elements enter into the question that even the relative importance of the different factors can be determined only with difficulty and as approximations. The taxpayer should in all cases determine as accurately as possible according to his judgment and experience the rate at which his [illegible] depreciates. The rate used will, however, be subject to the approval of the commissioner.**
>
> **In recognition of these facts, if understatements of taxable net income in returns are due to charging off depreciation in excess of an amount deemed reasonable by the commissioner, negligence or intent to defraud will not be imputed to the taxpayer unless the position taken is so unreasonable as to indicate gross carelessness or bad faith.**
>
> **It is recognized also that property, for example, manufacturing machinery, may be subject to extraordinary depreciation due to being operated overtime, at an overload, or being used for some purpose for which it is not adapted. Under such conditions, a taxpayer may deduct, in addition to the amount measuring the depreciation under normal conditions, a further sum to provide for the extraordinary depreciation. It does not necessarily follow that if a machine, operated normally for eight hours a day, is operated for sixteen hours a day, it will depreciate twice as rapidly as when operated under normal conditions. The estimate of the extraordinary depreciation should be made by the taxpayer according to his judgment and experience, and will be subject to the approval of the commissioner. (p. 26-27.)**
>
> **The capital sum to be replaced by allowances for depreciation should be charged off over the useful life of the property, either in equal annual installments, this plan being generally known as the "fixed percentage" method, or in accordance with any other recognized trade practice, such as apportionment over units of production. Whatever plan or method of apportionment is adopted must be reasonable and should be described in the return. The "fixed percentage" method as applied by the commissioner contemplates that the annual depreciation deductions with respect to any property should be equal; that the rate of depreciation should be assumed to be uniform during the useful life of the property, as compared with the so-called "fractional method—weighted years," "declining balance method—scientific or unscientific," "revaluation method" and "sinking-fund method," the use of which is advocated by accountants, but none of which have been approved in their entirety by the commissioner for income-tax purposes.**
>
> **The only other method which has been approved by the commissioner is an apportionment of the depreciation charges over the total amount of work to be performed or over units of production. (p. 30-31.)**
>
> **Reduction in the value of property due to exhaustion, wear, and tear through use in trade or business is an actual fact, whether or not evidenced by book entries.**
>
> **An allowance for depreciation and obsolescence must, however, be charged off by the taxpayer in his books and records in order to constitute an allowable deduction from gross income. The manner in which it is charged off is not material, except that the amount measuring a reasonable allowance for depreciation must either be deducted directly from the book value of the property or preferably credited to a depreciation reserve account, which should be reflected in the taxpayer's annual balance sheet. The allowance should be computed and charged off with express reference to specific items, units, or groups of property, and taxpayers should keep such records as may be readily verified. (p. 33.)**
>
> **Depreciation Reserves.—Amounts [illegible] on account of depreciation should be credited to a [illegible] and carried as a liability [illegible] to the [illegible] that when the total of these credits [illegible] investment account no further deduction [illegible] will be allowed.**
>
> **While the presumption is that amounts [illegible] to these accounts will be used to make good the [illegible] either through a renewal or replacement [illegible] property or a return of capital, there is no [illegible] of law that the funds represented by these [illegible] shall be**

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*Procurable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at [illegible] per copy.

held intact or remain idle against the day when they may be used in making good the depreciation of the property with respect to which the deduction is claimed or in restoring the capital invested in the depreciated assets.

The conversion of the depreciation reserve into tangible assets will not constitute such a diversion as would deny the taxpayer the right of deduction, provided in all cases that the deduction claimed in the return is reasonable.

A distribution made from a reserve for depreciation will be considered a liquidating dividend and will constitute taxable income to a stockholder only to the extent that the amount so received is in excess of the cost or fair market value as of March 1, 1913, of his shares of stock.

The most casual reading of this bulletin will indicate the great progress toward fairness and equity which it shows as compared with the department's regulations under the original income-tax law; such as the old ruling that a depreciation reserve was allowable only if a cash fund of equivalent amount were retained on hand, or those which endeavored to apply specific rates of depreciation to various classes of buildings and machinery, irrespective of the conditions of their location or use.

To some extent the change in regulations results from the broadening of the allowance for depreciation and obsolescence which was brought about under the 1918 law.

Whether or not the department was ever correct in its ruling that the law applicable to 1917 and prior years limited depreciation only to that resulting "from wear and tear due to the use to which property is put," and practically ignoring the word "exhaustion," which was specifically used in the law, is perhaps not a matter of current interest. The fact was, however, that the regulations of the Treasury Department, whether or not they justly interpreted the law, so greatly restricted the amounts deductible for depreciation on the tax returns that in many cases corporations could only have their accounts fairly and conservatively stated by setting up larger depreciation reserves on their books than the department was disposed to allow.

The rulings of the department under the new law as they appeared in Treasury Regulations 45, in the bulletins issued from time to time, and as finally summarized in the present bulletin, seem now to be such that any corporation can regularly carry fair and adequate depreciation reserves with some assurance that its financial statements and its tax returns can be in accord.

In general, the rulings are sound and can be followed as stated. There is, of course, the inevitable tendency, which arises in making general statements to cover a vast number of different cases and conditions, that some rulings should be laid down in general terms, although they were based on a particular set of circumstances, so that the rule as worded would seem to apply to cases for which is was never really intended. This is a frequent source of friction with regard to the earlier regulations of the department, and though it is inevitable that there should be some cases in which the same criticism might be directed against some of the rulings set forth in Bulletin "F" (e.g., "Obsolescence"—p. 13), they are practically counteracted by the very definite statements repeatedly made that depreciation "is an actual fact," that "the rate applicable and the adjustment of any case must depend upon the actual conditions existing in that particular case," and other like explanatory matter.

The fair spirit in which this bulletin is issued is also set forth by the reference (p. 31 [illegible]) to possible adjustment of depreciation rates previously claimed with no evidence that there would be any discrimination against a taxpayer who endeavored fairly and honestly to review his prior practice regarding depreciation and adjust it to accord with the ruling now made by the department.

The comments given in regard to basing depreciation on the value at March 1, 1913 (p. 19) seem of particular interest to lessees. The general statement is made that depreciation charges should "be such as to amount in the aggregate during the life of the depreciating property to the value of that property as a capital asset; and that . . . this capital value should be determined as of March 1, 1913." Although this bulletin is not intended to cover the 1913 and 1916 laws, the line of reasoning here set forth would seem clearly to support the contention that, for leaseholds which had been acquired prior to March 1, 1913, depreciation should be allowed, in 1917 and prior years, on a basis of their 1913 value, rather than on a basis of their original cost.

From many aspects, this is one of the most important bulletins issued by the department, and should receive the widest possible distribution, both among the engineering and the office staffs of all mining companies.

Ontario's Mineral Production

Returns received by the Ontario Department of Mines from the metalliferous mines, smelters, and refining works of the province for the nine months ending Sept. 30, 1920, are tabulated below, and for purposes of comparison the quantities and values are given for the corresponding period in 1919. Tons throughout are short tons of 2,000 lb.

ONTARIO'S METALLIFEROUS PRODUCTION, FIRST NINE MONTHS OF 1920

Product	Quantity 1920	Quantity 1919	Value 1920	Value 1919
Gold, oz	424,297	366,288	$8,735,768	$7,574,586
Silver, oz	7,831,143	7,475,396	8,435,088	7,898,220
Platinum metals, oz	213.75	87.26	13,917	4,981
Nickel (metallic), lb	7,060,078	7,820,866	2,440,303	2,732,676
Nickel oxide, lb	4,886,712	5,700	1,146,768	1,607
Other nickel compounds, lb	159 725	217,135	15,362	22,279
Nickel in matte exported(a), tons	17,446	11,301	8,723,000	5,424,552
Cobalt (metallic), lb	159,151	93,227	373,168	174,782
Cobalt oxide, lb	509,043	321,483	1,015,696	463,916
Other cobalt compounds, lb	1,717	29,491	1,629	18,250
Lead, pig, lb	1,290,726	1,481,204	117,122	54,802
Copper (metallic and sulphate), lb	4,952,413	4,436,101	800,369	756,883
Copper in matte exported(a), tons	9,497	6,818	2,659,160	1,908,936
Iron ore ( ), tons	5,468	5,827	47,120	44,234
Iron, pig (c), tons	49,422	30,849	1,395,948	795,009
Total			$35,920,418	$27,875,713

(a) Copper in matte form was valued at 14c. and nickel at 25c. per lb. in both years. Total matte produced was 44,922 tons, of which 31,800 tons was exported.

( ) Shipments of iron ore totaled 89,931 short tons, valued at $445,355. The figures in the table cover shipments to points other than Ontario blast furnaces.

(c) Total output of pig iron from both domestic and imported ore was 512,559 tons, worth $14,480,794. Figures in the table represent proportional product from Ontario ore.

Although the aggregate production of mines, smelters, and refineries in the Province of Ontario for the nine months ending Sept. 30 shows an increased valuation of over six million dollars as compared with the 1919 figures, developments during the last two months have been such that a proportional increase for the full year cannot be expected. Rainfall was so scanty during the late summer and fall that the power plants supplying Cobalt, Porcupine and Kirkland Lake have been unable to meet the requirements. A power shortage setting in now may be prolonged. Furthermore, the wholesale prices of commodities have declined abruptly, and industry and commerce are feeling the effects of this inevitable aftermath of the war. Labor, however, is becoming more plentiful, and the cost of production is declining. Such circumstances are specially advantageous to the gold-mining industry, which has had to carry on during the war period under difficult conditions.

The Hidachi Copper Smelter

Highest Concrete Stack in the World, Pot Roasting of Fine Copper Ore, and Introduction of Coal Into Blast Furnace Tuyeres by Hand, Chief Features of This Large Japanese Works

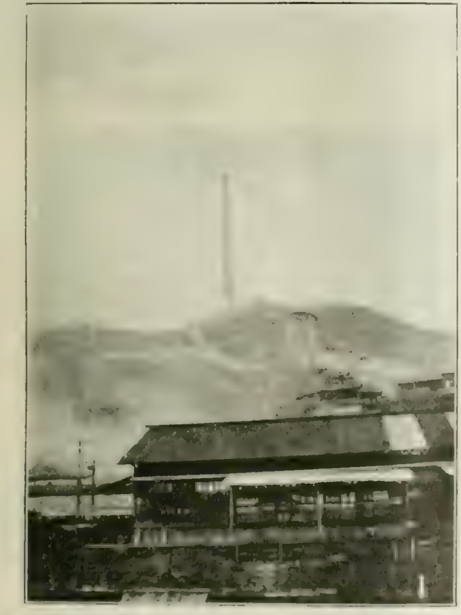
BY CHARLES F. MASON

Written for *Engineering and Mining Journal*

TO MANY American smeltermen the Hidachi copper smelter, at Ibarakiken, Tagagori, Hidachimura, Japan, is known principally as "that Japanese copper smelter where they have the highest concrete stack in the world." It is interesting to learn that this stack was built several years ago, not with the idea of establishing a world's record in chimney construction, nor because its great capacity was really needed from a metallurgical standpoint, but to protect the tobacco which is grown in the vicinity from the effects of the sulphur fumes. The stack rises 550 ft. from its foundation on the top of a hill about 200 ft. above the smelter and 1,220 ft. above the level of the sea, three or four miles away. It stands several hundred yards away from the nearest point of the smelter proper, to which it is connected by a main flue and a number of branches, all of which are built of reinforced concrete. It is said to have a capacity of a million cubic feet of gases per minute. Even with its great height, it is necessary to curtail smelting operations at certain times during the tobacco- and rice-growing season, when the observation stations in the vicinity report the wind in a dangerous quarter.

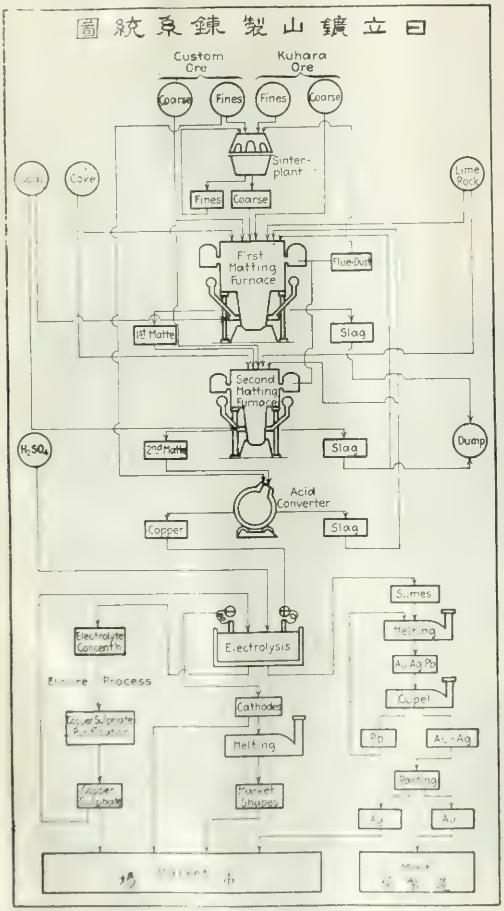
The ores smelted at Hidachi consist of about 70 per cent of cupriferous pyrite from the Hidachi mine (both smelter and mines are owned and operated by the Kuhara company), and about 30 per cent of custom ore, of which one-third is siliceous ore carrying about 3 per cent copper, and two-thirds gold- and silver-bearing quartz, containing about 85 per cent silica. The latter is used for converter flux. As received at the smelter, all of the ores contain about 40 per cent fines, separated by a ¾-in. grizzly.

The green-ore fines and blast-furnace flue dust are sintered together in large cast-iron tapered "pots," with grate bottoms, 12 ft. in diameter and about 4 ft. in depth, having a capacity of sixteen tons per charge. A stand for one of these sintering pots consists merely of a metal ring, set about 4 ft. below the floor level, which makes contact with the lower edge of the pot all around the circumference of the latter when placed upon it. Inside of this ring is an opening which is connected with the blast main, and outside of it is an annular space which is connected to the flue, and thence to the stack. A thirty-ton overhead traveling crane places an empty pot on a stand. Rough straw mats are strewed over the grates in the bottom of the pot and set afire. A sheet-steel hood, shaped like a truncated cone, the diameter of its base being slightly larger than the outside diameter of the annular flue, with inspection doors in the sides



1. VIEW OF THE BIG STACK FROM THE OFFICES. 2. THE BLAST FURNACE PLANT, SHOWING ENDLESS ROPEWAY FROM SINTERING PLANT. 3. SINTERING PLANT

and charging doors in the top, is lowered into place over the whole, and the blast turned on slightly. Then a charge of ore and flue-dust is dumped in by the crane from a five-ton bucket with a bell-hopper bottom, followed, when it is well lighted, by a second and then a third. The average time required for sintering a sixteen-ton charge is about five hours, and the maximum blast pressure is about fifteen ounces.



FLOW SHEET OF THE HIDACHI SMELTER

When the sintering process is complete, the hood is removed and the pot with its charge is carried by the crane to the breaking floor, where the charge is dumped and broken up by an electro-magnetic "skull cracker," the pot being ready for another charge as soon as replaced on a stand. The illustration shown on p. 57 shows the crane carrying a pot with its charge to the breaking floor. The sintered material, after being broken up, is passed over a 1-in. grizzly, where about 20 per cent is removed and reverted to the sintering process, the remainder going to the blast furnaces by means of electric locomotives and an endless ropeway, shown in one of the photographs on p. 55.

There are ten blast furnaces, all 48 in. in width at the tuyères and of lengths as follows: three 15 ft.; three, 20 ft.; two, 24 ft. and two, 40 ft. Only seven of the smaller furnaces are in operation at this time, six for first matting and one for matte concentration. The tonnage smelted varies from 170 tons of ore, for the 15-ft. furnace, to 250 tons, for the larger furnace, per furnace per day. The ore-column in all cases is about 11 ft. high, and a maximum blast pressure of twenty ounces per square inch is used. A 20 per cent copper matte is obtained from the first furnaces, and is concentrated to about 35 per cent in the second. Water-cooled forehearths, of probably fifteen or twenty tons' capacity each, are used, one to each furnace, and the first matte is tapped into the pans of an endless conveyor, to facilitate cooling and breaking up. The first-matting furnaces are situated in parallel positions and charged through side doors in the tops by hand, whereas the matte-concentrating furnaces are end to end and are charged by bottom-dump cars running on a track over their tops. They have side flues, but the charging floor is remarkably free from fumes, thanks to the big stack. The flue dust is about 2.7 per cent of the ore charged.

TYPICAL ANALYSES—HIDACHI SMELTER.
KUHARA MINING CO.

Material	Cu	Pb	Fe	Zn	SiO_2	Al_2O_3	$BaSO_4$	S	CaO	MgO	MnO	CO_2	SO_3
Hidachi No. 1..	2.9	...	28.8	1.8	23.8	6.2	0.8	29.5	0.8	3.4	0.3	....	...
Hidachi No. 2..	3.0	...	30.0	1.9	18.5	6.2	1.2	32.5	0.9	3.9	0.4	....	...
Pyrite cinder	2.9	.	46.6	3.6	11.1	4.0	1.1	7.0	0.9	1.4	0.1	....	4.6
Custom Cu ore	7.3	0.2	13.6	1.2	55.4	5.0	0.4	14.1	0.4	1.4	0.1	0.02	...
Au-Ag flux.....	0.1	...	1.9	0.4	83.8	4.7	...	0.3	0.4	0.4	4.7	0.13	...
Sinter-cake....	3.2	0.2	35.1	1.8	30.7	5.8	1.1	5.5	0.9	2.9	1.0	....	...
First slag......	0.2	...	25.8	1.1	38.0	8.8	0.9	0.8	2.3	3.6	0.6	....	...
Second slag.	0.4	.		.	41.0								
First matte .	20.0			.	.	.							
Second matte .	35.0		.	..	.					.			..
Converter slag.	2.4	...	45.0	...	26.0	...	...	....	...	...	...	....	...

CONVERTER AISLE

The fuel used in the blast furnaces is 7.5 per cent of the ore charged, and consists of one-third coke and two-thirds bituminous coal. The former is charged in the usual way, with the ore and flux, whereas the latter is charged through the tuyères by means of hand-operated plungers working in small cylinders which are introduced through the tuyère caps, as shown in the illustration. The coal is crushed previously to about 1-in. size, and a charge consists of about 7 lb. Needless to say, this method, although showing fuel economy from a metallurgical standpoint, is wasteful of labor, and plans are being made to use pulverized coal instead.

BLAST FURNACE AND SETTLER

The copper recovery in all of the blast furnaces is apparently good, being reported as 90 per cent or better for the entire plant. It will be noticed that the copper content of the first slag, as shown in the table of analyses on p. 56, is 0.2 per cent, and that of the second slag approximately 0.4 per cent. It is only recently that the second slag loss has been brought down to this figure, thereby cutting out a large amount of revert. All blast-furnace slag is granulated in water, drained, and hauled to the dump in electric cars.

Acid-lined converters of the barrel type, 68 in. in diameter and 8 ft. long, receive the 35 per cent matte direct from the small ladle-cars into which the matte-concentrating furnace settlers are tapped. There are six converter stands. The tilting device consists of a vertical hydraulic plunger, operating a rack which engages a gear on the converter trunnion. The converter blast is supplied by a motor-driven turbo-blower at a pressure of 8 lb. per square inch, and each converter has eleven [illegible] in. tuyères, only nine of which are open in a new lining. The slag carries an average of 2.5 per cent copper, and is reverted, cold, to the first-matting furnace. The blister copper is cast into 24 x 30 in. anodes, weighing about 400 lb. each, through a swinging launder, in stationary copper molds arranged in a semicircle and cooled with water jets underneath in the usual manner.

INTERIOR OF SINTERING PLANT, SHOWING [illegible] AND SINTER GOING TO BREAKING FLOOR

I am indebted to Mr. Tokuzumi, metallurgical engineer, and Mr. H. Kajikawa, mechanical engineer, of the Hidachi smelter, for their courteous assistance in securing the information and data presented in this article.

Geologic Explorations for Asbestos

The United States now obtains most of its high-grade, long-fiber asbestos from Canada, but geologists of the U. S. Geological Survey hope that large deposits which will yield material of good quality may yet be found in the Western States, especially in Arizona, where asbestos of unusually long fiber and silky texture has been discovered.

In the Apache and San Carlos Indian reservations, in Arizona, asbestos is found associated with rocks known by geologists as the Apache group, which is made up of several formations. The principal deposits are in the Salt River region, where the Apache group is represented chiefly by beds of quartzite and limestone, which are at many places invaded by diabase, an igneous rock. Throughout this area much diabase has been injected into beds of limestone, and the asbestos is found near the contact of the limestone with the diabase. Places where the limestone has been much broken by the diabase have been particularly favorable for the formation of asbestos. The asbestos is invariably associated with serpentine, a greenish mineral that is in some deposits in other regions mottled like a serpent's skin, and although serpentine occurs at many places without asbestos, serpentine "float" fragments of it that lie loose on the surface, having been washed out from its outcrop, are a valuable aid to the prospector for asbestos. In this region asbestos itself is also generally found as float for a considerable distance below its outcrop.

Metal Production in the United Kingdom For 1919

The following table is taken from the general report of the chief inspector of mines, and gives the official metal production of the United Kingdom and the Isle of Man for the years 1919 and 1918:

SUMMARY OF THE METALS OBTAINABLE BY SMELTING FROM THE ORES IN THE UNITED KINGDOM, 1918–1919

Description of Metal	1918 Quantity	1918 Value at the Average Market Price, Pounds	1919 Quantity	1919 Value at the Average Market Price, Pounds
Aluminum	(a)	(a)	(a)	[illegible]
Antimony, tons	[illegible] 4	338		
Copper, tons	179	22,599	141	14,176
Iron, tons	4,581,772	46,788,732[illegible]	[illegible]	[illegible]
Lead, tons	10,909	328,72[illegible]	[illegible]	[illegible]
Silver, oz	79,645	[illegible]	[illegible]	[illegible]
Tin, tons	3,954	[illegible]	[illegible]	[illegible]
Zinc, tons	3,245	[illegible]	[illegible]	[illegible]
Total values		[illegible]		[illegible]

(a) Information not supplied. [illegible] calculated on the value of pig iron [illegible]

Approximately 75 per cent of the Silica Brick produced in the United States is manufactured in Pennsylvania. The ganister or quartz rock from which the brick is made comes from the vicinity of Mount Union and Hollidaysburg and contains over 94 per cent silica.

Organization of Mine-Surveying Work

System of Maps in Use by Anaconda Copper Mining Co.—Office Work and Method Of Filing—Reports on Detailed Mining Operations—Brief Account of Drainage Layout

BY FRANK L. FISHER

Written for *Engineering and Mining Journal*

A NUMBER of operating companies in Butte were brought together into a compact organization under the name of the Anaconda Copper Mining Co. Functions having to do with the control of operations were consolidated into separate departments which served the individual properties or mines in common. The engineering department may be cited as an example. One of the first important steps undertaken by this department was the establishment of a surface triangulation system which tied all of the individual surveys together. Starting with a base line, points were accurately located by transit in strategical positions relative to the respective properties throughout the district. Between these points courses and distances were determined, and thus the various surveys tied in to the base line. The triangulation points were given either numbers or names. Both triangulation points and the mine shafts were mapped on a scale of 1,400 ft. to one inch. This gave a base map of convenient size.

Many intermediate survey points on the surface were necessary to tie to the system new improvements constantly being made, such as buildings, railroads, shafts, pipe lines, and the like. These necessitated the running of traverses from the nearest triangulation points, frequently at no little distance, each time it became necessary to map a new improvement. Closed traverses tying in these more temporary points to the triangulation were thus established. These were platted on a scale of 600 ft. to one inch. A co-ordinate system was next determined upon. All surveys are considered to be in the northeast quadrant of a circle. Imaginary east-west and north-south co-ordinate base lines are thus established which are sufficiently far south and west of the properties to include within the quadrant all probable lateral expansion of the company's operations.

A working scale of fifty feet to the inch was decided upon, and from the maps platted upon this scale other maps are reduced in scale as needed by means of the pantograph. A unit map, eighteen inches north and south by twenty-four inches east and west, was also adopted. The units are joined by co-ordinate numbers running in series from west to east and south to north, and extending beyond the company's property boundaries. The unit map on the fifty feet to one inch scale includes a distance of 800 ft. north and south and 1,100 ft. east and west. A one-inch border is allowed on the sheet. The surface map shows claim lines and all excavations, shafts, and improvements. Additional sheets are prepared for each level of the underground workings immediately below the limits of the unit surface map. Two-inch squares, each representing one hundred feet on a side, and numbered at each intersection according to the number of hundreds of feet north or east of the co-ordinate base lines, are drawn upon each unit sheet.

An index map on a scale of 1,000 ft. to one inch shows the position of the small unit maps, which are numbered sequentially from west to east and from south to north. Shafts and names of mines are shown upon the index map, so that the number of any particular unit map can be quickly determined and the map taken from the files. Cabinets each holding fifteen shallow drawers, the size of the unit maps, are used to contain the maps. A single drawer contains a surface unit map and all of the levels below the unit surface map, the series of drawers being numbered from top to bottom, and from west to east to correspond to numbers on the index.

Stope books are used to supplement the unit maps which are for vertically separated planes where there are underground workings from one to two hundred feet apart or according to the distance separating the levels. The pages of the stope book are the same in size and ruled similarly to the unit maps. When the book is open, the two pages represent the same surface area as two east and west units. The levels are platted in the stope books according to their elevations, and on the intervening pages the stopes are platted to scale, one floor, representing approximately eight feet vertically, being platted on each double page. The books are also numbered to correspond to the index system and are kept on edge in cases of about the size of those used for the maps. The numbers read down from north to south, and to the right from west to east.

The surveying field books are leather bound, 8½ x 5½ in. in size. They contain eighty double pages, numerically numbered on the right-hand page. Each book is a continuation of the one preceding, for convenience in indexing. The pages are lined from left to right like ordinary letter paper. On the left-hand page, columns are ruled vertically to keep the notes in order. The headings are from left to right: Transit (including back sight and set up); Height of Instrument; Angle Right (always doubled for permanent points to insure against error in reading, or, in some cases where great care is needed, as many as six or more angles read, and entered here, and the average used); Courses, both magnetic and true (the former is noted merely as a check on the turning of the angle, from which the true course is computed); Vertical Angle and Slope Distance; Height of Point (the vertical height of the foresight above the height of instrument, so that the elevation of all points may be recorded as surveyed); and Station to Floor (the distance of the station vertically above the floor, in order that all floor elevations below survey stations may be determined as needed to plan out grades to be used in connecting workings, the platting of longitudinal sections, and similar work). On the right-hand page a column is provided on the left-hand side for horizontal distances. The remainder of the page is ruled in squares for descriptive notes and sketches.

The mines are surveyed monthly and the notes calculated in the office. The calculations are made in books 12 x 8¼ in. in size, containing 100 double pages each. The right-hand page is numbered similarly to the field books, for indexing purposes. The books are made in sets of two, numbered alike, and in each respectively surveyor and assistant go through the same calculations as a check to prevent error. The right-hand page is ruled from left to right and the spaces from top to bottom contain in order: Backsight and Set-Up; Azimuth of the Course from Backsight to Set-Up and Angle Right from this course; Calculated Course and Horizontal Distance; North and East Ordinates; Station Number and Elevation of Survey Station. The left-hand page is blank, and is used for calculations and sketches. After calculations have been made, the field and calculation books are co-indexed, the work is platted into the stope books by reference to both, and from the stope books transferred to the fifty-foot scale level maps. From the level maps the new portion is transferred to the 100 and 200-ft. scale maps by pantograph.

MONTHLY POSTING OF MINE MAPS

Each month the set of mine maps, made on tracing cloth on the 150-ft. scale and kept at each mine, is sent to the office and posted to date by tracing from the office maps. The superintendent and his assistants are provided with sets of leather-bound tracings of the mine workings on a scale of 200 ft. to one inch, which is a convenient size to carry underground with them. These are posted regularly from the 200-ft. scale maps. Upon completion of platting, the notes in field and calculation books are copied into ledgers, numbered and indexed similarly to field and calculation books. A record is thus kept in the office of all finished work. As the field and calculation books become filled, they are indexed and filed in cases for convenient reference.

MEASURING CONTRACT WORK

At present, the contract system is in operation in the mines, and weekly payment to the miners is made on the basis of a fixed price per cubic or linear foot of ground mined or timber placed in position. On Wednesday of each week the engineers measure the work finished in the preceding seven days. Field stope books are used, and sketches made showing the work accomplished in relation to the sill floor work which has been already surveyed. The field stope books are 11½ x 5½ in. in size and contain 100 double pages ruled in one-inch squares, with inter-ruling of from one-eighth to one-sixth inch squares representing square-set timbers in plan.

A sketch is made of the sill floor showing timbers, chutes, and survey stations. From this as a basis, each floor of the stope or raise, above the sill floor, is sketched in accurately, showing timbers, offsets, and outline of the floors. Recently, these books have been supplemented by the use of loose-leaf field books of about the same size, but containing, in addition to the sheets ruled in squares (each square representing in plan a square set, 5 ft., 4 in. on a side), other sheets ruled for the purpose of sketching cross and longitudinal sections which give the height of the regular sets, 7 ft. 10 in., as well as the breadth. This has been found a more convenient method of showing stopes that have irregular or no timbering, as, for example, rill and stull-timbered stopes.

The use of the loose leaf books obviates carrying the permanent field stope books through the workings. As the work represented in them is transferred regularly to the permanent field books, the danger of the loss of sheets containing sketches is minimized. From the sketches and measurements, a weekly report is made in triplicate, one copy for the superintendent, one for the mine foreman, and one to be kept in the engineering office as a record.

The record in the field stope books is platted to scale monthly in the office stope books in proper relation to the surveyed sill-floor work. At the end of each year, all work finished during the year is given a distinctive color. A quick visualization of the approximate time required for certain work is thus possible, as well as the ready finding of the exact date of any particular piece of work from the records.

MONTHLY PROGRESS REPORTS

At the end of each month, a report is made showing the progress in feet and excavation in cubic feet of ore and waste made in each drift, crosscut, raise, shaft, winze, stope, or other working, together with the costs, such as mining, development, and filling, for each vein. This report is permanently recorded in progress books, from which, at the end of the year, an annual report of operations is made and from which the data are obtained for the annual calculation of ore reserves.

From the monthly report a clerical report is also made monthly, in which, under the caption of development, is given footage and cubic feet excavation for crosscuts, shaft sinking, raising, and station cutting; under the caption of drainage, advance and excavation of drifts, crosscuts and sumps; under the caption of mining and breaking ground, stope advance and excavation in sills, and raises in ore; under the caption of mining and breaking ground-filling, advance and excavation in raises, winzes, and drifts in barren veins and waste, and lateral drifts and crosscuts therefrom; under the caption of ventilation, advance and excavation in raises, winzes, drifts, crosscuts and shafts; and under the caption of fire expense, advance and excavation in raises, drifts, and crosscuts. A report is made for each mine annually, and under the caption of veins there is given the advance made in ore and waste, number of stope sets removed, and cubic feet extracted from stopes, drifts, laterals, crosscuts, raises, winzes, and shafts.

ANNUAL CALCULATION OF ORE RESERVES

Ore reserves are calculated annually. To facilitate this computation, longitudinal sections have been made of the workings upon the veins on a scale of 100 ft. to one inch, and they are posted once a year just prior to the calculation of reserves. The sections are drawn on east and west or north and south planes, depending upon whether the course of the vein is more nearly east and west or north and south. The sections are divided into "blocks" or areas of convenient size extending between two levels on the dip of the vein, and on the strike for any convenient length up to three or four hundred feet, depending upon the regularity of the orebody in its course and upon the assays obtained upon samples.

From the assay reports for the drifts and raises which bound the blocks more or less completely, the approximate percentage of copper and zinc contained in the blocks is calculated, together with the average width of ore, due allowance being made where the course of the vein materially departs from the east-west or north-south planes. The contents of the block in cubic feet is then calculated, the percentage of waste deducted, and the remainder divided by ten, the approximate number of cubic feet of ore per ton, this giving tons of ore in that part of the "reserves." The posting of the sections indicates the amount of decrease made in each block by mining during the year, or, in case of new development work, the increase in ore blocked out. By summation and subtraction the "net reserves" resulting from the year's work are given for that horizon upon the vein in question. Summation for all exposed horizons upon all of the veins will determine the total net reserves.

The elevation of the collars of all shafts has been established by accurate leveling from bench marks, in many cases the triangulation points, or, in other instances, apparently permanent points, established at convenient places, where they may be needed in the future for determining elevations. These elevations have been carefully checked to form a primary system of leveling, and are platted on a scale of 1,400 ft. to one inch.

The exact elevations of shaft collars having been established, the elevations of the floors of each level at their intersection with the shafts are determined by measuring down from the respective shaft collars with a steel tape. The underground survey elevations are based upon these results. It is necessary that the elevations be correct, as the properties are in many cases in close proximity and it is desirable from the viewpoint of safety to know exactly at what point workings will connect.

DRAINAGE SYSTEM OF ANACONDA GROUP

Before the consolidation, the various mines were drained through their own shafts, but as they were gradually consolidated into groups and later under one company, a more economical system of drainage was developed. A pumping unit was installed on the 1,200-ft. level of the Leonard mine. The Boston and Montana group, comprising the Mountain View, Pennsylvania, Leonard, West Colusa, and East Colusa mines, was drained by connections made on this level. Similarly, at the High Ore mine, pumps drained the remaining properties. On the 1,800-ft. level of the Boston and Montana group, like connections were made later. The other properties for the most part are drained by the High Ore pumps at various levels.

When the High Ore mine attained a depth of 2,800 ft., a more comprehensive plan of drainage at this level was decided upon for all of the mines. Connections have been made, or will be made as fast as the mines reach the 2,800-ft. level, for drainage through the two systems, one at the High Ore and the other at the Leonard. It is planned to install drainage units at each thousand feet difference in elevation. The drainage crosscuts are driven upon a fall of eight inches per 100 ft., with an additional fall of one foot per 1,000 ft. as a margin of safety.

In addition to the work as outlined in the foregoing, the engineering staff is called upon to plan and supervise all underground development. In the determination of lines and grades to be used in making connections between various workings or in constructing shafts by raising, extremely accurate and painstaking work is essential if time is to be saved and expense minimized. The engineering staff is also a link in the safety-first organization. The first-aid units which the company has organized of late years have become capable and efficient, with the result that there is a low accident ratio when the number of operating properties and men employed is considered. Most of the engineers have qualified in the first-aid course. In fighting fires the engineering staff is called upon to devise methods for expeditiously getting at the source of the trouble as well as to keep operations away from sections which have been temporarily or permanently sealed up on account of fire, in order that work may proceed in the remainder of the property without danger.

Electric Melting Furnaces Used by Mint

One of the changes brought about by the Director of the Mint has been the installation of large-capacity electric melting furnaces in lieu of small gas- and oil-burning furnaces. An electric furnace of 1,000 lb. capacity installed at the Philadelphia Mint demonstrated that it was equal to nearly four gas furnaces, with a fuel saving of about 50 per cent. An additional furnace having a capacity of one ton has been installed at the Philadelphia Mint, and an electric furnace of one-half ton capacity has been installed at the San Francisco Mint. The installation at the Philadelphia Mint of mechanical conveyors for the handling of metal ingots, strips, disks, and coin, in lieu of hand trucking, has brought about a labor saving of 40 to 50 per cent in these processes. Tandem arrangement of six rolling machines brought about a labor saving of 75 per cent in operation.

Analysis of Samples of Ancient Armor

The analysis and microscopical examination of about one dozen samples of ancient armor from the Metropolitan Museum of Art, New York, have been completed by the Bureau of Standards, Washington. The analysis indicates that all the samples were made from very pure wrought iron converted into steel by the old cementation process, as would be expected. The carbon determination was made on the entire cross-section, as the material of all the pieces was too thin and corroded to make it possible to obtain samples from different layers.

The microstructure indicates that the process was very simliar to our wrought-iron process. The metal was then carbonized, probably by a supplementary process, hammered into sheets differing in hardness (i.e., in the amount of carburization), and these sheets were welded together. The whole was then hammered into shape and quenched, thus producing the final hardening effect.

Swedish Iron-Ore Production in 1919

According to the Swedish Board of Trade, the total production of iron ore in Sweden in 1919, including both lump ore and "slig," amounted to 5,040,000 tons, compared with 6,620,000 tons in 1918 and 7,480,000 tons in 1913. Only in the great strike year of 1909 was the total ouput less than in 1919. Of the output, 2,970,000 tons, or 58.79 per cent, was mined in Norbotten. The value of the ore won in 1919 is stated to be 72,630,000 kroner, against 90,860,000 kroner in 1918. The average annual production per miner, which was 633 tons in 1913, declined to 561 tons in 1918 and further to 474 tons in 1919.

Mining Engineers of Note

J. Parke Channing

PROMINENT among the mining engineers of note who have taken an interest in the good of their profession is J. Parke Channing. Mr. Channing, who was born in New York and was graduated in 1883 from the Columbia School of Mines, gained his early experience in the Lake Superior copper and iron districts, where he remained ten years with the exception of about a year spent in Honduras. He was early associated with Frank Klepetko, then mining engineer of the Osceola and Tamarack mines, and was with the Tamarack when its No. 1 vertical shaft—a great undertaking in those days—struck the Calumet lode. While in the copper country he made the suggestion that better instruction should be given in mining in Northern Michigan. From this resulted establishment of the Michigan College of Mines. From the copper country Mr. Channing went to the then new Gogebic iron range and helped explore and develop it. In 1887 Michigan passed a mine inspection act and he was the first mine inspector for Gogebic County, a position which he held for three years. In 1890 he took charge of the East New York iron mine at Ishpeming, Mich., and later was in charge of the explorations for iron ore conducted by a subsidiary of the Chicago, Milwaukee & St. Paul Ry. While at Ishpeming his public spirit again manifested itself, and at his suggestion the Lake Superior Mining Institute was formed, Nelson P. Hulst being the first president and Mr. Channing second. In 1893 he was appointed assistant to the manager of the Calumet & Hecla Mining Co., but his stay there was short. They say that he was too progressive and ahead of his time.

J. PARKE CHANNING

Mr. Channing then went to Montana and was again associated with Frank Klepetko, who was manager of the Boston & Montana, which later on was consolidated with Anaconda. Here he got his first practical experience in copper metallurgy at the B. & M.'s Great Falls works. One of the leading interests in the Boston & Montana was the firm of Lewisohn Brothers and in 1897 Mr. Channing associated himself with them as consulting mining engineer and has been with them ever since. In 1889 the old firm of Lewisohn Brothers, as a result of Mr. Channing's examination and report, took over the properties of the Tennessee Copper Co., which were developed and equipped by him. The technical success of this operation was due to the combination of Lake Superior methods of mining with Montana methods of smelting. After a few years' operation, during which time the ore had been heap-roasted and smelted, Mr. Channing introduced pyritic smelting, based upon the experience of Robert Sticht in Tasmania, and the late W. H. Freeland at the mines of the Ducktown Sulphur, Copper & Iron Co., a neighboring company. Still later he built for the company a large sulphuric acid plant to utilize profitably the fumes from the furnaces. In 1905 Mr. Channing examined and reported upon the properties of the Nevada Consolidated Copper Co., and on the strength of his report large financial interests completed the development and equipment of the Consolidated property. In 1906 Adolph Lewisohn, the surviving partner of the old firm of Lewisohn Brothers, organized the General Development Co., of which Mr. Channing was made vice-president and consulting engineer. Under the latter this company found the Miami mine and later on organized the Miami Copper Co., one of the so-called porphyry properties. It has had an excellent record as a producer of copper, Mr. Channing being its vice-president.

Mr. Channing was one of the founders, in 1908, of the Mining & Metallurgical Society of America, of which organization he was president for the years 1910-1912. In 1914 Columbia University conferred on him the degree of master of science.

In February, 1918, he was elected chairman of Engineering Council, which he held until Dec. 31. Engineering Council was replaced on Jan. 1 by American Engineering Council, of which Herbert Hoover is president and Mr. Channing one of the five vice-presidents. Mr. Channing has particularly interested himself in the human side of engineering and in impressing upon engineers that they are the men on whom devolves the duty of bringing about proper coöperation between capital and labor.

HANDY KNOWLEDGE

Loading Black Powder Into "Gopher Holes"

Written for *Engineering and Mining Journal*

A method of loading "gopher holes" used in one of the large open-pit iron mines in northern Minnesota is shown in the accompanying illustration. The powder is poured directly from the can into a small wooden launder, which is inclined so that the powder will run into the hole. The launder is of sufficient length to reach the end of the hole, so that the explosive may be poured in without leaving a train of powder, and the inner portion of the hole may be filled first. These "gopher holes" are usually 15-in. in diameter and sometimes as much as 25 ft. long. They are dug into the stripping banks by means of long-handled shovels and are usually "sprung" or chambered before the charge of powder is placed. The springing consists of a preliminary blasting with dynamite so that the "gopher hole" is enlarged inside. From five to ten kegs (25 lb.) of black powder are used for the final blasting. This practice of "gopher holing" is used to bring down high banks in the open pits where it is desired to entirely remove the overburden or to break down the bank which might be a menace to the men working below.

LOADING BLACK POWDER INTO "GOPHER HOLES"

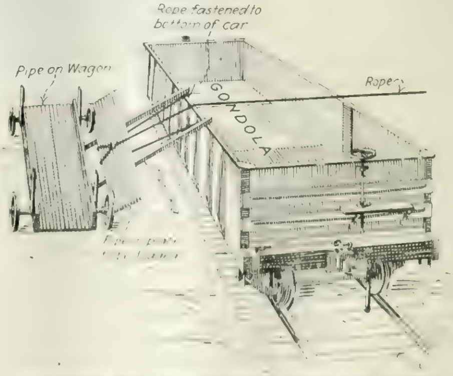
A covered box, provided with a hopper bottom and fastened to one end of a closed launder, is sometimes used for the same purpose. The powder is poured directly into the hopper, the cover shut, and a plug closing the bottom of the hopper is removed by a cord through the cover, permitting the powder to run out. The launder is then given an oscillating motion, so that the powder will run into the hole. This contrivance is safer than the launder previously described, as it is possible to protect the powder from the danger of flying sparks.

Method of Loading Drill Stem and Casing

Written for *Engineering and Mining Journal*

A simple and rapid method of loading drill stem and casing from wagons or trucks into gondolas is shown in the accompanying illustration. The wagon is drawn up parallel to the railway car and at a convenient distance from it. Two skids are so placed that they extend from beneath the wagon to the top of the near side of the car. Two 20-ft. lengths of casing or stem can be used for skids. Both ends of a stout rope are tied to the bottom of the car on the side nearest the wagon and at points directly under the upper ends of the skids. The rope is then passed up the inside of the car and out to the wagon in such a fashion that it forms a "V" with the apex at the wagon.

Several pieces of pipe are then laid together across the skids, and the center of the rope is passed under all of them and back over the top. A chain, or another piece of rope, is fastened to the apex of the rope loop with a hook, and then passed over the car to a doubletree on the opposite side of the car from the wagon. A team of horses, hitched to the doubletree, is driven straight away from the car, and the shortening rope loop causes the bundle of pipe to roll over and over up the skids until the pipe falls into the car. As the pipe moves up the skids the two sides of the rope "V" slip further out on the pipe and prevent one end of the bundle of pipe from traveling faster than the other end and eventually slipping off the skids. With this arrangement two men and a team can load a considerable quantity of casing in a short time.



MANNER OF LOADING DRILL STEM AND CASING

Punching Holes in Bucket Elevator Belts

By punching holes through the belt for the bolts, the tensile strength is materially reduced. An ingenious method of avoiding this decrease in strength that is worthy of universal adoption is used by one of the large mining companies, according to an article in the *South African Mining and Engineering Journal.* A punch is made from a piece of bar steel a little larger in diameter than the elevator bolts used. One end is tapered down to a sharp point, and the other end is drilled and tapped to suit the thread on the bolts. A bolt is screwed into the threaded end of the punch, which is then driven through the belt and the punch unscrewed from the bolt. In this way none of the warp threads of the fabric are cut, as they are simply pushed aside to make room for the bolts, and the strength of the belt is unimpaired. The method as described is limited in its application to "rubber" belts and fabric belts generally.

Thermit Welding of Cast Iron

In thermit welding, the superheated steel produced by the reaction, when tapped into the mold surrounding the weld, naturally fuses back into the fractured parts two or three inches on either side, and the whole mass, solidifying at one time, effects the repair. The excess metal of the weld may then be removed or not, as the necessity indicates.

In cast-iron welding, steel is the welding medium, and the weld material will, therefore, necessarily consist of a mixture of this steel and the cast iron of the parts being welded. The graphite carbon in the cast iron, therefore, combines with the thermit steel, thus making a high-carbon steel, which usually can be machined only by grinding. This material, however, is not so brittle as cast iron and is physically stronger.

The weld material, being steel, has double the shrinkage of the cast iron. This difference in shrinkage is of no importance where the section welded is approximately square. Where, however, the length of the section at the fracture is four or five times its width, the difference in shrinkage is evidenced by one or more minute cracks perpendicular to the line of the weld and extending through the weld material only. These cracks are caused by the difference in shrinkage, the cast-iron parts tending to restrict the shrinkage of the thermit steel along the length of the piece. Hair-line cracks will be found in the welding of sections such as, for example, 12 in. x 2 in., but would not be found in sections 12 in. x 12 in. The cracks are unimportant, as they are parallel to the line of strain. Extended experience indicates that thermit welds are successful where the length of the fractured section is not in excess of four times its width and where the subsequent machining can be done by grinding rather than by the usual process.

A Crushed Ore Feeder Which Is Economical Of Head Room

By Harold A. Linke

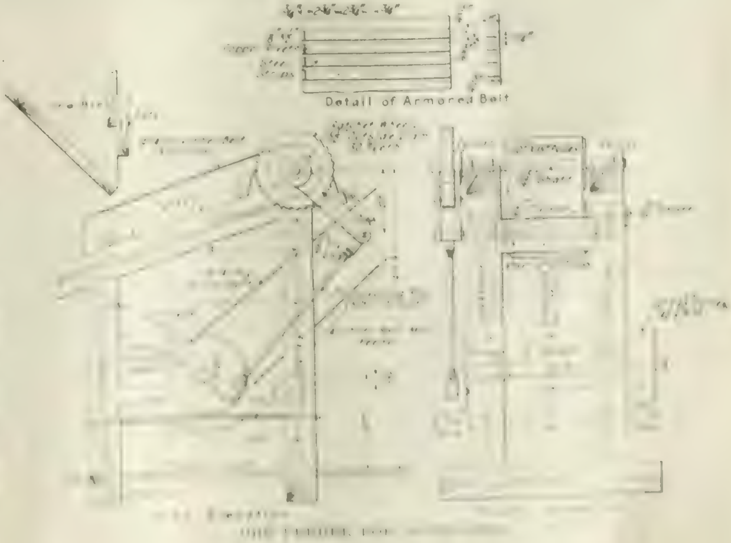
Written for Engineering and Mining Journal

In designing a thirty-ton pilot mill for the A. H. Jones Co., metallurgists, of Salt Lake City, it was necessary to provide for a crushed-ore feeder which would not entail loss of mill head room, which would permit of close regulation, be fool-proof, and less expensive than the regular feeders carried in stock by machinery houses. The sketch herewith presented shows the details of the one designed. Regulation of the feed may be done by adjusting the bin gate or by attaching the connecting rod to different holes in the ratchet wheel arm or crank disk. The feeder belt is inclined at an upward angle and the length between pulleys will depend upon the angle of inclination and the mill heights which it is desired to save.

The material of which this feeder is made is all stock, as follows:

6 common flat boxes, 1$\frac{15}{16}$ in.
12 bolts ½ x 7½ in. for same.
12 ½-in. mal. washers, for same.
1 shaft 1$\frac{15}{16}$ in. x 3 ft. 2 in.; keyseated for 10 x 15 pulley and ratchet wheel.
1 shaft 1$\frac{15}{16}$ in. x 2 ft. 6 in.; keyseated for 10 x 15 pulley.
1 shaft 1$\frac{15}{16}$ in. x 3 ft. 4 in.; keyseated for 14 x 4½-in. pulley and crank disk.
6 split safety collars 1$\frac{15}{16}$ in.
9 ft. 3 in. of 4-ply rubber belt, armored as shown.
2 c.i. solid pulleys 10 x 15 in., 1$\frac{15}{16}$ in. bore.
1 c.i. solid pulley 14 x 4½ in., 1$\frac{15}{16}$ in. bore.
1 ratchet wheel (15½ in. outside diam., 2½ in. plus or minus face), with arm; 1$\frac{15}{16}$ in. bore.
1 crank disk, 15 in. diameter 2 in. plus or minus face; 1$\frac{15}{16}$ in. bore as shown.
1 crank pin $\frac{15}{16}$ in. x 4 in. plus or minus.
1 connecting rod with ends, as shown.
1 pin, $\frac{15}{16}$ in. x 6 in. plus or minus, with washers and keys.
1 pawl, 2 in. x 6 in. x 2½ in. with pin, washers, and keys.
1 pawl, 2 in. x 6 in. x 2½ in. with pin, washers, keys and box.
Armor plates and rivets for belt.

The only special work was the armoring of the belt. The cost, except for the drive belt and timber frame, was $156.94 f.o.b. factory. The weight was 760 lb. Plunger feeders of equal capacity cost $285 and $350, and roll-type feeders, $300.



By the Way

Real Miners Wanted

"Tha need for miners, real miners, m'son, be jus' as gert today as t'were back long we an' in that h'early days," said Cap'n Dick. "I remember back in tha h'eighties one o' tha cow punchers from tha foot'ills came to Grass Valley one h'afternoon an' w'en 'e'd put 'is cattle to pasture an' 'is 'orse in tha livery barn 'e starts forth to see tha town an' celebrate. Didn't seem to make no difference to 'e jus' w'ot 'e ad to drink, so long as t'was wet an' tasty an' strong h'enough. A'for' h'evenin' 'e 'ad grawed noisy an' boisterous. 'Baout nine o'clock a crowd o' we miners wuz standin' in front o' tha bar in Si Rowe's place, 'avin' tha las' glass o' beer a'for' we went 'long 'ome to bed, w"en this 'ere cowboy chap rushed in tha front door an', without sayin' a bloody word, min' you, 'e pulled forth two gert guns from 'is fuzzy pants an' shot away h'all tha lamps 'angin' from tha ceiling. Some o' we chaps, as couldn't get h'out tha back door soon enough, wuz cut h'up a bit with broken glass. By tha time both guns wuz h'empty tha constable h'appeared an' put Mister Cowpuncher in jail. 'E wuz boun' h'over for trial for disturbin' tha peace an' Nick Trebilcock wuz drawed, 'long with h'others, for jury duty. Nick never 'ad served h'on jury before, so 'e figgers this 'ere wuz somewhat o' a honor. Bein' mighty careful o' 'is h'answers to tha questions tha lawyers h'asked 'im, 'e wuz gettin' long fine an' looked sure 'nough like 'e would get h'on that jury. Finally tha prosecutin' lawyer h'asked Nick, ''Ave you h'ever 'ad contact with this man in a business way?' 'No, sir,' sez Nick. 'I've never worked contract with un. W'en I do work contract I 'as a real miner for a pardner, an' no bloody cow puncher like 'im.'"

An Honest Effort

According to reports in the press Senator Ashurst of Arizona had a busy time on Dec. 29 trying to learn whether the President had signed the assessment work bill. He made considerable progress, that is, from one building to another, but late that night he put the job on next day's calendar as unfinished business. No satisfaction was obtained either from Secretary Tumulty or Mrs. Wilson. The Senator's efforts actually took him to the residential section of the White House, somewhat disconcerting the policemen there, who were at a loss as to how far their jurisdiction extended over a Senator constitutionally immune from arrest. The latter's persistence reflected the anxiety of his constituents. This was no way for the President to treat a Senator and of his own party at that, or so thinks Mr. Ashurst.

Iron in Connecticut

A Bridgeport, Conn., paper says that iron ore running 200 lb. to the ton has been discovered in excavating for the foundations of a building on [illegible] Street in that city. The contractors, it is said, however, will not stop work to "permit the development of a mine to pursue the lode." The imagination, fired by this incident, leaps ahead to the time when the higher grade deposits of today are worked out and the efforts of the Mesabi Iron Co. and Replogle Steel to concentrate lean ores shall be ancient history. It may be then that ores running 10 per cent iron will be eagerly sought. The earth's crust has been estimated to contain about 5 per cent iron on the average. Possibly when metallurgy has sufficiently advanced this crust will be indiscriminately mined and shoveled into Somebody's patent disintegrator and the iron separated from the other elements at, of course, a ridiculously low cost. Someone in Bridgeport is evidently thinking in advance of his time.

Dowser Nissley Makes Good

Down in Pennsylvania lives a strong minded people that will not be coaxed out of its old beliefs. Despite the volume of testimony that has been published against the efficiency of "water witching," the people of Ephrata, Pa., are rejoicing over having located two sadly needed wells with the aid of a peach twig in the worthy hands of one "dowser" named Nissley. The following from the *Lancaster Examiner* speaks for itself:

> Ephrata, Dec. 9—The members of Ephrata borough council are as happy today as a bunch of miners that located a gold mine, as they have been successful in locating several good springs that have helped considerably in relieving the water shortage.
>
> During the latter part of the summer Ephrata's water supply had reached such a stage that certain parts of the town were without water for several hours each day. The water situation was under discussion in every nook and corner of the borough, and many were of the opinion that the only way to overcome this shortage would be to build a filter plant and use the water from the Cocalico Creek. This plan was strongly resented by a number of citizens, as they did not care to have Ephrata lose the reputation it has gained far and wide through its pure mountain water, and insisted on drilling wells on the Ephrata ridge.
>
> But where were the wells to be drilled? This was the question that was asked by many and finally answered by resorting to an ancient method of locating underground springs by means of the divining rod or peach twig. A number of citizens curious to know the possibilities of this method, traversed the mountain side with a peach twig and after several interesting experiences agreed that this would be the only logical way of locating a spot where a well might be drilled and be sure of a supply of water. A number of councilmen became interested and soon had a "dowser," as the English call him, on the job in the person of Jonas Nissley, of Salunga. Mr. Nissley located a spot on the Ephrata ridge near the borough pumping station, where a shaft 201½ ft. was sunk by the well drillers, E. G. Meyers & Co., of Salunga. This well was given a hard test and after pumping continuously for 29 hours an average of between 40 and 50 gallons per minute was maintained with no apparent effect on the supply.
>
> So well pleased were the members of the council with their find that it was decided to make another search and drill another well. The services of "Dowser" Nissley were again secured and he located a spot on the Ephrata ridge a short distance from the pumping station. A shaft of about 200 ft. was sunk and after giving this well a 24-hour test on Tuesday and Wednesday, a flow approximately 50 gallons per minute was maintained with no effect on the supply. The possibilities are that a third well will be drilled shortly.
>
> To a number of people this method of locating water may seem like a fairy tale, on a par with consulting the ouija board for certain information. Nevertheless, this method has been in vogue for over 100 years and proven successful in most instances. History on this subject informs us that the hazel twig was successfully used in locating springs after large sums of money had been fruitlessly spent in boring for water.

It would be mean to take the joy out of Ephrata's life by making fun of its peach twig. After all, they found the water and care little about the means employed.

Society of Economic Geologists Holds Meeting In Chicago

Many Interesting Papers Mark First Gathering of New Organization—R. A. F. Penrose, Jr., Discusses Relation of Economic Geology to General Principles of Geology—A Central Bibliography Urged

THE Society of Economic Geologists held its first meeting in Chicago Dec. 28 to 30, with headquarters at the Chicago Beach Hotel. Meetings were held at the University of Chicago. The society, at the invitation of the Geological Society of America, whose meetings were held at the same time and place, affiliated itself with the latter society to the extent of selecting one of its members to serve as one of the vice-presidents of the Geological Society of America.

At the meeting of Tuesday, Dec. 28, in Rosenwald Hall, President R. A. F. Penrose, Jr., read the opening address, on "The Relation of Economic Geology to the General Principles of Geology." According to Mr. Penrose, the term economic geology is used to indicate the application of the general principles of geology, that is, purely philosophic geology, to material uses. Scientific research is possible in both these phases of geology. Research in purely philosophic geology consists in an effort to unveil the as yet undiscovered secrets of the earth; research in applied or economic geology consists of making useful to mankind the various facts that purely philosophic geology has disclosed, but it may even go further and disclose some of these facts itself.

Many geologic phenomena have been utilized by mankind long before their scientific significance was known, he continued. Prehistoric man often lived in caves of immense proportions with no conception of their origin until geology in modern times demonstrated how they were formed. The discovery of water in artesian wells was made centuries before its geologic cause was known; while the discovery of oil in borings was simply a wild venture until some thirty-odd years ago Dr. I. C. White pointed out the geologic structure affecting its accumulation.

PRACTICAL USE OF GEOLOGICAL PHENOMENA NOT RECOGNIZED AT FIRST

On the other hand, stated Mr. Penrose, many geologic phenomena have not been used for practical purposes until long after their discovery and were at first considered only of scientific interest. Thus the careful petrographic study of rocks, developed so wonderfully in recent years, was at first considered a study of only scientific interest, but it has now become of very great importance in deciding the resistance of different rocks to atmospheric and other conditions. If such knowledge had been available in by gone ages many great structures now crumbling in ruins might have been saved for later generations, for they would have been built of different materials. Even in modern times the brown sandstone in some of the magnificent buildings of New York, now crumbling in premature decay, might have been substituted by more durable rocks, and many of our highways, quickly torn to pieces by the automobile, might have been made durable for ages.

Where research in theoretic geology ends and that in economic geology begins is undefinable, in Mr. Penrose's opinion. The work in one is a supplement of that of the other, and no distinctive line can be drawn between them. Both strive for the truth, whether that be simply scientific or economic. Likewise among economic geologists no sharp line can be drawn. Many of the latter devote their time to particular subjects, but they are all geologists and they are all devoting their attention to the application of geology to useful purposes. There should therefore be no distinction between those geologists who devote themselves to iron, copper, oil, clay products, saline deposits, and other metallic or non-metallic materials. The only difference between the oil, the iron, and other economic geologists is in the matter of detail. There has been a disposition of one class or other to assert its superior importance over the others. Such a feeling seems out of place in the broad conception of the grand work of geology applied to the great industries of the world. The workers are all economic geologists; they are all applying their services to special subjects, and any envious distinction as to the special object to which their talents are applied is unworthy of the greatness of their work. No class of economic geologists should vie with another for importance or notoriety, but they should all work together in the great effort for the benefit of industry and mankind.

ATTITUDE OF MINING COMPANIES TOWARD GEOLOGISTS HAS CHANGED

Many can remember when the great mining companies smiled condescendingly at the assertion of geologists that they could be of service to them, Mr. Penrose remarked. The mining companies of those days sought the old prospector, or the so-called old-time miner, for advice, and were often sadly misled. Today all these conditions have changed. Every great mining company or oil company has its corps of geologic experts, often supplied with very elaborate laboratories for purely scientific research in each particular industry. The economic geologist has become indispensable to the mining industry, and many a great mining operation today would either never have been started or would have absolutely collapsed without his expert knowledge. Hence the time is ripe and even more than ripe for the organization of a society such as is now represented by the Society of Economic Geologists. Such a society was advocated by J. E. Spurr at a special meeting which he called during the meeting of the Geological Society in Boston in 1919, and the present Society of Economic Geologists is the direct outgrowth of his suggestion.

"During the recent war many geologists, both economic and pure scientific, offered their services in one way or another entirely to our country, and research departments were largely depleted of their workers," said Mr. Penrose. "With the termination of the war some of the research workers in geology have returned to their old pursuits, but I believe that now more than ever the world is in need of work in geologic research. Cannot the economic geologist increase his assistance in this matter by drawing scientific conclusions from his vast practical experience in commercial work? Business difficulties often prevent this, but in many places these can be honorably overcome. Much work of this kind has already been done, but vastly more can be accomplished. Let the economic geologists be men who discover new constructive ideas as well as use the ideas formulated by others. In the conception of such an ideal I look forward with unwavering confidence in the future for good to mankind and usefulness to science which will be exerted by the Society of Economic Geologists, both as a national and an international organization."

DR. LEITH PLEADS FOR NATIONAL POLICY FOR MINERAL RESOURCES

Following Mr. Penrose's address, Dr. C. K. Leith, of the University of Wisconsin, in a communication to the society, pleaded the necessity of a well-considered and co-ordinated national policy for mineral resources, and stated that this could most understandingly be worked out by economic geologists, who specialized on the distribution and reserves of the metals. The discussion led to the adoption of a motion for the appointment of a committee to consider this problem, and the council of the society subsequently appointed C. K. Leith and J. E. Spurr on this committee.

Dr. Waldemar Lindgren, of the Massachusetts Institute of Technology, gave an interesting talk on "Nickel Sulphides" and the possibility of enrichment of nickel ores, in which he indicated the evidence of the formation of secondary richer nickel sulphides in nature from poorer ones, this enrichment in different cases being accomplished by descending surface waters, as at Sudbury, or by ascending warm waters, as at the Key West mine, in Nevada.

A paper on the "Scientific Byproducts of Applied Geology," by George Otis Smith, director of the U. S. Geological Survey, was read by Philip S. Smith, assistant director. Dr. Smith said:

> Byproduct is a term that suggests large-scale industrial engineering and perhaps even "big business." Byproduct practice carries the complex idea of waste turned into profit, of painstaking engineering converting the raw material into many products, and of persistent salesmanship that finds a market for commodities as varied as dynamite and toilet sets or hams and violin strings. Yet, except in its larger commercial aspect, byproduct practice is not limited to modern times or to large corporate enterprise; conserving the incidental or the "left-over" was also a virtue of our forefathers. The giving of value to the additional or secondary products and their successful disposal with profit to all, however, seems the modern expression of old-fashioned thrift.
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> So while, no doubt, applied geology has always paid its tithes in the form of incidental contributions to the theoretical side of the science, it is probably true that as our geologic efforts have been spread over larger fields, with greater variety of endeavor, these scientific byproducts have come to represent greater values to the world of science. As a large operator in applied geology, the United States Geological Survey would be blind to its opportunity if it failed to utilize these scientific byproducts, and indeed it is to be hoped that this Federal service has caught the commercial [illegible] at least to the extent of [illegible] large [illegible] in byproducts. The other type of [illegible] economic results incidental to research would make a more impressive showing; but that is another story, well worth telling under other auspices.

In the program of geologic work of the United States Geological Survey for the last decade three phases of applied geology stand out prominently—land classification, oil and gas exploration, and the study of mineral reserves both in our own and foreign countries. Each of these phases represents a task laid upon the Survey by a national need, but neither of them at first glance is expected to include research into fundamental principles of the science of geology. In fact, they have all been looked upon as a levy upon the science rather than as an aid to its progress. However, it may be opportune to pause and suggest some of the valuable byproducts of all this work that has absorbed so much of the activities of geologists of high scientific training and attainments. To list all these scientific byproducts, however, would result in a bibliography imposing in both length and quality.

The principal beneficial influence of land classification surveys upon our science has operated through the requirement of quantitative detail and the necessary training for close observation. The geologist trained in this work has through great travail of spirit attained notable accuracy in field methods, which has reacted favorably upon standards of work throughout the field organization.

The results of scientific value incidental to the large expenditures of effort and money in the classification of public coal, phosphate, and oil lands have included the increased interest in stratigraphic problems and the increased attention to structural details, overlooked in broad regional studies, and to variation in sedimentation. It is not too much to say that a large part of the present knowledge of the Cretaceous and early Tertiary stratigraphy and paleontology of the West can be traced directly to the public coal-land work, broadly administered by Campbell. The Laramie question became a live issue; Stanton, Lloyd, and Hares recognized and discussed new problems in the Lance of the northern area, just as Gilmore contributed to the paleontology of the southern area; Lee and others made substantial revisions of the stratigraphic column for the eastern flank of the Rocky Mountains; and far to the north, Hollick's monographic study of the Cretaceous flora of Alaska and Martin's work on the Mesozoic stratigraphy of Alaska, of which the Triassic chapter has been published, are a direct outgrowth of the coal and oil investigations. With these and many other highly scientific contributions in mind, it is not too much to credit the fifteen years devoted so largely to examination of the nation's coal lands with an addition to our geologic knowledge of the West fully comparable with the pioneer results of the similar period of exploration over the same area forty years earlier. The new geologic map of Wyoming now ready for publication is in largest part the result of the activities directed primarily to classifying oil and coal land.

RESULTS OF STRUCTURE STUDY

Less obvious, perhaps, have been the scientific results of the increased attention given to structure, such as the recognition and description of the Bannock overthrust by Richards and Mansfield in mapping phosphate rocks in Idaho or the interpretation of the Hart Mountain overthrust by Hewett as a byproduct of his coal and oil work in Wyoming, although the discovery of this great overthrust is to be credited to Dake. These are displacements on a large scale, but observations of structural details have formed an essential part of the general geologic descriptions by other geologists. A few petrographic contributions have also resulted, such as the discovery of the nepheline basalt on the Fort Hall Indian Reservation by Mansfield and the detailed mapping of the Leucite Hills by Schultz.

The close observation necessary in tracing coal outcrops and in valuing public lands according to the thickness and character of the coal beds has naturally led to intensive study of variation in sedimentation. Thom's work on the Lance and Fort Union sediments, in which the source of sediment deposited in flood-plain swamps is traced by means of microscopic examination, and Hewett's discovery of the persistent presence of bentonite in the Upper Cretaceous series, proving volcanic activity in four states, are important contributions to paleogeographic science—despite the bar sinister.

The observed influence of the oil and gas studies by the Federal geologists has aroused a larger interest in geophysics and in physical chemistry, an influence which shows itself for the most part only indirectly but is none the less of large profit to our science. Here again close attention to structural details is yielding theoretical contributions, but probably the most noteworthy byproduct of the oil and gas work of the United States Geological Survey has been the augmented interest in the petrology of sedimentary rocks. For purposes of correlation and of interpretation of the details of "oil sand" stratigraphy, petrographic methods must be developed and used. Questions of oil genesis, accumulation, and recovery lead to theoretical problems whose solution will deepen our insight into earth processes.

The study of mineral resources stimulated by the war also yielded scientific profits, both subjective and objective. Foremost among these I would place the appreciation of the physiographic relation of manganese oxide deposits to stages of planation and of the fact that degree of rock decay depends more upon physiographic stage than upon climate; and the tracing of deposits of manganese ore disclosed in the Appalachian Valley region a planation stage that had previously received little attention.

The study of the literature of foreign mineral reserves as a part of the American problem of raw material supply has also added to our appreciation of exact statement in geologic reports. The critical reader of scientific literature may even profit by the faults of others, and our geologists who have made largest use of the reports on the ore deposits of the world have acquired the keenest understanding of what standards are needed in geologic work, in both field and office. This intensive study of the commercial side of geology should tend to make our science more exact.

PURE SCIENCE SIMPLY "NOT-YET-APPLIED" SCIENCE

In the course of a discussion at the Baltimore meeting of the Geological Society of America, Dr. Iddings hesitated to characterize pure geology as unapplied geology, and my suggestion was that pure science is simply not-yet-applied science. I believe this descriptive definition stands the test of our experience, and a long list of economic byproducts of pure geology could be cited as proof. One such example of the later application of the results of a purely scientific investigation to everyday use of large value may be mentioned here because it illustrates the final point I wish to make. Alden's glacial studies in Wisconsin, which were continued over a decade and covered about 10,000 square miles, resulted in two professional papers, one bulletin, and one geologic folio, each a contribution of high scientific and educational value. Now, an extensive and intensive program of state highway construction has given to this geologic study a value not anticipated. Measured by the commercial standards of value, Alden's glacial mapping is expected to save the State of Wisconsin in the location of road material at least two and a half times what the geologic work cost the Federal Survey. The economic byproduct thus more than repays the production costs, and any economist can see a large profit in the operation.

The general trend in useful geology is to call for quantitative results, and indeed exactness is more truly scientific than vagueness. Moreover, the testimony of [illegible] is that whatever the purpose of a geologic [illegible], if its execution is thoroughgoing, its methods exact, and its standards high, it will yield byproducts of [illegible]. It is therefore from the best of scientific research that [illegible] byproducts are obtained and it is only from [illegible] well applied that scientific byproducts may be [illegible]. The incidental is not accidental.

The personal element in geologic byproducts [illegible] is not to be overlooked in this brief resume of the [illegible]. Geologists differ in both their telescopic and their microscopic vision, and even more in their catholicity of [illegible]. The field observer whose eyes are open to every [illegible] of geologic phenomena is pre-eminently a byproduct [illegible], whether his primary object is the examination of [illegible] or the correlation of two interglacial formations, he returns with note book and mind enriched with all [illegible] saw, so that the byproducts may eventually outvalue the answer to his original problem. Mr. Gilbert well illustrated the geologist whose researches yielded so great a wealth of products, and in his work the line between pure geology and useful geology was not marked. In that type of geology, broad in scope and accurate in detail, byproducts of high value can always be expected.

EXPERIMENTS ON ACCUMULATION OF OIL IN SANDS DESCRIBED

At the conclusion of Dr. Smith's paper an interesting talk on the "Results of Experimental Work on the Accumulation of Oil in Sands" was given by W. H. Emmons, and George Thiel, of the University of Minnesota. In a series of bent glass tubes, representing anticlinal and other structures, if sand containing a little oil was put together with water, no segregation of the oil took place; but if a very little gas of any kind were introduced, the surface tension of the oil films on the sand grains was affected, and the oil accumulated at the tops of the anticlines. The suggestion was made that artificial pressure in the field might do the same thing, after the ordinary flow of oil was exhausted.

Dr. J. F. Kemp, of Columbia University, described occurrences of metallic ores where copper ores occurred at lower horizons than lead and zinc ores, according to the law which has been so often described. Dr. D. F. Hewett, of the U. S. Geological Survey, discussed the existing bibliographies of economic geology, and argued for a central bibliography under the auspices of the Society of Economic Geologists.

A smoker was held in the evening, in conjunction with the Geological Society of America.

SECOND SESSION ON FOLLOWING DAY

The second session of the Society of Economic Geologists was held at 2 p.m., Wednesday, Dec. 29. A committee was appointed to consider the question of an international bibliography of economic geology, and report to the council, following out the discussion of the subject by Dr. D. F. Hewett on the previous day.

Roswell H. Johnson contributed a thoughtful paper on the "Influence of Spacing of Oil Wells on Acre Yield," in which the necessity for more accurate statistical information, in order to arrive at a tabulation which might be used as a practical guide in deciding as to well-spacing, was pointed out.

Prof. Edson S. Bastin, of the University of Chicago, contributed a paper on the "Origin of the Silver Ores of the Comstock Lode," in which the results of microscopic study of the ores was described. In general, he found quartz, zinc blende, and chalcopyrite somewhat earlier, and galena, argentite and gold somewhat later throughout the ores, although all represented one general period. The point of interest was that the argentite was not derived from the galena, but was contemporaneous with it. This paper aroused considerable discussion, J. E. Spurr pointing out that at Tonopah and also at Aspen, Col., the rich silver sulphides had been found to be primary, and not secondary, as [illegible] conclusions based on the analogy of [illegible] might decide. A question was raised by [illegible] as to the connection of the hot waters on the Comstock and at Tonopah with the [illegible] of the ores, on the source of which Prof. G. D. [illegible] the hot waters of the neighboring Steamboat Springs, now depositing cinnabar, the sulphide of mercury, and other metallic minerals.

THE PETROLEUM INDUSTRY

The Legal Status of Oil-Shale Deposits On the Public Domain

BY JAMES R. JONES*

Written for *Engineering and Mining Journal*

THE provisions of the act of Feb. 25, 1920, so far as they relate to deposits of oil shale, are as follows:

Sec. 21. That the Secretary of the Interior is hereby authorized to lease to any person or corporation qualified under this act any deposits of oil shale belonging to the United States and the surface of so much of the public lands containing such deposits or land adjacent thereto as may be required for the extraction and reduction of the leased minerals, under such rules and regulations, not inconsistent with this act, as he may prescribe; that no lease hereunder shall exceed five thousand one hundred and twenty acres of land, to be described by the legal subdivisions of the public-land surveys, or if unsurveyed, to be surveyed by the United States, at the expense of the applicant, in accordance with regulations to be prescribed by the Secretary of the Interior. Leases may be for indeterminate periods, upon such conditions as may be imposed by the Secretary of the Interior, including covenants relative to methods of mining, prevention of waste, and productive development. For the privilege of mining, extracting and disposing of the oil or other minerals covered by a lease under this section the lessee shall pay to the United States such royalties as shall be specified in the lease and an annual rental, payable at the beginning of each year, at the rate of 50c. per acre per annum, for the lands included in the lease, the rental paid for any one year to be credited against the royalties accruing for that year; such royalties to be subject to readjustment at the end of each twenty-year period by the Secretary of the Interior: Provided, That for the purpose of encouraging the production of petroleum products from shales the secretary may, in his discretion, waive the payment of any royalty and rental during the first five years of any lease: Provided, That any person having a valid claim to such minerals under existing laws on Jan. 1, 1919, shall, upon the relinquishment of such claim, be entitled to a lease under the provisions of this section for such area of the land relinquished as shall not exceed the maximum area authorized by this section to be leased to an individual or corporation: Provided, however, That no claimant for a lease who has been guilty of any fraud or who had knowledge or reasonable grounds to know of any fraud, or who has not acted honestly or in good faith, shall be entitled to any of the benefits of this section: Provided further, That not more than one lease shall be granted under this section to any one person, association, or corporation.

Sec. 29. That any permit, lease, occupation, or use permitted under this act shall reserve to the Secretary of the Interior the right to permit upon such terms as he may determine to be just, for joint or several use, such easements or rights of way, including easements in tunnels upon, through, or in the lands leased, occupied, or used as may be necessary or appropriate to the working of the same, or of other lands containing the deposits described in this act, and the treatment and shipment of the products thereof by or under authority of the Government, its lessees, or permittees, and for other public purposes: Provided, That said secretary, in his discretion, in making any lease under this act, may reserve to the United States the right to lease, sell, or otherwise dispose of the surface of the lands embraced within such lease under existing law or laws hereafter enacted, in so far as said surface is not necessary for use of the lessee in extracting and removing the deposits therein: Provided further, That if such reservation is made it shall be so determined before the offering of such lease: And provided further, That the said secretary, during the life of the lease, is authorized to issue such permits for easements herein provided to be reserved.

Sec. 30. . . . . Each lease shall contain provisions for the purpose of insuring the exercise of reasonable diligence, skill, and care in the operation of said property; a provision that such rules for the safety and welfare of the miners and for the prevention of undue waste as may be prescribed by said secretary shall be observed, including a restriction of the work day to not exceeding eight hours in any one day for underground workers except in cases of emergency; provisions prohibiting the employment of any boy under the age of sixteen or the employment of any girl or woman, without regard to age, in any mine below the surface; provisions securing the workmen complete freedom of purchase; provision requiring the payment of wages at least twice a month in lawful money of the United States, and providing proper rules and regulations to insure the fair and just weighing or measurement of the coal mined by each miner, and such other provisions as he may deem necessary to insure the sale of the production of such leased lands to the United States and to the public at reasonable prices, for the protection of the interests of the United States, for the prevention of monopoly, and for the safeguarding of the public welfare: Provided, That none of such provisions shall be in conflict with the laws of the state in which the leased property is situated.

Sec. 37. That the deposits of coal, phosphate, sodium, oil, oil shale, and gas, herein referred to, in lands valuable for such minerals . . . shall be subject to disposition only in the form and manner provided in this act, except as to valid claims existent at date of passage of this act and thereafter maintained in compliance with the laws under which initiated, which claims may be perfected under such laws, including discovery.

The act does not apply to lands in forest reserves created under the Appalachian Forest Act, approved March 1, 1911; in national parks; in military or naval reservations; or in Indian reservations. Whether it applies to ceded Indian lands depends upon the laws controlling their disposition.

OIL-SHALE CLAIMS LOCATED UNDER LODE LAW SHOULD HAVE MINERAL DISCOVERY

Previously to Feb. 25, 1920, oil-shale deposits were located under the mining law of 1872 with its amendments, and it is probable that a considerable acreage of oil shale has been located and is now being held under that law either as lode or as placer claims. It is important, therefore, that all who are interested, or likely to become interested, in property of this character should keep in mind the salient features of the mining law.

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*[illegible] Law Examiner of the U. S. Bureau of Mines; author of [illegible] mining code of the Dominion [illegible]

One of the requirements of this law is that each claim must be supported by the discovery of mineral. It has been held that a discovery sufficient to justify a miner in the expenditure of further time and labor with the expectation of finding a paying deposit is a sufficient discovery to meet the requirements of the law. What tests as respects discovery will be applied to oil-shale claims where their validity may be brought into question before the Land Office or in the courts cannot be foreshadowed with certainty, but the discovery on which a claim is based should afford reasonable ground for believing that the deposits may be placed on a commercial basis.

It is probable that most oil-shale deposits which have been located under the mining law have been located as placer claims. The size of such claims is limited to twenty acres for one person, and a corporation is considered to be an individual and may not locate a claim in excess of twenty acres, but two or more persons may associate themselves together and take up a claim consisting of twenty acres for each person, with the limitation, however, that no claim may exceed 160 acres, no matter how many persons may be in the association holding it. If an individual or a corporation wishes to locate more than twenty acres of placer ground, more than one claim must be taken up and each claim must be supported by a discovery and $100 worth of annual development work. One discovery will support a claim of 160 acres held by an association of eight persons or more, and requires the performance of only $100 worth of annual development work. It is probably these provisions regarding development work and discovery which have given rise to many of the so-called "dummy" locations of mining claims on public lands; i.e., the use of the names of persons having little or no interest in the matter, with the object of getting them to assign their interest to some person or corporation after the location has been made and thereby giving to the assignee the advantage of a claim consisting of more than twenty acres, and usually of 160 acres, upon which only $100 need be expended during the year. Once the location has been made in good faith by two or more persons, however, they may, having thus established their interests, assign such interests to a single person or to a corporation.

LIMITATIONS ON SIZE OF LODE CLAIMS

Regarding any deposits which may have been located under the lode law, it should be noted that the Federal law limits the size of lode claims to 1,500 ft. along the vein or lode, and to 300 ft. on each side of the middle of the vein at the surface, and this size may be further restricted by state statute or local regulation. The discovery should have been well identified either by means of a shaft at least ten feet deep from the lowest rim, or by an open cut, crosscut or tunnel of the same depth, or an adit at least ten feet in along the lode from the point where the lode may be in any manner discovered. These or similar requirements are contained in the laws of many of the public-land states.

By an act of Congress approved July 17, 1917, the owners of mining claims were relieved from the performance of annual development work for the years 1917 and 1918 and by an act approved Nov. 13, 1919, they were relieved from the performance of such work during the year 1919. Any person who wished to take advantage of these acts, however, was required to place on record in the office where the record of the claim in question was recorded a statement of his intention to hold such claim. Where owners of claims neglected either to perform the necessary work or to file such a statement it would probably be held that the claim lapsed with the approval of the act of Feb. 25, 1920, and could not afterward be revived.

According to an article which appeared in the *Salt Lake Tribune* of Nov. 26, 1920, 2,240 acres of oil-shale deposit in Garfield County, Col., have recently been patented. This is said to be the first deposit for which patent has been obtained. It lies within a Naval Reserve, and a protest was filed by the Navy Department against the application, but the protest was evidently withdrawn without a contest.

NEWS FROM THE OIL FIELDS

Legality of Townsite Drilling in Mexico To Be Tested

From Our Special Correspondent

Drilling has been started in the *funda legal*, or townsite of Zacamixtle. This is a test case well to see whether the government will deem this act legal or not. Much agitation has been shown in the Mexico City papers over this matter, and it is difficult to tell just how it will turn out. It happens that the townsite lies on the line of production through Zacamixtle, and consequently it is a very valuable piece of land.

It is rumored that the Aguila company has brought in a well in the Tempoal Valley, but no details are available as yet, because of lack of communication between this field and Tampico. Much wildcatting is going on in this section of the country, and it is said by several of the well-known geologists of this section to be the next pool in the Mexican oil fields.

Over sixteen million barrels of oil were shipped from Mexican fields during the month of November. The Aguila, [illegible] and Transcontinental companies all shipped over two million barrels each. Island, Texas, Mexican Gulf, Cortez and Cias del Agwi companies all [illegible] upward of a million barrels [illegible].

Buckley Thompson well No. 2 showed [illegible] salt water recently and was [illegible] to one half its initial production. With the passing of this well the [illegible] has only one producing well, [illegible] Nichol's well No. 1. The well of [illegible] & Buchanan is still bridged, and it is doubtful if it will ever produce any oil for the market. The surface of the ground for several hundred yards around is covered with waste oil which flows through the oil saver, and great care has to be taken that this does not [illegible]. The drillers are hard at work on this well, setting forth every effort to break the bridge and bring the well to production.

The Transcontinental Co. had a large gas blowout on its well No. [illegible] on lot 198, Amatlan. The [illegible] of this well is slightly over two thousand feet. It is [illegible] continually and the [illegible] is expected in the near future. A tank site is being [illegible] and the tank will be well under [illegible] before the well comes into production.

The United States Mexican Oil Cor

poration has started development of its properties in Mexico, and it is expected by next June it will be one of the big producers of both Panuco and the lower field crude. An inspection trip of its properties here was made by several of the officials of the company.

Texas Companies Reduce Crude Oil Purchases

From Our Special Correspondent

The Humble Oil & Refining Co. has announced that after Dec. 27 its purchases of crude oil from the central west Texas fields would be reduced 50 per cent. The other 50 per cent normally purchased from pipe-line runs will be stored in the nearest steel storage tanks at the rate af 3c. per bbl. per month according to the regular storage contract. It is stated the company's pipe-line runs in west Texas have been about 31,000 bbl. daily. The Breckenridge Townsite field will be the most affected by this new order. This is on top of 50 per cent and 30 per cent cuts in pipe-line runs in Oklahoma by the Texas Co. and Prairie Pipe-Line Co. respectively.

The Humble Oil & Refining Co. recently completed its No. 3 Robinson well, in the north extension of the West Columbia field, at 3,134 ft. The well came in making 1,500 bbl., of which 5 to 6 per cent was salt water. Several other wells are being drilled in this section north of the Texas Co.'s Abrams lease tract.

At Hull, Liberty County, the Pulp Production Co.'s No. 5 Thomas Fee was completed recently at 2,700 ft. making 2,500 bbl.

Notes From Louisiana Fields

From Our Special Correspondent

One of the largest wells completed recently in northern Louisiana was brought in by the Lee Oil & Refining Co. at Pine Island, Caddo Parish. This is the No. 2 Fee, making 4,000 bbl. from 2,200 ft. The well is in the southwest corner of Sec. 33-21-15.

The Simms Petroleum Co. has purchased the Shaw lease, in the Homer field, from the Western Oil Fields Corporation. The reported price is $250,000.

It is reported that the White Eagle Oil Co. has recently brought in a gusher on Sandy Bayou, on the east side of Ouachita River, sixteen miles south of Columbia, Caldwell Parish.

A rush for oil leases in the Brazeau forest reserve at the foothills west of [illegible], Alberta, recently took place, as the result of which, since Dec. 6, [illegible] from [illegible]. The officials estimate that about 30,000 acres have been filed on, half of which, under the new regulations, is reserved for the Crown. The leading interests represented are the Imperial Oil Co. and the Olphant Munson Collieries.

Commission Finds Wyoming Oil Controlled

The Federal Trade Commission on Jan. 3 sent to the Senate and House of Representatives its report on the petroleum industry of Wyoming, which in abstract is as follows:

"The attention of the commission was drawn to the situation in Wyoming by a complaint regarding certain alleged unsatisfactory conditions in connection with the production and sale of crude petroleum marketed under certain contracts in the Salt Creek, Wyoming, field. It soon became evident that there were monopolistic conditions in the production, pipe-line transportation, refining and wholesale marketing of crude petroleum and its products throughout the entire Rocky Mountain section and the scope of the commission's inquiry was broadened to include such phases of the petroleum business of that section.

"The geographic isolation of the Wyoming oil fields with reference to the prolific Mid-Continent and California field and the absence of pipeline transportation to large consuming centers make it necessary for the producer to sell his crude petroleum to local refining companies. The only refineries outside of the state that purchase Wyoming crude are comparatively small ones which are largely dependent upon this source of supply. These refineries are in Colorado, Utah and the Province of Saskatchewan, Can.

"There is greater concentration in the control of the production of crude petroleum in the Wyoming oil fields than in any other field in the United States. The Midwest refining interests, according to admissions of representatives of both the Standard Oil Co. (Indiana) and of the Midwest Refining Co., are now for all practical purposes under the control of the Standard Oil Co. (Indiana), which together with other Standard Oil companies, now controls the bulk of the crude petroleum produced in Wyoming. This control on the part of the Midwest interests has been largely acquired through long-time contracts which expire Jan. 1, 1934. The Ohio Oil Co., a Standard company, has the largest owned production in the state, and in addition to this controls considerable quantities through working agreements. During the period 1917 to 1919 the Midwest interests controlled from 65 to about 69 per cent of the state's production; the admitted Standard interests controlled from 27 to 29 per cent. Together these two interests controlled from about 93 to 97 per cent of the total production.

"The Wyoming oil fields are so distant from large consuming centers of refined products that no extensive pipe lines have been built to such points, and the different oil fields in the state are so widely separated that the pipe lines do not form a complete system, but consist of comparatively short lines which connect a single field with a refinery or railroad."

Wyoming Well Brought in Following Contract Expiration

From Our Special Correspondent

The Ohio Oil Co. recently brought in a well on the Dixon farm, in the Rock Creek field, flowing 1,000 bbl. per day. Work on this well had been under way for over a year. The Lance Creek Royalties Co., a royalty owner on this land, and the owner of the land have notified the Ohio Oil Co. that the latter's lease has been cancelled on account of alleged violation of its contract in failing to complete the well within the stipulated time limit.

The Elkhorn Oil Co. is now making a good production of oil from its holdings in the Big Muddy field. It has also purchased a lease in the Cat Creek field, in Montana, and will begin drilling soon.

The United States Supreme Court recently dissolved the injunction obtained by the Midland Carbon Co. and the Occidental Oil & Gas Co., restraining the State of Wyoming from imposing the penalties prescribed by the gas conservation laws of the state. These two companies have been operating carbon-black plants near Crowley and in Lovell in violation of the ten-mile proximity statute. The penalty is a fine of $100 to $1,000 for each day of operation.

Kentucky 1920 Production Below That of Previous Year

From Our Special Correspondent

The production of crude oil in Kentucky for 1920 will aggregate 8,750,000 bbl., according to latest estimates. These figures show a falling off of approximately 500,000 bbl. from the 1919 output.

In eastern Kentucky, Johnson County district, Gibson and associates who are drilling an advance test on Paint Creek have a showing of 100 bbl. daily. Several new wells drilled in Magoffin County made from ten to fifteen barrels. Three five-barrel pumpers and one strike making ten barrels are reported from Lawrence County.

The Lee-Estill-Powell-Wolfe districts show a number of moderate strikes. No late completion has been reported above twenty barrels. In southern Kentucky recent completed work was restricted to Wayne County, where two dry holes, two five-barrelers and one ten-barrel pumper were reported.

The western Kentucky district, Warren County, shows two new wells averaging 75 bbl. and a number of smaller strikes. Simpson County reports scattered strikes; one puncture in the Wheat pool is estimated at 40 bbl. Christian County is a new section of western Kentucky that is attracting attention, and a number of tests are now being made.

A report states that Gilbert well No 1, on Brush Creek, Cumberland County, came in and is flowing. It is regarded by oil men who have seen it as one of the best wells that have been developed in that territory.

Book Reviews

Geology of the Non-Metallic Mineral Deposits Other Than Silicates. Vol. I, Principles of Salt Deposition. By Amadeus W. Grabau, S.M., S.D. 6 x 9; pp. 435. McGraw-Hill Book Co., Inc., 1920. Price, $5.

This volume is a geological treatise on certain non-metallic minerals. As the author states in his preface, it may be designated as "a handbook of salt-geology," if we use the term salt in a sufficiently broad sense to include nitrates, borates, phosphates, and similar deposits. Chapters I and II are devoted to the chemistry and mineralogy of these salts, and are naturally chiefly compilations. Chapter III treats of the sea as a source of saline deposits; Chapter IV of the condition of deposition of sea salts in nature; chapters V, VI, and VII, of salts in sea-margin deposits, and deposits from the evaporation of a cut-off portion of the sea. Chapter IX treats of salts of "connate" origin; that is, salts derived from marine sediments which have retained some of the salts of the sea in which they were originally deposited. Chapter X discusses salts leached from older rock-salt deposits, and Chapter XI salts leached from the decomposition products of older rocks, and also the concentration of salts by plants. Chapter XII covers the "playa" or alkali flat deposits of complex salts, like those of Nevada and California; Chapter XIII, the occurrence and origin of nitrate deposits; Chapter XIV, deposits of phosphate of lime; Chapter XV, the salt deposits from mineral springs and volcanic fumaroles. Finally, in separate chapters are treated the "salts" which are secondary or alteration products, as gypsum and dolomite from limestone; the changes of structure and occurrence imposed on salt bodies by earth pressure, including a discussion of the famous "salt domes" such as those of Texas and Louisiana; and the conditions of salt deposition in former geological periods.

There is no doubt that this is a valuable and a scholarly volume, which should be in the library of every geologist; and that it will be a great aid to our comprehension of the origin of the abundant and economically important non-metallic minerals treated. It bears evidence of thorough research, and carries a judicial mode of statement and of balancing various evidence and different points of view. Students of economic geology in the universities, as well, should certainly include this in their reading. The tendency is perhaps to be a trifle detailed in the descriptions and discussions, with possibly too much attention to detail and statistics to be ideal as a textbook; but, when all is said, the size of the volume remains reasonably modest. The discussions of precipitation of salts like lime, manganese, and silica by marine organisms, and of other salts, like soda and potash, by plants, are among the very valuable features. The book would perhaps have been better rounded without the last chapter on the conditions of salt deposition in former geological periods, as this chapter is a trifle hypothetical, but in all it occupies only twelve pages. J. E. S.

Fuel Oil in Industry. By Stephen O. Andros. Cloth; pp. 244; illustrated; 6¾ x 9¼. Chicago. Shaw Publishing Co., 1920. Price, $3.75.

To those unfamiliar with the several uses of fuel oil in industry, the formidable list which appears in the appendix of this book is enlightening. The list includes 85 of the purposes for which fuel oil may be used and indexes the importance which may be attached to this source of energy. The increasing attention paid to liquid fuel makes the book a particularly timely and valuable one, and the manner of presentation is good. The preliminary chapters deal with general facts concerning principles of fuel oil combustion, physical and chemical properties of fuel oil, distribution and storage, heating and pumping. The later chapters cover the application of fuel oil to specific industries such as steam navigation, locomotives, iron and steel, sugar, glass, and ceramics; also its utilization in the heating of buildings and in gas making. Altogether, the subject is presented in readable fashion and will be found most suitable as a reference or text book. D. E. A. C.

MacRae's Blue Book. Cloth, pp. 2,000, 8 x 11. Published by MacRae's Blue Book Co., Chicago. Price, $10.

This is a buying guide containing the names and addresses of 35,000 American manufacturers; the manufacturers of 14,000 classifications of material; an index of trade names of materials with the manufacturers thereof; about 75 pages of miscellaneous tabular matter such as is found in manufacturers' handbooks; and about 150 pages of list prices of materials. The last is a distinguishing feature of this book.

Gypsum—A very complete book of 326 pages has just been issued by the U. S. Geological Survey as *Bulletin* 697; entitled, "Gypsum Deposits of the United States." It takes the place of *Bulletin* 223, published in 1904, and is obtainable from the Superintendent of Documents, Washington, D. C., for 50c. The first forty-five pages are of general interest to those engaged in the industry, being devoted to the mineralogy and geology of gypsum, analyses and methods of analysis, production, methods of mining and milling and uses. The remainder of the book describes the gypsum deposits of the United States in detail by states. The American gypsum production in 1918 was [illegible] short tons, coming mainly from New York, Michigan and Iowa. It is principally used [illegible] as wall plaster, [illegible] and as a retarder in portland cement.

Technical Papers

Copper Converting—A ten-page paper describing the converting practice at the Spassky copper smelter, Akmolinsk, Siberia, appears in the *Bulletin of the Institution of Mining and Metallurgy* for November. Copies of the paper may be obtained from the offices of the Institution, 1 Finsbury Circus, London, E. C. 2, for 1s. There are two 10-ft. Great Falls type, magnesite-lined converters and a 55 per cent matte is treated, requiring slight modifications of ordinary practice.

Mine Surveying—The November issue of *The Anode*, published by the Anaconda Copper Mining Co., Butte, Mont., contains an interesting eight-page article entitled, "Engineering in the Anaconda Copper Mining Company's Mines in Butte." A brief history of the science of mine surveying is given, followed by a discussion of modern methods as used by the Anaconda staff.

Electrolytic Zinc—The Anaconda electrolytic zinc plant at Great Falls, Mont., is the subject of a 55-page paper just published by the American Institute of Mining and Metallurgical Engineers, 29 West 39 St., New York. The paper goes into considerable detail regarding the equipment and process. Another valuable article entitled "Electrolytic Zinc Methods" appeared in the Dec. 4 issue of *Mining & Scientific Press* (420 Market St., San Francisco, Cal.; price, 15c).

Hoisting—"Rational Design of Hoisting Drums" is the title of a paper by Everett O. Waters which appears in the December issue of *Mechanical Engineering*. (29 W. 39 St., New York.) The discussion is confined to the determination of the flange shape and thickness and that of the thickness of the drum body. Several formulae relating to the above are deduced.

Petroleum Research—The U. S. Bureau of Mines, *Reports of Investigations*, Serial [illegible], obtainable on request, is a five-page pamphlet describing the work and aims of the Petroleum Experiment Station at Bartlesville, Okla.

Natural Gas—The forty-four-page section of *Mineral Resources*, 1918, entitled "Natural Gas and Natural Gas Gasoline," has just been published by the U. S. Geological Survey, Washington, D. C. There is no charge.

Refractory Brick—[illegible] for Dec. [illegible] Cleveland, Ohio, [illegible] a three-page article on linings for electric furnaces, in which the properties of the following refractories are discussed: fire clay, silica, magnesite, chrome, bauxite, carborundum, and zirconia.

Asbestos—"Asbestos in South Africa" is the title of a [illegible] report issued by the U. S. Bureau of Mines, Washington, D. C. (*Reports of Investigations*, Serial [illegible]).

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

New York Section of Mining and Metallurgical Society Meets

Mining and Industrial Conditions in Poverty-stricken China Sketched by H. Foster Bain

The New York Section of the Mining and Metallurgical Society of America listened to an interesting address by H. Foster Bain on the evening of Dec. 29. J. A. Church, Jr., presided. The subject was "Problems Fundamental to Mining Enterprise in the Far East." Dr. Bain presented a general review of conditions. Among other things he stated that the Far East is not a rich country. It is poor as compared with Europe and America. Trade must be a give and take. The countries are largely self-contained. A selling campaign necessitates a campaign to increase buying power. Successful development of trade depends on thorough study of local conditions and customs, and primary rather than secondary contact through trading companies. The Chinese do not produce enough mineral to supply their own requirements.

In developing new industries Dr. Bain showed how difficult it would be to induce the working population to change from habitual employments to new ones. The seasonal requirements of the agricultural industry were exceedingly difficult to overcome. Under the existing sociological conditions there is little incentive to individualism and industry must contend with closely knit family groups. In addition, there is the general lack of sanitation and the fact that the climate over considerable areas is a tropical one. European powers that have established themselves in the Far East hold on to what each has for the benefit of its own nationals, and it is a fact that many countries are not freely open to aliens.

The mineral resources of China, according to Dr. Bain, have been overrated. Many of the mines are small and the mining conditions in general are comparable to those which prevail in the southeastern part of the United States. The mineral production is small and is made under unusual transportation and local conditions. Foundries and machine shops are essential parts of mining plants. While the day's pay is small, other factors have to be considered and these in themselves are more important than day's pay. Labor is largely employed under a contract system; workers are indifferent to accuracy, as there is no standardization of local weights and measures; and efficiency is low. Transportation is difficult and costs high. Absence of a common [illegible] for both native and foreign, exchange difficulties, and local customs are matters of no mean moment.

Dr. Bain is of the opinion that the Far East is no place for the shoe-string promoter, but that well organized companies would find it a remunerative field. At the close of the meeting many of the members asked questions and the interest taken in the subject was keen.

E. J. Mehren Addresses A. S. C. E.

Describes Western Europe of Today from the Engineer's Point of View

At the meeting of American Society of Civil Engineers in New York City, on Jan. 5, Edward J. Mehren, editor of *Engineering News-Record*, gave an address on "Europe Today—An Engineer's Impressions." His interesting remarks presented a brief summary of present industrial and political conditions in England, France, Belgium, Holland and Germany. The lantern views presented illustrated engineering works and other features.

Economic Liaison Subcommittee Secures Information on Strategic Materials

As the result of a letter addressed by the Secretary of State to the Secretary of War on Feb. 25, 1919, there was organized the Economic Liaison Committee, the members of which represent the departments of State, Treasury, Navy, Post Office, Interior, Agriculture, Commerce, Labor, and also the Interstate Commerce Commission, Federal Reserve Board, Federal Trade Commission, Shipping Board, War Finance Corporation, Tariff Commission, and Council of National Defense. The object is to aid the foreign trade advisor in helping both State and War departments to secure information that they need.

Late in that year the Economic Liaison Subcommittee on Strategic Materials was created for the purpose of obtaining information in regard to the production possibilities of this country and of other countries with respect to commodities the procurement of which would probably be difficult in the event of war. It is now actively engaged in this work. Concerning the need for such work the Chief of Staff of the Army has the following to say in his latest report:

"In order that the War Department may be prepared to meet any emergency which may arise, it is essential to have on file and ready for immediate use complete data as to the probable requirements of the army and the sources from which these requirements can be met. There has been initiated in the War Department the computation of war requirements based on an assumed military program and an assumed army organization. The compilation of war requirements is a comparatively simple matter and the arrangements already made are such as to insure its being carried to completion as rapidly as authorized personnel will permit.

"The question of ascertaining the sources of supply is a more difficult one. It is a serious error to assume that in the event of war supplies can be obtained from sources which will be ascertained after declaration of war. This was, in fact, what was done in 1917, and the fallacy has been clearly demonstrated. There appear to be two courses open to the War Department.

"The two courses referred to are: (1) For the War Department alone to make a thorough investigation without reference to other Government departments, of all sources of supply of raw materials and manufactured articles. This will involve great expense, will require years of work and much duplication of effort, and when completed will be practically useless, as it will be out of date; (2) to make use of information filed in other Government departments or readily obtained by them. The second method is the one that is being followed.

"Assuming that the probable requirements of the War Department are known and that other Government departments have furnished full information as to the sources of supply available in this country and in other countries, there yet remains one other item of information of vital importance to the War Department which can be obtained in no other way than through other Government departments. This is the requirements of the Navy, Shipping Board, and other Government agencies and of the public. No matter how accurately War Department requirements are known, or how carefully the sources of supply may have been checked, the information will be comparatively useless unless it is known what part of the existing sources of supply will be available for use by the War Department.

"In order that this question may be answered, it will be necessary for all departments to determine their own needs and for some department to determine the needs of the public. The War Department alone cannot obtain the information essential for insuring its own efficient operation in the event of war."

Engineering Council recently sent out a copy of the Final Report of its Committee on Classification and Compensation of Engineers. At its meeting on Dec. 16, 1920, council voted to concur in the recommenations of the committee, and to refer that report to American Engineering Council. Address: 29 West 39th St., New York City.

MEN YOU SHOULD KNOW ABOUT

H FOSTER BAIN

H. Foster Bain, mining engineer, of Washington, D. C., has been nominated by President Wilson to succeed Dr. F. G. Cottrell as Director of the Bureau of Mines.

Mr. Bain was born at Seymour, Ind. After his graduation from Moore's Hill College, Indiana, in 1890, he spent two years at Johns Hopkins University and later received his doctor's degree from the University of Chicago. He was educated and trained as a geologist and mining engineer. He was one of Herbert Hoover's assistants in London on the Belgian relief work during the war. From 1909 to 1915 he was the editor of the *Mining & Scientific Press* of San Francisco, Cal., and later the editor of the *Mining Magazine* of London, England. He made some important mining investigations in south and central Africa and later undertook similar investigations in China. At one time he was a mine operator in Colorado and once was connected with the U. S. Geological Survey. Subsequently, he was the first director of the Geological Survey of Illinois.

The first thing Mr. Bain did after taking his doctor's degree was to obtain employment as a shift boss in a mine with the idea of gaining first hand experience in that phase of practical operation. He took charge of a gold-silver operation known as the Franklin mine in Clear Creek County, Col. The mine labor employed was Italian. Some friction had arisen as to the selection of a night shift boss the first Sunday after Mr. Bain's arrival. The affair had given rise to a serious fistic encounter which kept Mr. Bain busy during his day of rest in negotiations with the keeper of the jail and the physician in charge of the hospital. This was followed a few days later by another ramification of the feud in which work on the property was stopped by a concealed rifleman who amused* himself by making the mine mouth his target. Finally, however, Mr. Bain got things running smoothly as far as open hostilities were concerned, but he learned that mining involves a great deal more than a knowledge of engineering and geology. In fact his first task on that job was to teach the men to use hammer drills, which just were coming into use at that time. The difficulties which he experienced in teaching his Italian workmen to operate the new type of drill is a story in itself.

Mr. Bain claims a connection with the introduction of pajamas into the Far West. With John Finch, he was doing some exploration work on a western Indian reservation. Early one morning a group of American cowboys rode up to their tent and found Finch still clad in his pajamas. It was a new form of dress to them and Mr. Bain immediately was pressed for an explanation of such a strange costume. Fearing that the cowboys might be called upon to show some disapproval of such a type of night apparel, Mr. Bain stated that Mr. Finch was clad in a Hindoo garb, worn during oppressively hot weather. The incident occurred at the height of the summer when that particular section was suffering from great extremes of temperature. It resulted in the immediate dispatch of a mail order to Chicago for a similar "Hindoo" costume for each cowboy in the party.

In addition to Mr. Bain's contact with English mining affairs, during his residence in England as editor of the *Mining Magazine*, he has been engaged in consulting work on the Rand, the Belgian Congo, and other mining regions of Africa. He also has had considerable experience in the Far East. During the two year trip from which he has just returned, he made mining examinations in ten Oriental countries.

Edmund Guggenheim and **E. A. Cappelen Smith** sailed on the "Santa Luisa" on Dec. 29, for Valparaiso, Chile.

George Gray, of the Dome staff at Porcupine, Ont., has been appointed manager of the Associated Goldfields, Larder Lake, Ont.

James M. Platt, mining engineer, of Los Angeles, Cal., is examining mining property in Michoacan, Mex. He will go to Mexico City from there.

Howard K. Welch, manager of the Hardshell mine at Patagonia, Ariz., has returned to the mine after spending several months in New York City on a visit.

R. P. McLaughlin has resigned his position as State Oil and Gas Supervisor for California, and has resumed private practice as petroleum engineer and geologist, with offices in San Francisco, Cal. J. H. Case is temporarily in charge of the supervisor's office.

E. W. Skeats, professor of geology in Melbourne University, Melbourne, Australia, has been spending a few days in Washington, D. C., visiting the technical bureaus there of interest to him. Professor Skeats is on his way back to Australia from a stay in England.

Mark R. Lamb, mining engineer, president of the New York Steel Exchange, sailed Jan. 1, on the "Martha Washington," for South America. Mr. Lamb is making his periodical visit to those South American mines for which he is purchasing engineer in New York.

R. N. Marble, superintendent of the Mahoning mine, at Hibbing, Minn., resigned that position on Jan. 1, 1921, and will be succeeded by **H. S. Wallins**. The new superintendent has had charge of the ore transportation division of the office of the general manager of Great Northern R.R., at Superior, Wis. Before going to Superior, Mr. Wallins had been resident engineer for the Hibbing district of the Great Northern, and formed a wide circle of acquaintances on the Mesabi Range.

SOCIETY MEETINGS ANNOUNCED

The provincial branch of the **Canadian Institute of Mining and Metallurgy** will meet at Vancouver, B. C., Feb. 9, 10 and 11, 1921.

American Electrochemical Society will hold its Spring Meeting at Hotel Chalfonte, Atlantic City, N. J., April 21 to 23, 1921. Plans have already been made, and Dr. Carl Hering, Philadelphia, Pa., is chairman of the committee on arrangements.

The Boston Section of American Society of Mechanical Engineers meets with the **Boston Section of A. I. E. E.** on Jan. 18, 1921. The joint meeting will be addressed by W. S. Murray, chief engineer of the Super Power Survey; his subject will be "The Super Power System."

The Northwest Mining Convention plans to meet at Spokane, Wash., Feb. 28-Mar. 5, 1921. The convention hall and exhibition rooms will be in the Spokane Hotel. Committee headquarters for mail, telegrams and express will be at 415 Chamber of Commerce Building. L. K. Armstrong is chairman, M. E. Poole, secretary, and F. C. Bailey, treasurer, of the committee of control.

OBITUARY

Miguel [illegible] [illegible] in Mexico [illegible] in [illegible] about [illegible] of the [illegible] bankruptcy. He was [illegible] years of age.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

Ottawa Ruling Aids Flin Flon Project

Blister Copper May Be Refined in U. S. —Product Under $10 Per Ton Exempt from Royalty for Ten Years

To facilitate the development of the Flin Flon copper deposit in Manitoba, involving the building of a railway approximately 100 miles long, the erection of a mill and smelting plant at a cost of about $3,000,000, and the development of water-power with 35 miles of transmission line at a cost of not less than $2,000,000, the Canadian government has issued an Order in Council making important changes in the mining regulations as affecting this enterprise. The regulation requiring that all ores shall be treated and refined in Canada is set aside, owing to the cost that would be involved in shipping the blister copper for final treatment to the Trail smelter in British Columbia, and permission is granted to export blister copper, the product of the mill and smelter, for refining for a period of ten years unless in the meantime facilities have been established in Canada for the electrolytic refining of this product as cheaply and efficiently as elsewhere. Under a previous Order in Council dated Dec. 13, 1910, it was provided that no royalties should be charged on the products of copper mining locations up till Jan. 1, 1921. It is now provided that products of the Flin Flon mine, in which the gross recoverable values average less than $10 per ton and which are reduced to blister copper at the mill and smelter, shall be exempted from royalty for ten years from Jan. 1, 1921.

Suit Over Engineer Mine Lost by W. Pollard Grant

Judgment has been given against W. Pollard Grant, a lawyer, of Vancouver, in his suit for a declaration that he holds legal title to a one-fifth interest in the Engineer mine of the Atlin district, B. C. This is a step toward clearing up the estate of the late Captain Alexander so that a transfer of the Atlin property can take place. As soon as a clear title can be delivered it is expected that the Engineer mine will be sold for a substantial figure, that development will be initiated without delay, and that the work will mean much for the advancement of that part of the north country. Captain Alexander went down two years ago when the C. P. R. Princess Sophia sank.

WEEKLY RÉSUMÉ

The assessment work bill providing six months' grace for claim holders was signed by the President on the last day of the year. Announcement has been made of the naming of H. Foster Bain to succeed F. G. Cottrell as Director of the U. S. Bureau of Mines, the latter having resigned to become head of the division of chemistry and chemical technology of the National Research Council. In Minnesota the matter of tonnage tax legislation is again before the state legislature. At Spokane, it has been announced that the Bunker Hill & Sullivan company will erect an electrolytic zinc refinery at Kellogg. In Canada, a movement is under way among operators of British Columbia to have the Dominion Government establish an 80-cent minimum price for Canadian silver. At Cobalt, curtailment of operations is increasing, an abundance of labor being reported everywhere. In Mexico further steps by the government to relieve the mining industry are anticipated.

Manganese Mine in Brazil Sold to U. S. Steel Corporation

A large manganese property in Brazil has been acquired by the U. S. Steel Corporation. When questioned as to the purchase Judge Elbert H. Gary, chairman of the board, said:

"After long negotiations we have purchased the Morro da Mina properties about 300 miles from Rio Janerio, in the State of Minas Geraes, Brazil. This mine contains a very large tonnage of good manganese ore. We are very much pleased with the purchase, as it makes the corporation independent concerning manganese ore, which is an essential in the manufacture of iron and steel. We have been receiving shipments from Morro da Mina for years."

The Steel Corporation has also announced that it will give its employees the privilege to subscribe to the common stock of the company at 81.

Licensing of Engineers Sought in Texas

The El Paso chapter of the American Association of Engineers will urge the passage of a bill through the State Legislature this year which will require the certification, after examination, of all engineers in Texas.

Tonnage Tax Before Minnesota Legislature Again

Commission Divided as to Advisability of Net Profit Tax in Place of Ad Valorem Method

The question of a tonnage tax has again come before the Minnesota Legislature. Years ago there was a tonnage tax but very little ore was mined during its existence of sixteen years. In 1897 this law was repealed due to an opinion of the Attorney-General that it was unconstitutional. Since then iron ore has been taxed on a valuation basis. For many years, however, the question of a tonnage tax has come up annually.

The State Tax Commission has rendered a report to the Governor in which many suggestions are made. The three outstanding recommendations are: That the tax imposed under the law be in lieu of all other taxes on mineral lands; that the taxable value of iron ore for county and local purposes be reduced from 50 to 33⅓ per cent of the true value; and that the method of determining net profits for the purpose of taxation be definitely fixed by law.

The commission is not in entire agreement as to the wisdom at this time of such a change, namely, of substituting a net profit tax on mined iron ore for the present *ad valorem* method, although admitting the feasibility of the plan so far as state taxes are concerned. Any form of double taxation which has been proposed is disapproved, as it would be a super tax and the validity of the same is very questionable. To support this position, it is pointed out that a similar law which tended to levy 2½ per cent of the market value of all anthracite coal mined in Pennsylvania was declared unconstitutional. Another point upholding their position is to the effect that no other state in the Union imposes a double tax on mineral lands unless the license or privilege tax imposed on the output of persons engaged in mining iron ore in Alabama is considered a double tax and in like manner 4½ per cent on the income of corporations engaged in mining in the State of New York, but in this case since other industrial corporations in New York pay this tax there is no discrimination against mineral lands.

A very wise recommendation is made to the effect that this tax problem be settled with reasonable assurance of permanency as it is not only desirable but almost imperative if the state desires to reap full benefit from the great mineral deposits within its bounds. It is pointed out that millions have already been invested in mining and millions more will have to be invested in the future if the immense deposits of low-grade and magnetic ore are to be made merchantable and that it is only fair to prospective investors that methods of taxing and values arising from such investments should be fixed with some assurance of future permanency. The commission also cautions in regard to any increase in the tax burden on lean ores as the result would not only be discouraging but without doubt would stop their future development. The state could well afford to exempt low-grade ores, it holds.

Bunker Hill and Sullivan To Have Electrolytic Zinc Refinery

Company's Smelter Director in Spokane Says Plant Will Be at Kellogg—Also Buys Into Seattle Company

That the Bunker Hill & Sullivan company will erect a million dollar electrolytic zinc refinery at Kellogg, Idaho, and through the purchase of an interest in the Northwest Lead Co., of Seattle, has entered into the manufacture of lead plumbing material, was announced by Frank M. Smith, smelter director of the Bunker Hill & Sullivan company, with offices in the Paulsen building, Spokane, Wash.

"The company has definitely decided to go into the zinc field," said Mr. Smith. "An electrolytic zinc plant is to be built at Kellogg to treat the Star ores, probably using this process. We are making arrrangements with the owners of the Star mine that, when market conditions are favorable, the mine will be operated and the ores treated at the Bunker Hill & Sullivan plant.

"The ore is a complex zinc-lead ore from which two classes of concentrates will be made—lead, which will be treated at the smelter, and zinc, which will be handled by the proposed new electrolytic plant. The initial capacity will be 25 tons of metallic zinc a day, so arranged that the capacity can be increased to 50 tons a day when market conditions warrant. The plant will cost approximately $1,000,000 for the first unit. We are going ahead with the plans so that they will be in readiness for use as early as next year if building costs justify. It will be two years probably before the plant is in operation.

"The Bunker Hill & Sullivan company has bought a substantial interest in the Northwestern Lead Co., of Seattle, a concern manufacturing lead pipe, sheet lead, lead traps, bends and many other lead products for the plumbing trade. This company has been operating for the last two or three years and has used the Bunker Hill & Sullivan pig lead exclusively. Now that the Bunker Hill & Sullivan company has acquired a financial interest in the company, it is proposed to extend its market in the northwest territory."

Mining in Peru in 1920

Copper Production Dropped Somewhat; Silver Increased—Vanadium Exports More Than Double

Special Correspondence

Although the output of Peruvian copper for 1920 will show a material decrease as a result of the world's present subnormal demand, the exports of both silver and vanadium, particularly for the first six months for which figures are available, show a marked increase. During the first half year of 1920 exports of copper bars amounted to 33,574,264 lb. as compared with 42,614.992 lb. for 1919; silver bars 82,340 oz. as compared with 47.332 oz. and 6,444,800 lb. of vanadium ores as compared with 2,688,000 lb. for the first half of 1919.

Cerro de Pasco Copper Corporation's production of copper for 1920, partly estimated, is 52,334 308 lb. as compared with 57 028,288 lb. in 1919 and its maximum output of 71,243,548 lb. in 1917. For 1920 it will have a record production of 5,959,085 oz. of silver as compared with 5,325,321 oz. in 1919. Notwithstanding the present inactivity in the copper market the company is proceeding with the construction of its new 2,500-ton smelter plant at Oroya scheduled to begin operation in 1922. The new cutoff railroad from the company's Morococha mines down to Oroya has just been completed. The company's ore reserves are [illegible] and average 5 per cent copper at Cerro de Pasco and 10 per cent at Morococha or a general average of [illegible] per cent. In addition to the copper ore reserves, 18,800,000 tons of [illegible] silver and silver pyrite ore averaging [illegible] oz. silver per ton have been [illegible] reported by the company's engineers.

The French company at Huaron near Cerro de Pasco has, during the past year been [illegible] and smelting an average of about 100 tons of ore per day yielding [illegible] tons of copper.

[illegible]

its Yauricocha property 450,000 tons of exceptionally high grade ore averaging 16 per cent copper and 2 oz. silver per ton. This development represents not more than 5 per cent of the company's mineralized area. A 100-ton blast furnace is now being installed at Yauricocha and an additional 200-ton smelter purchased which is scheduled for operation by July, 1921. The company has opened numerous drifts and entries at its coal mines in the Jatunhuasi field for large scale production and now has in continuous operation a battery of ten beehive coke ovens with additional ovens under construction. The company's auto-truck road is in operation, with White 5-ton trucks, from the Central Railroad at Pachacayo, 35 miles to the coal mines and coke ovens, and the remaining 20 miles to Yauricocha copper mines will be in operation early in 1921.

Vanadium Corporation of America's property, at Minas Ragra, which has the world's largest deposit of vanadium ore, has been largely extended during the past year, including new hydroelectric and concentrating plants. As noted in a preceding paragraph the output of vanadium for the first half of 1920 more than doubled that of the corresponding period of [illegible] with a reduced output now following the [illegible] in the steel industry.

At Huancavelica, the ancient mercury mines operated extensively in Spanish colonial times have been taken over by a successful Peruvian [illegible]. The old Belen tunnel has been cleaned out a few [illegible] to get under the main ore shoot of the Santa Barbara mine and an experimental furnace erected to determine the best method of treating the ore. The prospect is that this [illegible] may again become a large factor in [illegible] production.

[illegible]

MINAS RAGRA VANADIUM MINE, DEPARTMENT OF JUNIN, PERU. PROPERTY OF VANADIUM CORPORATION OF AMERICA down its operations during the last year owing to lack of adequate transportation and scarcity of labor in that remote section of Peru.

The present activity of the Cerro de Pasco company as well as the Peruvian Copper & Smelting Co. in pushing construction for increased and new plant facilities in the present copper market is believed to be fully justified in view of the opportunity for low cost production. This is made possible by the exceptionally high-grade ores handled and the large supply of native labor available to each of these companies. Under these conditions copper-silver production is likely to be maintained in Peru when the combination of high-priced labor and low-grade ores makes production unprofitable in other countries.

oil is colorless, of aromatic smell, and 65 deg. B. The oil from the latest well is lighter, namely 75 deg. B. This oil is sold just as it flows from the ground for power purposes. It is said to be used in automobiles.

The iron companies operating on the northern and southern coast of the province of Oriente have united under the name of Bethlehem Cuba Iron Mines Co. Ore exported during the year comes exclusievly from the southern coast, whence 518,342 tons averaging 58 per cent iron had been sent to the states up to the first of December. Extensive improvements are reported under progress in the northern coast properties (Mayarí), and it is said that production will be resumed sometime next year.

LLAMAS CARRYING CALCINED VANADIUM ORE, A FORM OF TRANSPORTATION EMPLOYED UNTIL RECENTLY IN PERU BY VANADIUM CORPORATION OF AMERICA

Mining Suffered in Cuba in 1920

Matahambre Sole Producer of Copper and Bueycito of Manganese—Holguin Gold Mines Shut Down

Special Correspondence

Mining activities received a serious setback during 1920. The extraordinary price in sugar, a staple in which nearly all Cuban capital is involved, and the failure of late mining enterprises to make good, have made it quite a task to arouse interest in mining ventures of any kind or to obtain further support for those under way at the present time.

Drilling for oil on a small scale has been carried on in the provinces of Piñar del Río, Habana, Matanzas, and Santa Clara. In the first two no success is reported. In Matanzas, east of the Harbor of Cárdenas, a well driven to a depth of 1,500 ft. in sedimentaries near an igneous contact has encountered oil of 28 deg. Baumé, which will [illegible] to be pumped. In Santa Clara, close to the boundary of Matanzas, drilling [illegible] a small area where natural gas [illegible] from the soil not far from a contact between sedimentaries and an igneous [illegible]. One of the four wells in the place is equipped for pumping, and partial tests so far show a yield of four barrels per hour. The

The Matahambre copper mine has been the sole exporter of copper during the year. Difficulties at the mine and in shipping have curtailed its exports to about 8,000 tons in the first six months of the year. It has been doing better in the second semester, and the manager states that it is now shipping at the rate of 3,000 tons a month. The shipments, consisting of concentrates and ore, average 22 per cent Cu. The concentrating plant of this mine has been doubled during the year, and is now ready to operate at 480 tons per day.

Manganese is being worked only at Bueycito, Oriente, where an American company has been active for several years. Its exports up to Dec. 1 were [illegible]000 tons of 53 per cent Mn ore. It has recently denounced 7,000 hectares of manganiferous and 1,000 hectares of cupriferous ground.

No chrome has been exported, but a certain amount of work has been done at the Cromita and Caledonia mines in the Province of Oriente, as well as the Nueva Union and Providencia claims in the Province of Matanzas.

The gold mines at Holguin, Oriente, shut down in March. Their production in the first two months of the year was [illegible] tons of ore assaying approximately $10 per ton.

Compensation for Injury Must Be Sought Within Year

Application for injury under the Utah compensation law to be effective must be made within a year of the date on which the injury occurred, according to a decision of the Supreme Court written by Justice S. R. Thurman. The decision sets aside an award of $4,500 made by the state industrial commission to Fortunata Parone, widow of Gaetano Parone, formerly an employee of the Utah Consolidated, and killed in July, 1917.

Mexican Government Said To Be Coining Gold

The Mexican Government is said by the New York *Times* to be coining gold, while the coinage of silver has been reduced to a minimum. At the present time the government has 251,000,000 pesos in gold in circulation and 50,000,000 in silver. Although the ratio is five to one the government has practically stopped coining silver, and the mint is busy on gold coins, copper pieces and small change.

Steel Corporation Reported Seeking Coal Land

The U. S. Steel Corporation is said to be negotiating for a huge tract of coal land near Waynesburg, Pa. The amount involved is estimated at $20,000,000. The acquisition of this land will serve to protect the company against future scarcity of fuel.

Indians Start Something New in Arizona

For the first time in the history of the Arizona Surveyor General's office Indians have asked for a survey of mining claims. The property lies on the San Carlos reservation and is claimed by James Stevens, an employee of the Copper Queen smelter at Douglas, and John Case, both full-blood Apaches.

Civil Service Examinations

Metal mining engineer, $4,000 to $4,800; associate metal mining engineer, $3,000 to $4,000; assistant metal-mining engineer, $2,000 to $3,000, and junior metal-mining engineer, $1,500 to $3,000. Open competitive examination for both sexes; men preferred for these positions in Bureau of Mines. Applications received up to and including Jan. 18. Those interested should apply for form 2118 to the Civil Service Commission, Washington, D. C., stating title of examination desired.

Replogle Steel Declines Bid for W. & N. Road

The Replogle Steel Co. is said to have been offered $2,000,000 for the Wharton & Northern R.R., which offer it has turned down. Resumption of operations will depend on the iron and steel market.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Assessment Work Bill Signed on Last Day of Year

Senator Thomas, of Colorado, Discusses Situation From Another Viewpoint —Predicts Total Suspension

The President waited until the last day of the year to sign the bill extending the time in which assessment work on mining claims may be performed. There was some apprehension felt that he might possibly veto the bill, which led Senator Ashurst, of Arizona, to propose that Congress remain in session so that an attempt could be made to pass the bill over the President's veto. The failure of the measure to become a law, Senator Ashurst told the Senate, prior to the signing of the bill, would precipitate protracted litigation and great financial loss among miners and prospectors in the West.

During the discussion in the Senate, Senator Thomas, of Colorado, among other things, said: "There are two sides to this question. I am in receipt of numerous letters and telegrams protesting against the passage of the bill. Many of these communications come from miners who are out of employment. They say that if the law is not suspended, they can make $100 upon each of these claims by performing the work which the statute requires. I shall, therefore, with some philosophy, feel resigned if the President should not approve the measure. Large areas of the public domain are held by men under mining locations who do not patent their claims, because when patented they have to pay taxes upon them. If they can get out of doing the required statutory work by appealing to an easy Congress, which yields to them, why not entirely repeal the law?"

Senator Thomas predicted that the requirement would be suspended later. Senator Ashurst disputed that opinion and expressed himself positively as being of the belief that no exemption from the 1920 work would be allowed.

New Bill Makes Metric System Compulsory

A bill providing for the compulsory use of the metric system as the single standard of weights and measures in the United States has been introduced in the Senate by Senator Frelinghuysen, of New Jersey. The bill was introduced at the request of advocates of the metric system. Senator Frelinghuysen explains that the introduction of the bill by him does not necessarily carry with it any support on his part for the measure, but he sees no reason why the measure should not be introduced so that members of Congress might acquaint themselves with it.

Passage of McFadden Gold Bill Urged by Raker

Describes Discouraging Situation in Gold Camps as Witnessed by Himself

In a speech on the floor of the House, on Dec. 30, Representative Raker, of California, urged the consideration of the McFadden bill at an early date. His remarks were as follows:

"Gold is the only one product in the United States that did not enhance in value or could not enhance in value during the war. Every other product, no matter what it was, raised from 10 to 1,000 per cent. The mining man's material, his labor, his powder, everything raised from 10 to 1,000 per cent.

"From personal observation, in going over a part of Nevada, and practically all the mining territory of California and southern Oregon and southern Idaho this summer I found this to be the true situation. In the mining counties not only in the State of California but in every other state of the Union the last census shows a decrease instead of an increase where it ought to have been an increase had the mining industry been properly provided for and taken care of. There is a bill now before Congress known as H. R. 13,201, and called the McFadden bill. That bill simply authorizes $10 per ounce for gold that is produced after the enactment of the law when the gold is used for mechanical purposes. There is no bill pending in Congress that will do as much for this great interest of this country as that legislation. It simply requires that those who use this gold shall pay a reasonable price for it. They have been getting it at a nominal price, the standard price, but so far as all other charges are concerned—and you may look into every industry that has used gold during the last five years —they have made a raise in their price incommensurate with every other product, while as a matter of fact they pay less for every other product produced.

"Twice in the history of this country has California come to our relief and to the relief of the world in producing gold that we needed to maintain and stabilize our credit. It is no burden upon the government; it is no special privilege granted to anyone; but you have fixed by your law the value of an ounce of gold and provided that it cannot be [illegible] or lowered, so far as the miner who produces it is concerned, in selling it in the market. Think of it, a great product like this, that means so much not only to California and the West but to every State in the Union and to the Federal Government."

H. Foster Bain Named To Succeed Cottrell as Director

Nominee Familiar With Work of Bureau of Mines—Wide Experience on Both Sides of Water

H. Foster Bain, of California, has been nominated by the President to be Director of the U. S. Bureau of Mines. He succeeds Dr. F. G. Cottrell who leaves the Bureau to became the head of the division of chemistry and chemical technology of the National Research Council. During the war Mr. Bain was assistant director of the Bureau of Mines and takes over the direction of the Bureau with an intimate knowledge of its functions.

In the course of his letter of resignation sent to Secretary Payne, Dr. Cottrell said:

"In tendering my resignation may I recall to your mind that, in accepting this position upon the resignation of Director Manning last June, I explained to the Secretary of the Interior that I had previously made all my plans to resign from the position I then occupied as assistant director and to give my undivided attention to the position of chairman of the division of chemistry and chemical technology of the National Research Council.

"I accepted appointment as director of the Bureau of Mines on the understanding with Secretary Payne that I would continue therein until an available successor should be found who was thoroughly acceptable to him and to the mining industry.

"The time having now arrived when Secretary Payne is ready to recommend a successor, I am placing my resignation in his hands for transmittal to you.

"It would be with very deep feelings of personal regret that I should take the present step were it not that the position in the Research Council will still permit me to co-operate very closely with those particular aspects of the Bureau's work for which I feel myself best fitted."

War Mineral Awards

During the week ended Dec. 24 awards were recommended by the War Minerals Relief Commission as follows (the name of the claimant, the mineral, the amount recommended and its percentage relationship to the amount claimed [illegible]): [illegible] John T. Campbell, [illegible], 10 per cent; Frank T. [illegible], 11 per cent; [illegible], 11 per cent; [illegible] Chrome Mining Co., [illegible], 18 per cent.

NEWS BY MINING DISTRICTS

Special London Letter

Operators Conservative Pending Absorption of Stocks—Results at Hampton Plains Disappoint Some

By W. A. Doman

London, Dec. 20—Metal mining companies have sustained some pretty hard shocks of late, each in its turn. First the base metals felt the influence, and then those termed precious. Gold producers, however, have benefited by the higher selling price, and silver which for a considerable time fetched a figure it had not enjoyed for years, is now on the down grade. The decline has left its mark not only on share quotations but in the mining world. Companies desirous of raising capital for extending operations are finding circumstances adverse. Were it not for general world conditions the money would doubtless be forthcoming, but when, owing to slackness of trade, industrial companies and merchant firms, whose reserves and spare cash are invested in Government and other securities, are compelled to realize for the purpose of meeting taxation and carrying on, the attractions of mining enterprises appear less rosy. The Burma Corporation is a large silver producer, and naturally feels the influence of the reduced absorptive power of China and other Far Eastern countries. The Broken Hill mines are also affected, and it would seem as though the prolonged strike of the miners, now at an end, will be followed by a period of enforced short working owing to the condition of the silver, lead and zinc markets. An indication of this was given in a rather rough and ready manner by the announcement that the Zinc Corporation and the Camp Bird company would not pay their fixed preferential dividends for the current half year. The Board of Directors are not downhearted, but pending absorption of stocks and improved metal prices, conservation of financial resources is regarded as the best policy to pursue. It is argued that Europe can consume tremendous quantities of the base metals when the economic situation of the different countries enables a resumption of trade and commerce.

Last week I reported that the Government of the Federated Malay States had temporarily fixed the minimum price for Straits refined tin at $110 a picul. It has since been announced that the pegging is about $10 higher. This action may prove effective for a time, but the law of supply and demand will assert itself in due course. Some of the leading Straits tin mining companies are feeling the strain, as holders of Siamese, Renong and Malayan know to their cost. If anything the position is worse in Cornwall. The leaders of the industry, Oliver Wethered, the Thomases, Messrs. Bewick, Moreing & Co., remain the optimists they always were. The stuff is there, they say, and in due course when monetary conditions improve, Cornwall will be as flourishing as ever she was. There is nothing like cheery leaders to maintain the flagging spirits of the investor.

Another illustration of this is to be found in the case of Hampton Properties, a company working on the Hampton Plains field in Western Australia. The discovery created intense enthusiasm at the outset, but when people began to lose their money and hopes and prognostications were falsified depression set in. In fact it has been stated that the field will not be anything of a producer. The chairman of the Hampton Properties took quite the right line, and pointed out to the shareholders that it was not a few sensational assays that made the success of a field, but half ounce ore and plenty of it. Latest advices are to the effect that the mine is showing 12 dwt. over 60 inches. The future appears so hopeful that people on the spot have expended £5,000 in erecting a hotel.

CANADA

British Columbia

Canadian Operators Want 80c. Minimum for Silver—Dolly Varden Ry. Down for Winter

Nelson—West Kootenay mining operators and the Associated Boards of Trade of Eastern British Columbia are behind a move in the direction of making representations to the Dominion government at Ottawa to have a fixed Canadian price for silver of a minimum of at least 80c. per oz., such figure to be paid by the government for all silver produced in Canada that is offered, the metal to be used for coinage purposes. The movement is as yet only in its preliminary stage, but will doubtless gather support from other sections interested in silver production.

A Nelson syndicate holding a lease on the Gold Hill mine at the head of Forty-Nine Creek plans to start shipments from the property at an early date, with a view to a thorough testing of the ore for milling.

It is indicated that there is a possibility of resumption of operations on an old time scale at the Rossland properties of the Consolidated Mining & Smelting Co. of Canada at an early date. These mines, including War Eagle, Centre Star and LeRoi, which in past years have been prolific producers of gold-copper ores have maintained only small scale operations for some years past, but with cost of labor dropping, efficiency increasing and a progressive decrease in cost of supplies, the outlook for profitable operation, provided some material increase in copper prices manifests itself is considered excellent.

R. R. Hedley, at one time manager of the Hall Mines smelter, at Nelson, has associated himself with J. T. Tipping in operation of the Black Prince mine, near Slocan City, and some good ore is being shipped.

Watson & Wolverton, of Nelson, who leased the Granite-Poorman mine in November, have been maintaining operations at both mine and mill.

S. and E. Terzian, of Hall Siding, have been securing excellent results from development work done recently on the Morning Star group, which is located on the Nelson & Ft. Sheppard branch of the Great Northern. Values are chiefly in gold and silver and present plans are to maintain development all winter.

Kitchener—A small crew is maintained on development work at the Leadville group, six miles from Kitchener, on the Crow's Nest branch of the Canadian Pacific railway. It is stated that there is a possibility of a wagon road being constructed to the property.

Ymir—The Mining Corporation of Canada is dropping the bond held by it on the Yankee Girl property, near Ymir. The owners, it is understood, have plans completed for other interests to take over the group.

Rossland — Le Roi No. 2, Rossland camp, more generally known as the Josie, is at present inoperative, with exception of cleaning up and shipping an accumulation of ore on hand. The shutdown is due chiefly to the prevailing low price of copper.

Princeton—The Princeton Mining & Development Co., Ltd., has completed its plant and will again take up development work. Three tunnels have been driven and considerable copper-silver ore of milling grade has been disclosed.

Stewart—At the Premier mine, the winter's work is in progress. Supplies for the mill are being taken in over the snow, sixty-five horses being used. Ore is being taken by the same means to tidewater for shipment to the smelter. The mill is about three-quarters completed. About 200 men are employed. Two 5-ton Holt tractors are being used over part of the trail. The installation of the hydro-electric power plant is finished.

Anyox—Following the laying off by Granby Con. of about 400 men and the announcement that unless the employees were prepared to accept a reduction in wages of about 75c. a day, it would be necessary practically to cease operations, the attitude of labor has been in doubt. Nothing has developed, however, and work is continuing. It is assumed that the men have acquiesced in the cut proposed.

Alice Arm—The Dolly Varden mine railway has closed down for the winter.

Over 1,000,000 oz. of silver has been produced since September, 1919. High-grade ore has been sacked and shipped to the Tacoma smelter and the lower grade has been going to Granby's smelter at Anyox.

Trail—Shipments received at the Consolidated smelter from Dec. 15 to 21 totaled 9,967 tons from the following properties:

Mine	Locality	Wet Tons
Canada Copper,	Allenby	161
Horn Silver,	Chepaka	53
Josie,	Rossland	257
North Star,	Kimberley	190
Paradise,	L. Wintermore	138
Company Mines		9,168

Ontario

Curtailment Increases at Cobalt—No Power Relief at Porcupine Before Spring—Labor Surplus Everywhere

Cobalt—Further curtailment of operations is being evidenced in Cobalt owing to the low price of silver. The Kerr Lake has stopped production but will continue development. The Dominion Reduction plant, which treated Kerr Lake ores and Peterson Lake tailings, will be completely closed down by about the middle of January. The Peterson Lake will confine its operations to a small amount of development work. The Beaver is still further curtailing operations and is seriously considering a complete shut-down. Their action will probably depend upon the cost of labor. It is understood that a cut in wages is being contemplated and this may be a sufficient inducement for some of the mines to keep operating. In the meantime, the power situation has improved and it is probable that the mines will be able to continue operations throughout the winter.

Shipments over the T. & N. O. Ry. during November totaled 589 tons from the following shippers: Beaver, 30; Bailey, 75; Coniagas, 84; Dom. Reduction, 42; La Rose, 99; McKinley-Darragh, 43; Nipissing, 152, and O'Brien, 64. This tonnage was consigned as follows: Deloro S. & R. Co., Marmora, Ont., 357; Coniagas Reduction, Thorold, Ont., 146; A. S. & R., Pueblo plant, 44, and A. S. & R., Perth Amboy, 43.

The Crown Reserve of Cobalt will resume diamond drilling on its claims north of Block B of the Associated Goldfields early in the year.

Porcupine—In Porcupine, however, practically all hope of additional power before spring has been given up. It is understood that companies without power contracts will not be able to obtain a supply. This, however, is a very small quantity. The Dome and Hollinger by using their auxiliary steam plants will be able to continue operations at their present output, which is, of course, much below their capacity. The McIntyre will have to reduce about 30 per cent.

At the annual meeting of the Keora Porcupine on Dec. 28 a complete new board of directors with one exception was chosen, consisting of J. R. Ness, W. Claude Fox, W. B. Gunton, George Mulholland and W. E. Smith. The following officers were elected: President and managing director, W. B. Gunton, vice-president; J. R. Ness; secretary-treasurer, W. E. Smith.

Larder Lake—At a recent meeting of the Associated Goldfields a vote of confidence was given to the directors. The company has $850,000 cash in the treasury. It has been decided to defer the building of a mill until more development work has been accomplished. A new company, with a capitalization of $30,000,000, has been formed to take over the various holdings of the company.

Sudbury—In the Sudbury field, due to a limited market for nickel, the three companies are operating at reduced capacity. The output of the International Nickel Co. is less than one-third of its maximum wartime production and over 1,000 men have been laid off. There is now a surplus of labor in all of the mining camps of Ontario for the first time in five years.

An official arbitrator is to be named to adjust claims made for damage resulting from smelter smoke in the Sudbury district, Ontario, according to advices from Toronto. It is said that there will be appeal from the decision of this arbitrator.

Manitoba

Herb Lake—At the Rex mine the shaft has been put down to the 200-ft. level with a continuance of the vein matter and drifting at this level has been started. The force of miners has been increased and three shifts a day are being worked.

Rice Lake—The shaft on the Pan Extension is down to the 200-ft. level where the vein is 4 ft. wide. Sixty tons of ore has been taken out which it is proposed to ship to Denver for refining.

The contract for sinking the shaft at the Gold Seal has been completed to the 210 ft. level and some drifting done at that depth. The vein has been in the shaft from the 160-ft. level down and is 4½-ft. wide showing heavy mineralization and some free gold.

MEXICO

Government Delays Relief Measures for Mining Industry

Durango—Although the Federal government has been studying the problem of how to [illegible] the mines for more than a month, and the metropolitan newspapers have given out the results of the [illegible] meeting in which it was [illegible] to take off all the taxes [illegible] until such time as the price of silver in New York returned to 70c. [illegible] has not been issued by the President and the mines continue to close down. In November on account of the low price of silver, [illegible] as well as high [illegible] Cia. Minera y Metalurgica Mexicana [illegible] closed all its [illegible] and [illegible] of course its customers had to close down also. The American Smelting & Refining Co. has so far kept all its smelters running, although several of the lowest grade mines have had to shut, and according to statements from officials the company expects to keep running and maintain its organization even without profits in the hope that the Mexican government will take some definite action to remove the present tax of 11c. per oz. on silver and that the price in New York may react within a reasonable time.

The Governor of Zacatecas has been quite active in urging immediate and drastic action toward relieving the mining industry of its high taxation burdens, and has even proposed that the government buy the silver production of the Mexican mines and either coin it or hold it until the price reacts. The Governor of Durango indicated in an interview published in the *Journal* a few months ago his great desire to assist the mining industry of Durango by encouraging in all legitimate ways the investment of capital, but no well-defined policy along this line has been announced, and it would seem that all that can be expected from the state governments in this crisis is that they voluntarily renounce the 2 per cent state tax on the gross value of the production of the mines. This action would be of great advantage to all low-grade properties, because in many instances this tax makes the difference between profit and loss.

Most of the mines in the Chalchihuites and Sombrerete (Zacatecas) districts have closed down and the remainder are running with a reduced force. Some new properties which were about ready to start operations have naturally suspended indefinitely the date for beginning production. The Cia. Eureka M.O. y Anexas of the Tejamen district in Durango was unable to start operations in October as announced, because a part of the machinery failed to arrive, and with the fall in silver prices the company will doubtless await the general adjustment of prices before starting up.

The Guanecevi district continue shipments to the Asarco (Durango) smelter but the other shippers have suspended shipments under their contracts with the smelters that have been closed down, and so the tonnage of the district is about half. Nothing is being received from the Topia district at present, although the Canelas district which is adjoining and [illegible] of equally high grade in silver and lead continues to make small shipments. Lack of transportation has not been sufficiently overcome in order to [illegible] larger companies to enter these fields and so only individuals and small companies are operating in the latter field [illegible]

[illegible]

As labor in Mexico has not yet realized the general economic situation and the adjustment crisis that is taking place and which must also reach the laborers in the mining industry in all districts the whole future for some months to come must be considered as grave and very unsettled; for unless silver and other metal prices should react to war prices, which no one believes, labor must take part in the readjustment by accepting reasonable reductions in wages, which labor is not ready to do at present.

Coahuila

Torreon Smelter To Be Enlarged

Torreon—The Torreon smelter is to be enlarged and its capacity increased. The Minerales y Metales company, owners of the Torreon, Mapimi and Monterrey smelters, are to make the Torreon plant their principal one. Owing to the superior railroad facilities to and from the mining camps of the states of Coahuila, Zacatecas, Durango and Chihuahua, Torreon has been selected for this purpose. Railroads run out in all four directions from Torreon to the principal camps and connect with important branch lines which extend to other mining districts. Torreon is on a direct line from the border at El Paso and Eagle Pass, with railroad facilities to the Coahuila coal fields and the Tampico oil region.

George Stinson, representing the Rosario Mining Co., has filed on a group of claims in the Prieto mountains near Bermejillo. The ores from this district are giving good values in silver and cinnabar. Development work will be carried on pending the receipt of titles which have been applied for through the Torreon mining agency.

Juan M. Hernandez has made application through the mining agency at Torreon for titles to the Lentisco group of mines in the Reyes mining district, State of Zacatecas. These mines were worked extensively before the revolution and produced large amounts of rich gold and silver ores, but were allowed to become delinquent for non-payment of taxes during the revolution.

MINNESOTA

Mesabi Range

Oliver Iron Using 30-cu.yd. Automatic Dump Cars on Stripping — State Mines Tonnage Larger in 1920

Duluth—Pickands Mather & Co., the M. A. Hanna Ore Co. and the Republic Iron & Steel Co. have recently held meetings, presided over by the respective general managers and attended by the general superintendents, superintendents of mines, and heads of departments. Operations of the past season were discussed together with plans for the future.

Virginia—A new and interesting feature of stripping operations has been introduced by the Oliver Iron Mining Co. in the use of 30-yard automatic dump cars of which 130 have been ordered for the various pits. In many instances these cars will require heavier equipment of every description, which has also been ordered where need for it exists.

Hibbing—The mines operated by the State of Minnesota report a great increase in tonnage of iron ore shipped during the 1920 season in comparison with that shipped in 1919. The 1920 shipments totaled approximately 5,912,088 tons against 3,836,099 tons in 1919. These shipments came from twenty-two properties of which nine were open pits, nine underground mines and four were combinations of both open pits and underground mines.

The Oliver Iron Mining Co. is working eleven shovels in its open pits in the Hibbing district, ten of them being on stripping. Five shovels are working in the Hull-Rust pit, one in the Sweeney, one in the Sellers and two in the Morris. Two shovels are in the Kerr pit, one of which is cutting a new approach to the pit for handling ore next season and the other casting lean ore on the north bank.

MICHIGAN

Menominee Range

Diabase Dike Found in Balkan Mine at Alpha

Crystal Falls—Mining men of Iron County are greatly interested in the dike which has been found in the Balkan mine at Alpha as this is the first dike found in an Iron County mine. It cuts off the ore completely, but it is known that ore lies beneath. The dike is of diabase and similar to that found on some of the other iron ranges. It cuts across the vein at an angle from the footwall to the hanging, being fan-like in shape. A drill has been put through it and ore found below, but the extent of the deposit has not been determined thus far.

MISSOURI

Operations in Southeastern Lead Belt —De Soto Stops Work at Lee Mine

Fredericktown—The Picher Lead Co. is still drilling on the Schulte tract, near Fredericktown, which it has under option and are said to have struck some very good lead ore.

Annapolis—The Annapolis Lead Co. will complete its initial shaft in the orebody this month at a depth of about 400 ft. This mine is located at Annapolis, on the main line of the Iron Mountain R.R., in the southern part of Iron County.

Vineland—The DeSoto Mining Co. has stopped work on the Lee mine, near Vineland, and will not erect the Joplin mill recently purchased until lead recovers.

The Wherry Syndicate has started drilling on the Big River, south of Vineland, where it has a large tract under option. It is drilling near an old pyrite mine from which considerable pyrite was shipped several years ago. The ore occurs in a faulted, brecciated limestone.

MONTANA

Elm Orlu Curtails Somewhat — Butte Western May Start Sinking

Butte — Anaconda's production of copper is coming from the Tramway, Badger State, Steward and West Colusa mines. The output at present is about 10,000,000 lb. per month compared with a normal production of 26,000,000 to 27,000,000. The company's zinc production is about 5,000,000 lb. per month, or about half of normal. This is coming from the Emma mine of the Butte Copper & Zinc Co. and from the Nettie.

The Rainbow vein in Butte & Superior's Black Rock mine will be cut on the 2,300-ft. level within three months, it is expected. Raising from this level to the 2,000 to connect with the No. 3 shaft will be completed first before the Rainbow and Jersey Blue fissures are developed below the 2,000. Sinking of the No. 2 shaft with the 2,600-ft. level as objective is under way.

Sinking of the Main Range shaft from the 1,200 with the 2,000 level as the objective continues the principal work at this property of the Tuolumne Copper Co.

Operations have been curtailed somewhat at the Elm Orlu mine in consequence of the reduction of the number of shifts employed at the Timber Butte Milling Co.

Installation of an electric pump has been completed on the 300-ft. level of the Butte & Plutus with a view of continuing sinking to the 400 level.

The Butte-Western Silver Mines is expected to start sinking from the 200-ft. level. Discovering of high-grade ore has been reported on the 200 level, one of the old time silver-gold shoots having been uncovered in the southwestern part of district, where a number of the early day silver bonanzas were discovered.

High-grade silver ore continues in fair tonnage on the 500- and 600-ft. levels of the Crystal Copper.

Lump Gulch District—The Liverpool Silver plans to sink from the 700 to the 900-ft. level.

Good ore is reported to have been found on the Pay Back property.

Sinking operations have been practically completed to the 400-ft. level of the Little Nell and drifting will be started soon.

Winston District—Driving of a tunnel 2,305 ft. by the Chicago-Montana, thus completing a contract, brings the heading about 150 ft. distant from the Eureka vein.

Champion District — Permission has been asked of the forestry officials by the Butte Jardine to build a six-mile power transmission line through the Deer Lodge national forest to furnish power for the mill now under construction.

Elkhorn — The Boston & Montana's 700-ton concentrator is under cover and it is said that the installation of machinery shortly will be under way.

Neihart—Cascade Mines & Mills suit has been brought by a lessee against the plaintiff claiming that he has lost $6,000 because of alleged violation of a lease in the Moulton mine. At present the company is not operating its properties.

Wickes—Operations at the Mount Washington have been suspended by the Angelica Mining Co. and construction of a 150-ton concentrator is planned.

Warm Springs—Installation of machinery at the Willard mine by the Jefferson & Teton has been completed and the property placed in shape for operations throughout the winter.

Saltese—The Tarbox is continuing drifting operations easterly on the 800-ft. level with the south vein as the objective.

COLORADO

Restoration of Old Rate on Bullion Hoped For

Silverton—The Ariadne Mining Co. is a new corporation, capitalized for $1,100,000, divided into 11,000 shares of a par value of $100, for the purpose of taking over and operating the Ariadne mine. Alfred Illes is manager. Development has opened a 2-ft. vein of galena, at a distance of 650 ft. from the portal of the lower tunnel, and 550 ft. below the surface. An aerial tram from the mine to the railroad is under consideration. The company has $50,000 cash in its treasury to expend on equipment and development.

Durango—Several pockets of rich silver-bearing ore have been opened by recent development in the Esmeralda mine. A trial shipment to the smelter returned 300 oz. silver per ton. W. B. Cauble is manager.

Idaho Springs — A consignment of pitchblende, weighing about 5,200 lb. and valued at $5,000, was shipped recently from the Gold Rock property in Russell Gulch. The deposit is one of the largest ever found in the district.

Denver — Colorado mining men are hoping that the hearing, held in Chicago recently, of the Western Trunk Lines Association on freight rates on bullion to seaboard and eastern refineries, will result in the restoration of the old rates. It is believed that any reduction in rates will be followed by a reduction of smelting charges in Colorado. George E. Collins, governor of the Colorado Chapter of the American Mining Congress, and A. M. Henderson, member of the executive committee of the Colorado Metal Mining Association, represented Colorado's mining interests at the hearing in Chicago.

UTAH

Salt Lake Valley Smelters Receiving Smaller Tonnages—Operators Fighting Freight Increase

Salt Lake City—Lessened tonnages of lead ores are coming in to the Salt Lake smelting plants owing to the low price of lead, which has caused curtailment of shipments and in a number of cases cessation of operations by properties in Utah and adjacent states shipping to the local smelters. Smelting costs are high, but the smelters find it impossible to increase charges from the fact that most of the ores coming in are being smelted under long time contracts; also increased charges would result in a further curtailment of the tonnages of lead ores coming in and in the closing down of more mines. Producers of lead ore with a high silver content are able to keep going, owing to the working of the Pittman Act, keeping silver at $1 for sale to the government. In the case of siliceous silver ores with little or no lead content the smelters do not find it advantageous to take too much of this ore without the lead ores to offset it.

Utah operators are hopeful that the ruling of the state public utilities commission refusing increased freight rates on intrastate shipments of coal and low-grade ores will be allowed by the Interstate Commerce Commission to stand. At the hearing before the commission just completed at Washington the Utah traffic bureau through H. W. Prickett presented figures and exhibitions to show that Utah rates have always been higher than in other sections similarly situated, and that if an increase were granted at this time it would result in the closing down of practically every mine. Walter Fitch, president of the Chief Consolidated mine at Eureka, testified at the hearing. The Chief mine producing annually ore of a gross value of $3,000,000 to $4,000,000 would have added to its monthly expense account through increased freight rates, if granted, $20,000 to $30,000. With such an increase, Mr. Fitch stated, there would be but one course open to the management, i.e., to close down. And what is true of the Chief holds for the other large mines of the Tintic and other Utah districts.

Eureka—Tintic shipments for the week ended Dec. 25 amounted to 172 cars. Shippers were the Tintic Standard, 50; Chief Con., 45; Dragon, 22; Eagle & Blue Bell, 13; Iron Blossom, 13; Iron King, 9; Victoria, 7; Gemini, 4; Mammoth, 2; Gold Chain, 2; Colorado, 2; Swansea, 2, and Tintic Drain Tunnel, 1. The Tintic Standard, which has been shipping at the rate of almost 10 cars of ore daily, is, through an order from the smelter, cutting down shipments to about 300 tons of ore daily. The first shipment of 4 cars of ore has been made to the new mill.

Park City—Shipments for the week ended Dec. 25 amounted to 2,318 tons, as follows: Judge M. & S., 1,199 tons; Silver King Coalition, 614 tons, and Ontario, 515 tons.

ARIZONA

Hardshell at Patagonia Resumes Development—Van Dyke Again Operating

Phoenix—Parker Woodman, for years connected with the Copper Queen at Bisbee, has taken charge of operations at the Kay copper property, 40 miles north of Phoenix on the Agua Fria. Work has been held up several months by non-delivery of a large electric hoist, that now is at hand. Power is taken from a main line that lately was completed between Mayer and Phoenix. The main three-compartment shaft is to be driven deeper.

The State Corporation Commission has given El Tiro Leasing Co. of Silver Bell permission to sell 250,000 shares of stock at $1.

PATAGONIA, ARIZ.

Morenci—William B. Gohring, of Bisbee, has been engaged as consulting engineer for the Stargo group of 26 claims near Morenci, with M. J. Hanlon in direct charge. The operating company, headed by George J. Stoneman, of Los Angeles, recently completed payment for the property and now will spend $50,000 in development work.

Miami—Work has been resumed on the Van Dyke property at Miami. Stations and ore pockets have been cut on the 1,220 and 1,550 levels, on which there will be lateral development. The upper level is in carbonates and the lower in a chalcocite zone.

Patagonia—The Hardshell Mining Co. has been financed to resume development work through the new vertical shaft, and the work began on Jan. 5. Recently, fifteen cars of lead sulphide and carbonate ore have been shipped from the Gardner lease, and at this time three cars are en route to the smelter. Average assays on smelter settlements are about [illegible] oz. silver and 11 per cent lead. Production from the old workings will be substantially increased during the coming year. The [illegible]-ft. level from the new shaft will be advanced to cut [illegible] under the ore shoot from which shipments are now being made.

AT CARSON HILL, CAL.—FINNEGAN MINE BUILDING ON LEFT; GLORY HOLE OF MELONES MINING CO. IN UPPER CENTER; BLACKSMITH SHOP AND DUMP OF CARSON HILL MINING CO.'S MORGAN MINE ON RIGHT

CALIFORNIA

Kate Hardy Mine Closed for Winter —Oneida Hoist Sold for Old Iron

Sutter Creek—A small force is employed in wrecking the South Eureka's Oneida hoist, the work being done by the Hamby Company of San Francisco. The mining company has concluded to sell it for old iron. The hoist is situated about one-half mile below Martell station. The mine has not been in operation for fifteen years, except for a short interval. The mill was demolished several years back. The Oneida company paid one dividend, but it has always been looked upon as a "waterhole" until the discovery of ore at the north end led the South Eureka Mining Co. to pay $100,000 cash for it.

Angels Camp—There are many low-grade mines in the Angels mining district which will be opened up in the event of the passage of the McFadden bonus bill. Among the larger low-grade properties which will resume if this takes place is the Gold Cliff mine of the Utica system. Operations will also then be resumed in the Lee mine at Altaville, the Angels Quartz and others.

Sonora — The Mexican mine, which was recently purchased from Booker & Vaville by Rossler, Ryan & Fetter, is yielding specimens of high-grade ore. During the last few days several pieces of ore well shot with gold have been taken out. Indications are that the seam will lead to a large pocket. The mine is said to have yielded $100,000.

It is unofficially stated that a ledge 3½ ft. wide of high grade ore has been struck on the 1,900 ft. level of the Black Oak mine near Soulsbyville. The ledge has been opened for a distance of 40 ft. with good ore all the way. The force employed will be increased.

Iron Mountain—The Mountain Copper Co. is shipping about 600 tons of ore daily to the chemical works on San Francisco Bay. The Hornet mine is yielding 100 tons a day, and the Iron Mountain 500 daily

Forest—The delay in completing the mill at the Kate Hardy mine has caused the closing down of the property for the winter. There is a good ledge on this property and a large amount of ore has been taken out and placed on the dump. As the mill is not ready to operate, and as it is necessary to handle the ore twice on that account, the shaft will be closed most of the winter, although work on the mill will continue as rapidly as possible.

NEVADA

Milling at Con. Mayflower to Be Resumed March 1—Silver Pick Retains Lease on Goldfield Con. Claims

Pioneer — Improvements completed lately by the Cons. Mayflower Mines Co. include a 20,000-gal. oil storage tank, assaying and surveying equipment, and additions to the mill, together with changes and rearrangement of machinery. Long drifts from the main shaft are nearing the Starlight workings, where the best ore has been found. Assay maps of all workings are being made, involving the crushing of several hundred large samples. W. J. Tobin, manager, is planning to resume milling about March 1.

The Reorganized Pioneer Mines Co., with property adjoining the Mayflower, is sinking to water level. The shaft is nearing the 800-ft. point and some water is coming in.

Goldfield—The Silver Pick Cons. retains its long-term lease on parts of the Red Top and Mohawk claims of the Goldfield Cons., recently reliquished by the latter company to the Goldfield Development Co.

Eureka—The once-famous Eureka Con., on Ruby Hill, is shipping low-grade silver-lead ore with a high iron content to Utah smelters for flux. High-grade ore is being shipped to smelters from the Eureka-Croesus and Eureka-Holly mines. Nearly all the smaller properties are closed for the winter.

Lovelock—The Nevada Sheba Mining Co., owning the old Queen of Sheba mine in the Humboldt Range, Pershing County, has been sued by workmen and other creditors.

Cortez—The Arctic tunnel of the Cons. Cortez Silver Mines Co. at a point over 1,600 ft. from the portal cut a fissure in the limestone that is correlated with one of the secondary fractures in which good ore was stoped from the upper tunnel workings. A short raise showed the fissure to be wider above and the filling a soft, brecciated porphyry like that found in ore-bearing areas above. The tunnel is nearing the 1,700-ft. point and is being advanced to connect with an incline from the upper tunnel which is in good ore.

Rochester—Rochester Silver Corporation has reported to its stockholders that on Nov. 30 there was 1,000 tons of broken ore ready for transportation to the mill. The average number on the payroll in November was 111. Tonnage milled in same month was 4,613.

[illegible] OF IDAHO MARYLAND MNG. CO., GRASS VALLEY, CAL., SHOWING HEADFRAME AND SHOPS

THE MARKET REPORT

Daily Prices of Metals

Dec.	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
30	12.25@12.50	30.75	34.50@35.25	4.75	4.65	5.70
31	12.00@12.25	31.25	35.00@35.25	4.75	4.65	5.70
Jan. 1	....	.....	....	...	....	....
3	12.25	32.00	35.00@35.25	4.75	4.65	5.60
4	12.25@12.50	32.00	35.75@36.00	4.75	4.60@4.70	5.55@5.60
5	12.50	32.50	36.25@37.00	4.75	4.60@4.70	5.50@5.55

*These prices correspond to the following quotations for copper, "delivered": 12.50@12.75, 12.25@12.50, 12.50, 12.50@12.75, and 12.75c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Dec.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
30	72	73¼	80	207	212	23½	24½	27	28½
31	71¾	72⅞	80	205½	210¼	23½	24¼	26	27½
Jan. 1	..							..	
3	71½	73½	80	206½	211½	24¼	25	26¾	28
4	72	73¼	80	205½	210½	24½	25	26¾	27¾
5	72¼	73¼	80	205½	209¾	23¾	24	26¾	27¾

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Dec.	Sterling Exchange	Silver			Jan.	Sterling Exchange	Silver		
		New York Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York, Foreign Origin	London
30	352¼	99½	65⅛	41¾	3	353	99½	65¾	41¾
31	353	99½	64¼	40¾	4	354	99½	65⅞	41¾
Jan 1	....	.		..	5	357½	99½	67⅛	42½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Monthly Average Prices for December:

Copper:

New York Electrolytic......	13.188
London Standard...........	75.702
London Electrolytic.........	85.905

Lead:

New York................	4.727
St. Louis..................	4.717
London....................	24.089

Silver:

New York, foreign..........	64.774
New York, domestic.........	99.500
London....................	41.845
Sterling Exchange..........	348.101

Zinc:

St. Louis..................	5.824
London....................	27.762

Tin:

99 per cent................	31.135
Straits.....................	34.058
London....................	212.440

Antimony	5.534
Quicksilver	49.577

Metal Markets

New York, Jan. 5, 1921

With the New Year a slightly better feeling can be noted in the metal trade, although sales continue disappointing.

Copper

During the last week the market has been pretty thoroughly combed for possible buyers. Some small dealers may be willing to lay in a supply of copper at present prices, but the larger consumers show absolutely no interest for tonnages of any size. Either they have stocks which they consider sufficient or they have not the money to buy; they are making no complaints about prices. Most of the business of the last few days has been done at 12½c. delivered. Yesterday and today practically all sellers seemed inclined to quote higher prices than this, although it appears that no business is resulting. Most of the large producers refuse to sell at these prices, but they have broken under the 14c. quotation and large tonnages could be obtained from them now at 13@13¼c. delivered, were any one in the market. Copper for forward delivery has been held a little firmer by those who have been selling at 12½c., and March delivery was not obtainable at any time under 12⅞c.

The Copper Export Association has adopted the policy of selling in Europe at the low prices now current in New York, and is reported to be selling some metal at prices which will net American producers about [illegible] New York. Fairly large amounts of copper have been sold in Europe recently, but much of it has been bought from agencies abroad. The Export Association has no doubt reduced its price to meet this competition.

The U. S. Geological Survey reports stocks of refined and blister copper on hand in this country on Dec. 31 as 874,000,000 lb., compared with 904,000,000 lb. at the end of 1919.

Lead

The American Smelting & Refining Co.'s price of 4.75c., New York and St. Louis, continues.

Inquiries have been better during the last week, and numerous sales of small tonnages have been made by various producers. Sellers seem well satisfied with the market under the prevailing business conditions, and in general have their metal pretty well sold up. The storage-battery makers of course are not active consumers just now, but paint and cable manufacturers seem to be in the market, and a considerable amount is also in demand by dealers. The price for prompt metal for delivery at almost any point in the East or Middle West, with the exception of St. Louis, is 4.75c. At St. Louis the price seems to be about 10 points under this. Today the London price is down about £1, but unless it falls further, producers here do not seem disposed to make any concessions.

The U. S. Geological Survey reports lead production from domestic ores during 1920 as [illegible] tons, compared with [illegible] tons for 1919.

Zinc

The market for this metal continues as lifeless as usual. The only thing of interest is a disposition on the part of some large consumers to inquire into European sources for their supplies. European zinc can be obtained delivered at the Atlantic seaboard for 5.35@5.45c.

Tin

Tin has been a little firmer here with the rise in sterling exchange. The withholding from the market of supplies from the Straits is almost certain to have an effect, also, and by the end of the month high-grade tin promises to be fairly scarce and at a higher premium over 99 per cent than at present. Electrolytic has been in feeble demand at, or slightly below, Straits.

Straits tin for future delivery: Dec. 30th, 35.75@36c.; 31st, 36@36.25c.; Jan. 3d, 36@36.25c.; 4th, 36.50@37c.; 5th, 37.25@37.50c.

Arrivals of tin in long tons: Total for December, 2,470; Jan. 1st, Straits, 10; 3d, Straits, 5; London, 100; 4th, Straits, 150. It now appears that on Dec. 28, 620 tons of electrolytic tin was exported to London.

Silver

Since our last report the market has broadened and a considerable speculative account has been operating. China has been a buyer, both in this market and in London, but on Dec. 29, according to London reports, China resold previous purchases, with the result that the quotation dropped to 41¾d. on the 30th. The market is sensitive, and the tendency uncertain, with buyers holding off at today's higher level.

Mexican Dollars—Dec. 30th, 49¼; 31st, 48½; Jan. 3d, 50; 4th, 50; 5th, 51½.

Gold

Gold in London: Dec. 30th, 116s. 4d.; 31st, 116s. 1d.; Jan. 3d, 115s. 11d.; 4th, 115s. 10d.; 5th, 114s. 10d.

Foreign Exchange

A pronounced strengthening in sterling took place during the last week. On Tuesday, Jan. 4th, francs were 5.825c.; lire, 3.40c.; and marks, 1.335c. New York funds in Montreal, 17½ per cent premium.

Other Metals

Aluminum—List prices of 28.3@28.5c. are purely nominal.

Antimony—Chinese and Japanese brands, 5¼@5½c.; market quiet. W.C.C. brand, 6¼@6½c. per lb. Cookson's "C" grade, shipment from England, 9½c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony[1] (200 mesh), 7@7¼c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 7c.

Bismuth—$2.40 per lb., 500-lb. lots, and $2.42 per lb., 100-lb. lots.

Cadmium—Nominal, $1.40 per lb.

Cobalt—Metal, $5 per lb.; black oxide, $3.50 per lb.; sulphate, $1.35.

Iridium—Nominal, $325 per oz.

Magnesium—Crude, 99 per cent, $1.35 per lb. f.o.b. Philadelphia.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Ingot, 43c.; shot, 43c.; electrolytic, 45c., f.o.b. Bayonne, N. J.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $70@$80 per troy oz.

Palladium—$75 per oz.

Platinum—Firm at $75 per oz.

Quicksilver—Nominally $45 per 75-lb. flask. San Francisco wires $47@$50. Dull.

[1]**Rhodium**—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 55@60c. per unit, New York. California concentrates, 50 per cent Cr_2O_3 and upward, 60@65c.

[1]**Manganese Ore**—40@45c. per unit, seaport; chemical ore (MnO_2) $60@$65 per gross ton, lump; $75@$80 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

[1]**Tantalum Ore**—Guaranteed minimum 60 per cent tantalic acid, 40c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¾@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

[1]**Tungsten Ore**—Scheelite, 60 per cent WO_3 and over, per unit of WO_3, $4@$4.50, f.o.b. mines; wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3.50, in New York.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 5c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Dec. 31—Zinc blende, per ton, high, $36.95; basis 60 per cent zinc, premium, $29; Prime Western, $27.50; fines and slimes, $25@$22.50; calamine, basis 40 per cent zinc, offerings $20, no sales. Average settling values: Blende, $35.50.

Lead, high, $58.05; basis 80 per cent lead, $55@$47.50; average settling price, all grades of lead, $54.75 per ton.

Shipments for the week: Blende, 4,518; lead, 656 tons. Value, all ores the week, $191,780.

Shipments for the year: Blende, 564,316; calamine, 10,136; lead, 88,954 tons. Value, all ores the year, $35,630,590.

Compared with 1919, blende shipments were 95,138 tons more, calamine 1,906 tons less, a net zinc ore increase of 93,232 tons. The lead increase is 16,595 tons.

Platteville, Wis., Jan. 1.—No market report and no demand for ore. No ore shipped out of the district during the week. Shipments for the year 1920: Blende, 60,506; calamine, 2,551; lead, 4,562; sulphur ore, 1,342 tons. Shipped during the week to separating plants, 1,007 tons blende.

Non-Metallic Minerals

Asbestos—Crude, No. 1 $2,000@$3,500; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, $23; ground (white), $45; ground (off color) $30@$32 per net ton, less than carload lots, f.o.b. New York. Crude, first grade, $10 per ton, f.o.b. cars, Missouri; floated, $28 per ton in bbls.; $26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis.

Chalk—English, extra light, 5@5½c.; light, 5@6c.; dense, 4½@5c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$12; washed, $12@$15; powdered, $18@$22; bags extra, per net ton, f.o.b. mines, Georgia; crude, $8@$12; ground, $15@$40, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $25@$35; powdered, $30@$35, f.o.b. New York.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar—Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $25 per ton, f.o.b. Illinois mines, and $25.50, f.o.b. Kentucky; ground, suitable for acid, chem-

ical or enameling purposes, $60; lump, $17.50, f.o.b. Tonuco, N. M. In Canada 85 per cent calcium fluoride sells for $20 per ton, f.o.b. Madoc; output limited. Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines.

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Fuller's Earth—$16 per ton, carload lots, f.o.b. New York.

Graphite—The 90 per cent crucible grade is held in Alabama for 9c. per lb. and 85 per cent grade, 7@9c. Lubricating grade commanding the best price is a fine flake, passing a 100@120 mesh, and running higher than 96 per cent carbon. Linotype machines use a flake passing 90 mesh and standing on a 120 screen, with 90 per cent carbon, retailing at 75c. to $1 per lb. and selling to jobbers at 11@40c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Dolomite, 1@2 man size, $1.60@$1.65; 2@8 in., $1.55@$1.65 per net ton, f.o.b. Plymouth Meeting, Pa.; fluxing, $1.65@$1.75 per net ton, f.o.b. Howellville, Pa.

Magnesite, Calcined — High-grade caustic calcined, lump form, $35@$40 per ton, carload lots, f.o.b. California points. In Chicago district, $57.70; Atlantic seaboard, $61@$63.

Dead-Burned — $38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 50c.; No. 5, $1.20@$1.40; No. 4, $2@$3; No. 3, $4.25@$5; No. 2, $5.50@$7; No. 1, $8. Clear block: No. 6, 55c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $10; extra large, $25; all f.o.b. New York; ground, $150 per ton, Philadelphia. Domestic, uncut, f.o.b. Franklin, N. C., as follows: Scrap, $45@$50 per ton; punch, 10c. per lb.; circle, 15@25c.; 1½ x 2 in., 75c.; 2 x 2 in., $1.15; 2 x 3 in., $1.65; 3 x 3 in., $2.10; 3 x 4 in., $2.50; 3 x 5 in., $2.75; 3 x 6 in., $3.75; ground 165 mesh, $150@$170 per ton; ground roofing mica, $60; mica washers, 75c.@$2 per lb.; 1¼-in. disks, No. 1, $1.40 per lb.; No. 2, $1.25. The foregoing domestic prices obtain also in the Chicago district.

[1]**Monazite**—Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $13; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $8.35; 68 per cent, $7.85; 68@66 per cent, $7.60. Finely ground Tennessee rock sells for $8.50 per net ton for 13 per cent phosphorus content, agricultural application; for acid-making, 14 per cent, $9; both prices f.o.b. Centerville, Tenn.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 16½c.; Spanish lump, 14@16c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1½ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Sand (Glass)—Dry glass sand, $4 per net ton, f.o.b. cars Mapleton, Pa. Sand, f.o.b. Ottawa, Ill., is $3 per ton; $2.50 on annual contracts. Sand at Klondike, Gray Summit and Pacific, all in Missouri, is $2.50 on contract; some outside sales have been made at $4. St. Louis, open market, at $3.50; contract price on large quantities, $2.50; on small quantities, $3.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $12@$22 per ton; roofing grades, $9.50@$15; rubber grades, $12@$18; all f.o.b. Vermont. California talc, $20@$45, talcum powder grade. Southern talc, powdered, carload lots, $12@$15 per ton; less than carload, $25, f.o.b. cars; freight to New York $5.25 per ton, carload lots; less than carload lots, $9.25. Imported, $50@$60; Canadian, $20@$40 per ton.

Mineral Products

Arsenic — White arsenic, 11½@12c. per lb.; sulphide, powdered, 15@15½c. per lb. in carload lots.

Sodium Nitrate—$3 per cwt. ex vessel, Atlantic ports. Market quiet.

Sodium Sulphate—For 95 per cent material, $22 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract.

Potassium Sulphate—Domestic, $225@$250 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrocarbontitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 16@17c. per lb. of chromium contained; 4 to 6 per cent carbon, 17@18c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $120@$125, freight allowed; $120, f.o.b. seaboard bases; resale, $115; English, $110, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $60, f.o.b. furnace.

[1]**Ferromolybdenum**—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus and [illegible], $[illegible] per lb. of contained [illegible] works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $55@$60; 50 per cent, $[illegible]@$80, 75 per cent, $1[illegible]

Ferrotungsten—Domestic, 70 to 80 per cent W., $[illegible]60c. per lb. of contained tungsten, f.o.b. works. Foreign, 60.

Ferro-uranium—35 to 50 per cent U, $7 per lb. of U contained, f.o.b. works.

[1]**Ferrovanadium**—Basis 30 to 40 per cent, $6@$6.50 per lb. of V contained, according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York list price, 21½c. per lb.; wire, 16½c.

Lead Sheets—Full lead sheets, 8½c.; cut lead sheets, 8¾c. in quantity, mill lots.

Nickel Silver—34¼c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets, 20¾c.; sheathing, 20¾c.; rods, ⅝ to 3 in., 17¾c.

Zinc Sheets—$11.50 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 11½c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr_2O_3, $55@$60 per net ton, and $65 in sacks, carload lots, f.o.b. eastern shipping points.

Fire Brick—First quality, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $45@$50.

Magnesite Brick — 9-in. straights, $110 per net ton; 9-in. arches, wedges and keys, $120; soaps and splits, $130.

Silica Brick—9-in., per 1,000: Chicago district, $65@$70; Birmingham, Ala., $56@$61; Mount Union, Pa., $55@$60.

Iron Trade Review

Pittsburgh, Jan. 4, 1921

Under date of Dec. 31 the Republic Iron & Steel Co. reduced its prices on tubular goods to the Industrial Board level. The other independent pipe mills have been taking similar action to that of Republic, some lists being dated Jan. 1 and others Jan. 3. There was not as general closing among independent steel mills last week, as had been predicted, as a few mills operated at rates up to 50 per cent.

Pig Iron—As was expected, a prominent Valley producer of bessemer and basic iron announced with the opening of business this month that it is prepared to sell bessemer [illegible] at $[illegible] and basic at $[illegible], [illegible] representing reductions of $[illegible] from previous nominal quotations. Foundry is quotable $2 lower, at $[illegible], with further readjustment to be expected. W. P. Snyder & Co. announce [illegible] price for December, [illegible] from actual sales reported, of $35, Valley, for bessemer and [illegible] for basic. The average quotation on foundry iron was $[illegible].76.

Charcoal and Coke

Charcoal—Willow, 7c. per lb. in bbls.; hardwood, [illegible] per lb., in [illegible]0-lb. bbls. Barrel charge [illegible].

Connellsville—Furnace, $6[illegible]@$7; foundry, [illegible]

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

COMPANY REPORTS

Butte and Superior Mining Co. Suspends Productive Operations

Zinc; Montana

The following statement of the Butte and Superior Mining Co. shows the principal operating features for the third quarter of 1920, as compared with those for the first and second quarters of the current year:

	Third Quarter 1920	Second Quarter 1920	First Quarter 1920
Dry tons of ore milled	92,659	81,619	130,204
Average zinc content (per cent)	13,075	13,339	14,164
Average silver content (oz. per ton)	5 251	5 340	5 530
Tons zinc concentrates produced	21,854	19,281	32,535
Average zinc in zinc concentrates (per cent)	52.564	52.774	53.859
Total zinc in zinc concentrates (lb.)	22,974,345	20,350,566	35,045,757
Average silver in zinc concentrates (oz. per ton)	19,316	19,429	19,499
Mill recovery (per cent zinc recovered in zinc concentrates)	94 815	93 457	95 018
Direct mining cost per ton	$7 624	$7 000	$5 521
Direct milling cost per ton	$3 142	$3 456	$2 610
Total direct cost, mining and milling (per ton)	$10 766	$10.456	$8.131
Indirect or general costs (per ton) exclusive of freight	$0 699	$1 066	$0.497
Total costs (per ton)	$11 465	$11 522	$8.628

Development work during the period consisted of 1,658 ft. of drifting, 2,019 ft. of cross-cutting, 880 ft. of raises and winzes, 55 ft. of station cutting and 173 ft. of shaft sinking and raising, or a total development of 4,785 ft., exclusive of diamond drilling. Diamond drilling to the extent of 220 ft. was done on the 2,300-ft. level as the beginning of a comprehensive plan of diamond-drill exploration of the ground from the lower levels.

The financial results for this quarter, as compared with the previous quarters of 1920, are as follows:

	Third Quarter 1920	Second Quarter 1920	First Quarter 1920
Net value of zinc concentrates at mill	$629,953.69	$587,957.25	$1,224,548.17
Net value of lead concentrates at mill and residual values	228,365 26	177,854.27	506,301.96
Miscellaneous	16,814.28	27,619.63	19,920.18
Metal inventory and quotation [illegible]	85,000 00		...
	$960,133.23	$793,431.15	$1,750,770.31
Operating costs, depreciation, shutdown expenses, etc.	1,062 351 72	940 432 97	1,123,514.36
Profit	(a) $102,218.49	(a) $147,001.82	$627,255.95

(a) Loss.

The above statement includes charges for depreciation and shutdown expenses, but no allowance has been made for depletion or taxes. The average price used in estimating the income for the quarter was 7.6355c. per lb., but since the close of it, the market price has dropped much lower.

During and since the close of the quarter it has become increasingly evident that productive operations could not be maintained without serious loss in the face of continuing high costs and the prevailing unsatisfactory market and price for zinc. Operations have for several months been conducted on the basis of reduced output, and all possible means toward economy have been employed in an effort to limit operating losses to some moderate amount, which would be no more burdensome than the unavoidable maintenance expense in connection with suspended operations. To this end the tonnage was recently reduced to the minimum that would support continuous operation at one-half the mill, in the hope that some improvement in metal prices might justify continuing operations on a minimum scale. Such hope has proved futile, and as this report is written, the directors have decided to suspend productive operations entirely until such time as the margin between costs and selling price warrants their resumption. A skeleton organization will be maintained by employing as much of the present operating force as practicable in a development program of moderate scope. Such limited quantities of ore as it is found necessary to remove in connection with development work will be stored for future use, as milling operations will be entirely discontinued.

The El Oro Mining and Railway Co. Has Profitable Year

Gold; Mexico

The annual report and audited statement of accounts of the El Oro Mining and Railway Co. for the year ended June 30, 1920, shows a net profit of £62,946 15s. 6d. earned for the period. Out of this sum the directors declared dividend No. 29, of 5 per cent, or 1s. per share, tax free, for the year 1919-1920, which was paid on Nov. 18, 1920. Important changes in the political condition of the Republic of Mexico have taken place during the last year, and have so far had a beneficial effect on the mining and industrial situation.

The report shows that 366,730 tons of ore, having a gross value of $8.77 per ton (U. S. currency), was treated in the reduction works, producing bullion which realized $2,789,457.27 ($1,984,926.16 gold value, remainder silver), or $7.61 per ton, resulting in a net profit of $326,909, or £81,727.

Working costs show some reduction, being returned at $6.70 per ton, against $6.80 during the preceding year. Taxation is still a serious burden. The sum paid for Mexican state and federal taxes in the accounts presented, which is included in working costs, amounted to $381,017.72.

An estimate of the amount of ore in sight on June 30 last is placed at 293,779 tons, which compares with 333,135 tons on June 30, 1919. As 368,538 tons was extracted during the year, it follows that 329,182 tons of new ore was developed during that period.

The gross earnings of the company's railway during the year amounted to $236,699, against operating expenses of $92,981, leaving a profit of $143,718. This is the largest net sum earned in any one year by this department.

The Suchi Timber Co., a subsidiary, fulfills a useful and profitable purpose, and has recently distributed a dividend, tax free, of 25 per cent.

At the last general meeting, the shareholders approved the policy, then submitted by the directors, of investing the surplus funds of the company, as opportunity offered, in other mining properties in Mexico. Options have already been secured on favorable terms over two mining properties, one with a well-established record of production, and the other of more recent discovery. Both these mines offer inducement for development, and give encouragement for the belief that work thereon will be successful. Other important enterprises are now the subject of negotiations. Profit and loss account follows:

DEBIT

	£	s	d
Mining expenditure	614,667	11	0
Railway department expenditure	23,245	4	6
London expenses	2,045	13	0
Directors' fees	2,200	0	0
Depreciation of plant and machinery	25,000	0	0
Provision for the [illegible] and corporation tax	43,600	0	0
Balance carried to balance sheet	62,946	15	6
Total	773,705	4	0

CREDIT

	£	s.	d
Bullion recovered	696,394	4	8
Railway department receipts	59,181	5	8
Interest and dividends	8,543	9	10
Sundry receipts	777	7	6
Exchange profit on [illegible]	8,808	16	4
Total	£773,705	4	0

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York 1919	New York 1920	London 1919	London 1920	Sterling Exchange 1920	Sterling Exchange 1921
January	101 125	132 827	48 438	79.846	367 082	
February	101 125	131.295	48 027	85 005	337 466	
March	101.125	125.551	48 171	74.194	370 870	
April	101 125	119 779	48 886	68.848	392 438	
May	107 135	102 585	52 104	60 010	383 360	
June	110 430	90 957	53 896	51.096	393 663	
July	106 394	91 971	54.133	53 736	385 538	
August	111 370	96 168	58.835	59 875	360 404	
September	114 540	93 675	61 668	59 476	350 370	
October	119 192	83 480	64 049	54.197	346 460	
November	127 924	77 734	70 065	50 952	342 333	
December	131 976	64 774	76 432	41 845	348 101	
Year	111 122	100 900	57 059	61 590	364 840	

New York quotations cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York Electrolytic 1919	New York Electrolytic 1920	London Standard 1919	London Standard 1920	London Electrolytic 1919	London Electrolytic 1920
January	(a)	18 918	92 238	118 095	106 619	123 238
February	16 763	18 569	78 700	120 188	95 700	126 950
March	14.856	18 331	76 821	109 533	82 071	118 348
April	15.246	18 660	77 300	103 025	82 200	111 500
May	15.864	18 484	77 767	96 750	81 227	104 200
June	17.610	18 065	83 062	87 864	85 900	101 409
July	21 604	18 576	99 576	90 148	103 046	106 455
August	22 319	18 346	97 300	93 935	106 429	111 143
September	21 755	18 144	100 767	96 381		111 905
October	21 534	15 934	103 418	93 327		104 905
November	19 758	14 257	98 894	84 807		94 614
December	18 295	13 188	103 708	75 702		85 905
Year	18 691	17 456	90 796	97 480		108 839

(a) No market. New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York 1919	New York 1920	St. Louis 1919	St. Louis 1920	London 1919	London 1920
January	5 432	8 561	5 316	8 300	37 227	47 095
February	5 057	8.814	4 784	8 601	28 675	50 246
March	5 226	9 145	4 992	8 894	27 952	46 054
April	4 982	8 902	4 722	8 618	24 888	39 225
May	5 018	8 576	4 773	8 352	23 852	38 488
June	5 340	8.323	5 070	8 169	22 544	34 330
July	5 626	8 338	5 408	8 283	23 457	34 960
August	5 798	8 687	5 583	8 725	24 750	36 304
September	6 108	8.177	5 853	8 160	25 330	35 452
October	6 487	7 070	6 249	7 018	28 473	35 238
November	6 808	6 159	6 649	6 127	34 731	32 489
December	7 231	4.727	6 955	4 717	41 202	24 080
Year	5 759	7 957	5 530	7 830	28 [illegible]	37 [illegible]

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton.

Tin

	New York 1919 99%	New York 1919 Straits	New York 1920 99%	New York 1920 Straits	London 1919	London 1920
January	67 702		61 596		248 557	376 512
February	66 801		58 466	59 932	223 963	[illegible]
March	67 934		61 037	61 926	236 [illegible]	[illegible]
April	72 500	......	61 120	62 115	22[illegible]	[illegible]
May	72 500	......	53 230	55 100	234 [illegible]	294 813
June	71 240	......	46 125	48 327	238 [illegible]	[illegible]
July	68 000		45 798	49 154	[illegible]	[illegible]
August	57 226		43 856	47 620	27[illegible]	[illegible]
September	54 482		41 940	44 465	280 102	[illegible]
October	54 177		39 310	40 555	279 239	[illegible]
November	55 307		35 667	36 854	28[illegible]	241 080
December	53 870		31 135	34 058	314 [illegible]	[illegible]
Year	63 328		48 273	49 101	25[illegible]	[illegible]

New York quotations cents per lb. London, pounds sterling per long ton.

Zinc

	New York 1919	New York 1920	St. Louis 1919	St. Louis 1920	London 1919	London 1920
January	7 272	[illegible] 483	6 922	9 1[illegible]	[illegible]	[illegible]
February	6 623	[illegible]	6 273	8 [illegible]	[illegible]	[illegible]
March	6 500	[illegible]	6 150	8 [illegible]	[illegible]	[illegible]
April	6 46[illegible]	[illegible]	6 114	8 [illegible]	[illegible]	[illegible]
May	6 429	[illegible]	6 [illegible]	7 [illegible]	[illegible]	[illegible]
June	6 901	[illegible]	6 [illegible]	[illegible]	[illegible]	[illegible]
July	7 [illegible]	[illegible] 070	7 [illegible]	[illegible]	[illegible]	[illegible]
August	7 [illegible]	[illegible]	7 439	[illegible]	[illegible]	[illegible]
September	7 [illegible]	7 717	7 [illegible]	[illegible]	[illegible]	[illegible]
October	7 [illegible]		7 473	[illegible]	[illegible]	[illegible]
November	8 [illegible]		7 [illegible]	[illegible]	[illegible]	[illegible]
December	8 [illegible]		8 [illegible]	[illegible]	[illegible]	[illegible]
Year	7 [illegible]		6 [illegible]	[illegible]	[illegible]	[illegible]

New York and St. Louis quotations cents per pound. London, pounds sterling per long ton.

Antimony and Quicksilver

	Antimony (a) New York 1920	Antimony (a) New York 1921	Quicksilver (b) New York 1920	Quicksilver (b) New York 1921
January	10 577		90 192	
February	11.588		84 432	
March	11 056		92 611	
April	10 500		102 192	
May	9 655		89 560	
June	8 289		90 154	
July	7 500		90 333	
August	7 177		85 806	
September	7 113		75 000	
October	6 723		67 200	
November	6 109		58 417	
December	5 534		49 577	
Year	8 485		81 123	

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask.

Pig Iron, Pittsburgh

	Bessemer 1919	Bessemer 1920	Basic 1919	Basic 1920	No. 2 Foundry 1919	No. 2 Foundry 1920
January	$33 60	$40 47	$31.40	$39 88	$32 40	$39 86
February	33 60	42 95	31 40	42 61	32 40	43 40
March	32 54	43 40	31 40	42 90	29 12	43 40
April	29.35	43 72	27.15	44 22	28 15	43 90
May	29 35	44 00	27.15	44 88	28 15	45 36
June	29 35	44 89	27 15	45 41	28 15	46.40
July	29 35	47 21	27 15	47 42	28 15	46 56
August	29 35	48 90	27 15	49 88	28 15	49 35
September	29 35	50 46	27 15	50 46	28 15	51 96
October	29 35	49 21	27 15	44 38	28 30	48 58
November	31 60	41 26	31 56	39 20	32 16	42 61
December	36 57	36 96	35 32	34 90	36 86	37 73
Year	$31.11	44.45	$29 26	43 85	$28 35	44.93

In dollars per long ton.

Monthly Crude Copper Production, 1920

	August	September (a)	October (a)	November
Alaska shipments	5,762,551	1,635,677	4,984,219	12,802,696
Arizona Copper	3,000,000	3,000,000	2,800,000	2,800,000
Calumet & Arizona	5,200,000	4,292,000	3,802,000	3,486,000
Con. Ariz. Smelting	975,000	950,000	865,000	750,000
Inspiration	7,200,000	6,500,000	7,000,000	5,350,000
Magma	556,760	663,219	750,814	671,752
Miami	4,630,725	4,549,140	4,582,293	4,505,232
New Cornelia	3,842,000	3,314,000	3,450,000	2,670,000
Old Dominion	2,802,000	1,957,000	2,912,000	2,563,000
Phelps Dodge	5,875,000	6,381,000	5,309,000	5,492,000
Shattuck Arizona	194,003	166,513	206,772	6,063
Ray	4,505,000	4,502,000	3,990,800	3,975,000
United Verde	5,125,000	4,837,000	5,858,000	4,030,000
United Verde Extension	5,805,568	3,327,644	3,864,756	2,642,812
Calumet & Hecla	7,520,107	7,278,215	7,945,502	7,326,763
Other Lake Superior	6,000,000	6,000,000	6,000,000	6,000,000
Anaconda	11,800,000	11,100,000	11,000,000	11,100,000
East Butte	1,566,800	1,634,260	1,626,980	1,658,860
Nevada Cons.	4,650,000	4,650,000	3,850,000	3,950,000
Chino	4,000,140	5,161,894	3,933,435	4,000,000
Utah Copper	4,820,000	8,420,000	8,000,000	9,120,000
Eastern Smelters	1,600,000	1,600,000	1,600,000	1,600,000
Others, estimated	15,000,000	13,000,000	10,900,000	10,200,000
Total United States	116,430,634	104,919,262	105,231,571	[illegible] 178
Imports, Ore and concentrates, etc.	11,640,0[illegible]	10,132,777	9,626,502	
Imports, bullion, blister, etc.	20,320,824	20,428,866	24,559,763	
Grand total	147,7[illegible]	135,480,905	139,4[illegible]	
British Columbia:				
Granby Cons.	2,471,200	2,239,174	[illegible]	[illegible]
Mexico:				
Boleo	618,590	440,120	[illegible]	[illegible]
Cananea	3,500,000	3,500 000	3,500,000	3,500,000
Phelps Dodge Mexican properties	2,490,000	1,617,[illegible]	[illegible]	[illegible]
Other foreign:				
Cerro de Pasco	4,440,000	4,360,000	4,698,000	3,612,000
[illegible]	10,640,000	9,4[illegible]	[illegible]	[illegible]
[illegible]	4,615,1[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1,580,000	[illegible]	[illegible]	[illegible]

Comparative annual copper production follows:

	1918	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

MINING STOCKS

Week Ended January 1, 1921

COPPER

Stock	Exch.	High	Low	Last	Last Div.	
Adventure	Boston	*60	*55	*60		
Ahmeek	Boston	45	40½	45	Sept.'20, Q	.50
Alaska-B.C.	N. Y. Curb	7/16	⅜	7/16		
Allouez	Boston	18	16½	18	Mar.'19,	1.00
Anaconda	N. Y.	35	30½	33⅞	Nov. '20, Q	1.00
Ariz. Com'l	Boston	6¼	5⅝	6¼	Oct. '18,	.50
Big Ledge	N. Y. Curb	⅜	¼	⅜		
Bingham Mines	Boston	9½	9½	9½	Sept. '19, Q	.25
Calumet & Ariz.	Boston	42	39¾	41	Dec.'20, Q	1.00
Calumet & Hecla	Boston	250	210	250	June '20, Q	5.00
Canada Copper	N. Y. Curb	*13	*11	*13		
Centennial	Boston	....	....	6½	Dec. '18, SA	1.00
Cerro de Pasco	N. Y.	26¼	24¼	26½	Dec. '20, Q	1.00
Chief Consol	Boston Curb	2⅝	2½	2½	Nov. '20, Q	.10
Chile Copper	N. Y.	9¾	8⅝	9¼		
Chino	N. Y.	19⅞	16⅞	19¾	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*32½	*32½	*32½		
Con. Ariz.	N. Y. Curb	....	....	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	1¼	1	1⅜		
Copper Range	Boston	27	25	26¾	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*41	*32	*36		
Davis-Daly	Boston	5¼	4⅞	5¼	Mar. '20, Q	.25
East Butte	Boston	8	7¼	8	Dec. '19, A	.50
First Nat'l	Boston Curb	*70	*56	*65	Feb. '19, SA	.15
Franklin	Boston	2½	2¼	2½		
Gadsden Copper	N. Y. Curb	*26	*20	*25		
Granby Consol	N. Y.	17¾	15⅞	17¾	May '19, Q	1.25
Greene-Cananea	N. Y.	19	16	19	Nov. '20, Q	.50
Hancock	Boston	2⅞	2	2		
Houghton	Boston Curb	....	...	*35		
Howe Sound	N. Y. Curb	2¾	2⅝	2⅝	Oct. '20, Q	.05
Inspiration Con.	N. Y.	32	28	31½	Oct. '20, Q	1.00
Iron Cap	Boston Curb	6⅛	6	6⅛	Sept. '20, K	.25
Isle Royale	Boston	16½	15	16½	Sept. '19, SA	.50
Kennecott	N. Y.	17½	15	17¼	Dec. '20, Q	.50
Keweenaw	Boston	1⅜	1⅛	1⅛		
Lake Copper	Boston	2	1½	1½		
La Salle	Boston	1⅜	1¼	1¼		
Magma Chief	N. Y. Curb	....	....	*21		
Magma Copper	N. Y. Curb	16¼	15⅝	15⅞	Jan. '19, Q	.50
Majestic	Boston Curb	*15	*7	*8		
Mason Valley	Boston	....	....	*90		
Mass Consol	Boston	2	1¾	1¾	Nov. '17, Q	1.00
Mayflower-O.C.	Boston	3⅞	3½	3⅞		
Miami	N. Y.	15½	14½	15¼	Nov. '20, Q	.50
Michigan	Boston	2½	1¾	2¼		
Mohawk	Boston	43½	40½	43½	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5⅜	5⅛	5⅜		
Nevada Con.	N. Y.	9¾	8½	9¾	Sept. '20, Q	.25
New Arcadian	Boston	....	....	2½		
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	14¼	13½	13¾	Aug. '20,	.25
Nixon Nev	N. Y. Curb	....	....	*5		
North Butte	Boston	9¼	8	8⅞	Oct. '18, Q	.25
North Lake	Boston	*40	*25	*40		
Ohio Copper	N. Y. Curb	....	....	3/16		
Ojibway	Boston	....	....	1½		
Old Dominion	Boston	16¼	15	15⅜	Dec. '18, Q	1.00
Osceola	Boston	23½	20½	22½	June '20, Q	.50
Phelps Dodge	Open Mar.	†175	†150	....	Oct. '20, Q	2.50
Quincy	Boston	35¾	34¾	35	Mar. '20, Q	1.00
Ray Con.	N. Y.	11⅝	10⅞	11½	Dec. '20, Q	.25
Ray Hercules	Boston Curb	....		*50		
St. Mary's M. L.	Boston	29	25¾	28	June '20, K	2.00
Seneca Copper	Boston	16¾	16	16¼		
Shannon	Boston	0.75	0.50	0.75	Nov. '17, Q	.25
Shattuck Ariz.	N. Y.	4⅞	4	4½	Jan. '20, Q	.25
South Lake	Boston	1	1	1		
South Utah	Boston	*4	*4	*4		
Superior Copper	Boston	3¼	2¾	3¼	Apr. '17,	1.00
Superior & Boston	Boston	1½	1½	1½		
Tenn. C. & C.	N. Y.	7½	6½	7½	May '18, I	1.00
Tuolumne	Boston	*40	*35	*35	May '13	.10
United Verde Ex.	Boston Curb	23	22½	23	Nov. '20, Q	.50
Utah Consol.	Boston	3½	2½	3	Sept. '18,	.25
Utah Copper	N. Y.	50½	45½	50½	Dec. '20, Q	1.50
Utah M. & T.	Boston	*95	*85	*90	Dec. '17,	.30
Victoria	Boston	1½	1½	1½		
Winona	Boston	*45	*25	*45		
Wolverine	Boston	9	8	9	Jan. '20, Q	.50

LEAD

Stock	Exch.	High	Low	Last	Last Div.	
Hecla Mining	N. Y. Curb	3¾	3½	3½	Dec. '20, QX	.15
St. Joseph Lead	N. Y.	12	11½	12	Dec. '20, QX	.50
Stewart	Boston Curb	.		*6	Dec. '15,	.05
Utah Apex	Boston	3	2¾	3	Nov. '20, K	.25

ZINC

Stock	Exch.	High	Low	Last	Last Div.	
Am. Z. L. & S.	N. Y.	8½	6	7½	May '17,	1.00
Am. Z. L. & S. pf.	N. Y.	30	28½	29	Nov. '20, Q	1.50
Butte C. & Z.	N. Y.	4½	4	4½	June '18, I	.50
Butte & Superior	N. Y.	11½	8½	10	Sept. '17,	1.25
Callahan Z.-L.	N. Y.	5	4	4½	Dec. '20, Q	.50
New Jersey Z.	N. Y. Curb	130	127	130	Nov. '20, Q	4.00
Success	N. Y. Curb	*3	*1	*3	Feb. '16,	.03
Yellow Pine	Los Angeles	‡....		*45	June '20, Q	.03

*Cents per share. †Bid or asked. ‡Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bimonthly. K, Irregular. I, Initial. X, Includes extra.

GOLD

Stock	Exch	High	Low	Last	Last Div.	
Alaska Gold	N. Y.	1	¾	⅞		
Alaska Juneau	N. Y.	1¼	⅞	1		
Carson Hill	N. Y. Curb	....	....	22¼		
Cresson Consol. G.	N. Y. Curb	....	....	1¼	June '20, Q	.10
Dome Ex.	Toronto	...	†*38	*41		
Dome Mines	N. Y.	10⅜	9½	10¼	Oct. '20, Q	.25
Golden Cycle	Colo. Sprgs.	‡....	....	*73	Dec. '20, Q	.02
Goldfield Con.	N. Y. Curb	*6	*4	*5	Dec. '19,	.05
Hedley	Boston	....	....	4¼	June '19,	.10
Hollinger Con.	Toronto	5.55	5.40	5.55	Dec. '20, BM	.05
Homestake	N. Y.	50	49½	50	Sept. '19,	.50
Kirkland Lake	Toronto	....	....	*39		
Lake Shore	Toronto	1.05	1.05	1.05	Oct. '20, K	.02
McIntyre-Porcupine	Toronto	1.81	1.76	1.79	Sept. '20, K	.05
Porcupine Crown	Toronto	*17	*17	*17	July '17,	.03
Portland	Colo. Sprgs.	‡....	....	*60	Oct. '20, Q	.01½
Reorgan. Booth	N. Y. Curb	*3½	*2	*3	May, '19,	.05
Silver Pick	N. Y. Curb	*4	*3	*4		
Teck Hughes	Toronto	*10	*10	*10		
Tom Reed	Los Angeles	‡....	....	1.22	Dec. '19,	.02
United Eastern	N. Y. Curb	2½	2	2 3/16	Oct. '20, Q	.15
Vindicator Consol.	Colo. Sprgs.	‡....	....	*18	Jan. '20, Q	.01
West Dome Consol.	Toronto	*8	*7⅛	*8		
White Caps Min.	N. Y. Curb	*5	*3	*4½		
Yukon Gold	Boston Curb	*50	*50	*50	June '18,	.02½

SILVER

Stock	Exch	High	Low	Last	Last Div.	
Arizona Silver	Boston Curb	*20	*17	*18	Apr. '20, M	.03
Beaver Con.	Toronto	*27½	*25¾	*25¾	May '20, K	.03
Coniagas	Toronto	....	....	2.00	Nov. '20, Q	.12½
Crown Reserve	Toronto	*16	*15	*16	Jan. '17,	.05
Kerr Lake	Boston	2⅛	2⅛	2⅛	Oct. '20, K	.12½
La Rose	Toronto	....	....	*22	Apr. '18,	.02
McKinley-Dar.	Toronto	....	....	*24	Oct. '20, Q	.03
Mining Corp.	Toronto	....	....	1.00	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	7¾	7	7⅝	Oct. '20, QX	.50
Ontario Silver	N. Y.	4½	4¼	4½	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	11/16	7/16	⅝	Jan. '12,	.10
Peterson Lake	Toronto	....	....	*9	Jan. '17,	.01¼
Temiskaming	Toronto	....	....	*25	Jan. '20, K	.04
Trethewey	Toronto	*17	*15¾	*15¾	Jan. '19,	.05

GOLD AND SILVER

Stock	Exch	High	Low	Last	Last Div.	
Atlanta	N. Y. Curb	*1½	*½	*1½		
Barnes-King	Butte	‡....	....	1 11	Aug. '20, Q	.05
Bost. & Mont.	Boston	....	....	*63		
Cashboy	N. Y. Curb	*5	*3½	*3½		
El Salvador	N. Y. Curb	½	⅜	7/16		
Jim Butler	N. Y. Curb	*18	*16	*17	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*5½	*4	*4½	June '16,	.05
Louisiana Con.	N. Y. Curb	¼	⅛	¼		
MacNamara M.	N. Y. Curb	7/16	⅛	3/16	May '10,	.02½
N.Y.-Hond. Rosar.	Open Mar.	†11	†9	....	Oct. '20, QX	.50
Tonopah-Belmont	N. Y. Curb	1 7/16	1¼	1 5/16	Oct. '20, Q	.05
Tonopah-Divide	N. Y. Curb	1 3/16	1	1⅛		
Tonopah Ex.	N. Y. Curb	1⅜	1 3/16	1⅜	Oct. '20, Q	.05
Tonopah Mining	N. Y. Curb	1½	1¼	1⅜	Oct. '20, SA	.05
West End Con.	N. Y. Curb	1	⅞	1	Dec.'19, SA	.05

SILVER-LEAD

Stock	Exch	High	Low	Last	Last Div.	
Caledonia	N. Y. Curb	*17	*15	*16	July '20, M	.01
Consol. M. & S.	Montreal	19	16½	17¾	Oct. '20, Q	.62½
Daly Mining	Salt Lake	....	....	2.00	July '20, Q	.10
Daly-West	Boston	....	....	3	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	....	....	2⅛	Dec. '20, K	.25
Electric Point	Spokane	‡....	....	*5	May '20, SA	.03
Fed. M. & S.	N. Y.	7½	6	7½	Jan. '09	1.50
Fed. M. & S. pf.	N. Y.	22¾	21¾	22	Dec. '20, Q	1.75
Florence Silver	Spokane	‡....	....	*14	Apr. '19,	.01½
Grand Central	Salt Lake	....	....	*37½	June '20, K	.03
Iron Blossom	N. Y. Curb	*18	*16	*16	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	3.00	2.92½	2.92½	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*8	*7	*8		
Prince Consol.	N. Y. Curb	⅜	¼	¼	Nov. '17,	.02½
Rambler-Cariboo	Spokane	‡..	..	*7½	Feb. '19,	.01
Rex Con.	N. Y. Curb	*5	*3½	*4		
South Hecla	Salt Lake	*65	*65	*65	Sept. '19, K	.15
Stand. S. L.	N. Y. Curb	3/16	3/16	3/16	Oct. '17,	.05
Tamarack-Custer	Spokane	‡...	....	1.80	Dec. '19, K	.03
Tintic Standard	Salt Lake	3.40	3.10	3.32½	June '20, Q	.10
Wilbert Mining	N. Y. Curb	*2	*½	*2	Nov. '17,	.01

NICKEL-COPPER

Stock	Exch	High	Low	Last	Last Div.	
Internat'l Nickel	N. Y.	13¼	12	13¼	Mar. '19,	.50
Internat'l Nickel, pf.	N. Y.	78½	78½	78½	Nov. '20, Q	1.50

QUICKSILVER

Stock	Exch	High	Low	Last	Last Div.	
New Idria	Boston	*45	*35	*35	Jan. '19,	.25

TUNGSTEN

Stock	Exch	High	Low	Last	Last Div.	
Mojave Tungsten	Boston Curb	....	..	*5		

VANADIUM

Stock	Exch	High	Low	Last	Last Div.	
Vanadium Corp.	N. Y.	34½	28½	33	Oct. '20, Q	1.50

ASBESTOS

Stock	Exch	High	Low	Last	Last Div.	
Asbestos Corp.	Montreal	....	...	82	Oct. '20, Q	1.50
Asbestos Corp. pf.	Montreal	....	....	92½	Oct. '20, Q	1.75

MINING, SMELTING AND REFINING

Stock	Exch	High	Low	Last	Last Div.	
Am. S. & R.	N. Y.	36	29½	36	Dec. '20, Q	1.00
Am. S. & R. pf.	N. Y.	76	64½	76	Dec. '20, Q	1.75
Am. Sm. pf. A	N. Y.	61½	61	61	Oct. '20, Q	1.50
U. S. Sm. R. & M.	N. Y.	33	29¾	33	Oct. '20, Q	1.50
U. S. S. R. & M. pf.	Boston	43½	40½	43½	Oct. '20, Q	.87½

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Postponing Assessment Work

IN THE last hours of the old year Congress passed the bill giving six months' extension to miners for doing the annual assessment work necessary for holding their claims. Just previous to its passage Senator Thomas, of Colorado, remarked that if the bill did not pass he would be quite reconciled to the fact, as he had been receiving so many letters and telegrams from miners in his state, protesting against its passage.

We have never advocated this measure, and such comment as we have received from the mining states of the West has been uniformly unfavorable to it. It appears to be a statute designed to win the favor of a certain group of citizens, without cost to the country, but the proponents erred in the failure to reflect and to investigate. During the war the obligation of the annual assessment work was properly postponed on account of the fact that a large number of claim holders were in the service; and later the principle was extended because of the difficulty of obtaining labor. None of these reasons excuse the most recent legislation. The soldiers are long since back on their jobs; and for the last few months unemployment has been growing in a most alarming way. There have been plenty of men eager to do the $100 worth of work necessary to hold a claim; but the claim owners, as one correspondent put it for his section of Nevada, were glad to save the money and spend the winter in California on it. Therefore, this foolish legislation served to aggravate the present unemployment evil.

But the crowning stupidity, as a Colorado correspondent points out, was to pass the bill in the last hours of 1920, when all miners, prospectors and other owners of mining claims, who thought enough of their claims to hold them, had already faithfully carried out the assessment work required by the law. [illegible] and hard-working individuals (and they are in the majority) look with no favor upon the Government pull which assisted the gamblers in mining claims, who would not think of spending any money [illegible] them, but also rely upon Congress, [illegible] to keep them in possession of Government land without labor or expense.

Present Misery and Future Hopes

TURNING to the misfortunes of [illegible] though a poor one, to alleviate [illegible] Those of us engaged in the mining [illegible] are suffering unduly, but we are [illegible] other basic industries the [illegible] have fallen below their [illegible] you like to be in the rubber [illegible] present price [illegible] per lb., compared [illegible] spring of 1914 [illegible] All producers and manufacturers are affected by present conditions, and the metal industry is no worse off than some others are.

The future in decidedly indefinite. With each drop in copper we try to think the bottom has been reached; and each time we are disappointed. Until copper is shipped abroad in much greater quantities than at present, an improvement is unlikely. Large stocks, estimated at close to one billion pounds, are hanging heavy over the market. Some people, both abroad and at home, seem to derive considerable pleasure from criticizing the policy which permitted the piling up of these stocks. The hindsight of these critics is excellent—would that it could be put to profitable use! The fact is simply that the copper producers made as intelligent a guess as was possible in this muddled world—and guessed wrong. Why blame them now? After all, they are the best copper producers that we have.

Fortunately, other metals are not troubled with the bugbear which faces copper, but still it is too much to expect prices to advance greatly for six months at least. It looks as if about the best we can hope for is a reduction in wages, fuel and necessary supplies which will permit us to get along even though prices are low. Students of business conditions, however, expect a pronounced improvement in the early fall.

Lodes and the Law I Sing

WHEN things get dull in the mining fraternity, when mines shut down, and the mills stop grinding, and no sales are reported in the copper market, it will always be possible to set off a few fireworks by criticizing the really positively abominable system which has been devised to decide the apex law problems. Our amateur editorial in the issue of Nov. 18 has borne fruit manifold. We have to thank Mr. Horace Winchell for a satisfying citing of authorities [illegible] to prove that a [illegible] entirely unnecessary, so far as we are concerned. Were we inclined to look for further authority in this matter, we should prefer Mr. Winchell [illegible] that he has cited.

They are dreadfully acute [illegible]. Mr. Winchell nail [illegible] to the wall [illegible] which lie between the limestone." Very bad, of course; we shall speak to the proofreader [illegible] Mr. Ross H. Sales, in a letter which we publish [illegible] [illegible] "The [illegible] of the vertical vein with the limestone," which, it appears, [illegible] this [illegible] geological phenomenon [illegible] and at the same time [illegible] We are confused about this, [illegible] the witness stand. We realize that we must have made so a break," but will somebody whisper us the answer? "Is it any wonder," he says, "that it cost two mining companies over half a million dollars, trying to make the geology in the case clear?" Oh, no, indeedy—say, who got the half million?

Mr. Winchell and Mr. Sales, and Mr. Robinson in his courteous letter which we published Dec. 25, all assume that the final decision to which we all bow is a court decision. But we were not discussing the matter with the lawyer's mind and standards, but those of the geologist and engineer. Equity, not decisions; common-sense, not argument; what should be, not what is and has been. The very fact that we criticized at all should have made this clear to them. And, therefore, the case cited by Mr. Sales where the view was "upheld by the court" that a body of unmineralized quartzite 200 to 500 ft. thick, with the sky for a hanging wall, was a lode, appeals to us as probably also very messy, although we know only what he tells us about it.

The general case for apex litigation, from our viewpoint, is put in a private letter from a distinguished engineer, whose name we have not the authority to state:

"I agree with you—a bed of limestone that happens to be the locus of increased mineralization is not a vein. Would it be a vein a hundred miles away from the mineralization? If you don't look at it from a geological point of view, how *are* you to look at it? Is a vein to be merely what you can persuade a court to say it is? On the other hand, I have always felt that intelligent men should not refrain from trying to make the best they can out of the apex law. Stupid men certainly would do no better. But I have never liked the idea of a man surrendering his independent and detached judgment to the claims of partisanship. In these apex cases, it is almost impossible to avoid becoming a partisan and a special pleader. That is not only my observation but my experience. That is not a candid attitude toward the truth. The pursuit of the truth is not just scientific exaltation; it is practical common sense—the process of getting things right."

Ownership of American Smelting & Refining Co.

THE Eilers-Guggenheim controversy concerning the management of the affairs of the American Smelting & Refining Co. is interesting and enlightening, at least in the partial list of stockholders of the company taken on the same date (April 1) in 1919 and 1920, which Mr. Eilers has presented. This will be a shock to common understanding and tradition. The miner who sells his ore to the A. S. & R. smelters, and kicks about the smelter charges, sometimes pictures the members of the Guggenheim family as taking a tribute on his labor and enterprise, and maintaining themselves in luxury therefrom. The public who hears about the "smelter trust" and the journals that quote the "trust price" for lead, doubtless visualize this great mining and smelting organization as in the main owned and controlled by the celebrated family of financiers.

Certainly, Mr. Eilers' revelations are as rude as those of the boy who in our tender years informed us that there was no Santa Claus, so woven into the web of our lives and economic theories is the time-honored conception. To be informed that Mr. Daniel Guggenheim owned on the dates mentioned only one hundred shares of common stock, value now three or four thousand dollars, is cruel; and that Mr. Isaac Guggenheim controlled on April 1, 1919, to the extent of one share of preferred stock, to the present value of eighty dollars! Surely any one of our readers can attain the same proud position, and any little group of them can, if they wish, control more shares than the number given for the whole Guggenheim family.

And the same thing is true of all the other directors and officers of the company. Mr. Eilers and his family made by far the largest showing in his entire list, but even the Eilers' holdings of something more than three thousand shares of preferred stock are only a tiny fraction of the shares of stock outstanding, and the total amount which he gives as owned by the entire list of officers is relatively negligible.

Again, what a surprise it will be to those who believe that the smelters, by virtue of their multiplicity and their organization, are enabled to profiteer on the miner, to find that the rake-off has not been sufficient to induce the Guggenheims to put much of their own money in the enterprise—with the corollary that they can make more profitable use of their capital elsewhere!

Who is it, then, that owns the great smelting company, and to whose pockets come its profits? Apparently, the general investor, the public; almost, we were tempted to state, the Common Peepul. These draw the 7 per cent on their holdings of preferred stock and 4 per cent on the common, and pray for the stock market to rise, so that they can sell out at a profit.

It must be added, however, to the picture as presented by Mr. Eilers, that according to the later statement of Mr. Newhouse, chairman of the board of directors of the company, in reply to Mr. Eilers, the present holdings of the Guggenheim family are far larger than they are shown in Mr. Eilers' statement, which he gives only for the two dates mentioned. According to Mr. Newhouse, their holdings of common and preferred stock amount to over 36,000 shares, and the total of over 28,000 shares of this amount, held by Mr. Simon Guggenheim, makes him the largest single stockholder in the company. Thirty-six thousand shares represents, of course, a tidy little fortune, but is not relatively of much consequence in a total amount outstanding of 1,110,000 shares—a little over 3 per cent; and incidentally, it probably represents far less than 1 per cent of the total wealth of the family—so that our reflections as to the real ownership of the smelting company remain.

Lenine and Vanderlip

THAT our diagnosis of the Washington B. Vanderlip incident in our editorial of Dec. 25 was correct has been confirmed by no less an authority than Lenine himself. The Bolshevik Premier's speech, before the convention of the Communist party recently held in Moscow, has been reported in full in the official Bolshevik *Krasnaya Gazetta*, and from there to our daily press:

"Our granting of concessions to the American millionaires will serve to make relations between Japan and America more strained," said Lenine. "There is already talk in Japan that Russia is driving it to war with America. We shall utilize their conflict for our own interests. By signing concession agreements with the bourgeoisie we gain a moral as well as material victory."

Also, Lenine remarked that "the world revolution, by whose aid alone we can win, does not mature at the speed we hoped for in the beginning." Hence, the necessity of little diplomatic moves, and the subsidizing of propagandists like Vanderlip!

WHAT OTHERS THINK

Cost of Copper in 1921

I was attracted by your general review entitled "Curtailment in the Copper Industry" appearing on p. 1154 of your issue for Dec. 11, 1920. At that place you noted Mr. Finlay's estimate that in 1910 no copper could be produced in North America at a profit for less than 10c. per lb., then left the reader to infer what must be the plight of the industry at present with copper at 13c.

Permit me to suggest that you have not laid enough emphasis upon improvements in technology as a means of reducing costs, in spite of decreasing ore-tenor and increasing prices for labor and materials. It is the pride of all thoughtful engineers who have been engaged in the copper industry that they and the business men behind them have at no time been content to settle back in their easy chairs and contemplate the art of getting copper as a thing of perfection. Mr. Finlay's remarks to the effect that 10c. represents the cheapest copper, 11c. cuts off half the production, and 12c. would barely cover costs of most of the copper are as applicable to 1900 and even to 1890 as they are to 1910. And remember that in 1890 "first-class ore" meant what "matte" means now; concentrating ore carried from 7 to 10 per cent copper; millmen were receiving 25c. per hour and Bradstreet's index of prices for wholesale commodities was about 8!

When viewing the honorable history of the engineer engaged in copper mining and metallurgy, it involves no great strain upon the credulity to state that Mr. Finlay's remarks will still hold, if not for 1920 despite its 1 per cent concentrating ore and Bradstreet's index of 19, then for some time in the not distant future.

It may be remarked, however, that it is unnecessary to estimate across a lapse of ten years, in arriving at an idea of the present cost of copper. You are undoubtedly familiar with the fact that the Federal Trade Commission has published a pamphlet on the cost of copper in 1918, based on uniform reports covering 95[illegible] per cent of the total United States production for twelve months. In view of the comprehensiveness of this inquiry, and its undoubted accuracy, it seems that it may form the basis of a more definite estimate of the condition among copper producers.

In scaling down from the 1918 estimates, however, it may be questioned whether 1918 actually represented the peak of the cost of copper. It was the last war year, labor was scarce and independent, and commodities were very high. Yet production was at a high rate of speed, and has recently been at a much lower rate.

We may examine the quarterly reports of Utah Copper Co. for information on this head, and note the following tabulation. (Cost is less miscellaneous income, and does not include Federal income and profits taxes.)

Period	Cost, Cents	[illegible]	[illegible]	[illegible]
Year 1918	12.[illegible]	1.[illegible]	[illegible]	[illegible]
Year 1919	1[illegible]	[illegible]	[illegible]	[illegible]
[illegible] June 1920	11.[illegible]	1.22	[illegible]	[illegible]

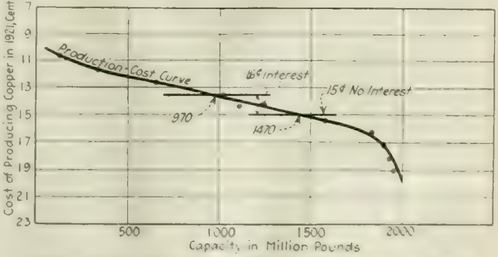
Increase in extraction and other economies have evidently kept down the costs despite low output. If Utah Copper may be taken as a representative, it is safe to assume that 1918 saw the peak of copper costs.

According to the Federal Trade Commission's report, the weighted average cost of all American copper in 1918 was:

	Cents per Lb.
Labor	$0 0531
Materials and supplies	0376
Overhead	.0214
Depreciation	0094
Depletion	.0072
Tolls	0500
Total	$0 1787
Less credits	0171
Net cost	$0 1616

This is exclusive only of interest, and Federal excess-profits and income taxes.

In making a prediction as to the cost of copper in 1921, these items may be considered separately.



ESTIMATED COST OF PRODUCING COPPER IN 1921

Labor has already shown an increase in efficiency of at least 10 per cent, and wage decreases averaging at least 15 per cent will be in effect early in 1921. Cost of labor in 1921 will certainly be no higher than 4.10c. per lb. copper.

Bradstreet's index value for wholesale commodities averaged 18.7117 in 1918, whereas in December, 1920, it stood at 13.6263. However, it is unfair to use these figures as they stand. Coal and coke are used in large tonnage in getting copper. They have increased in price since 1918 rather than decreased. On the other hand, timber and locally obtained supplies will decrease roughly proportional to the decrease in labor costs. A great deal of fuel and power comes in this category. On the whole, it may be approximately correct to figure "Materials and Supplies" used in getting copper in 1921 to an index number of 16, which reduces the value to 3.22c. per lb. copper.

Overhead tends to go up with decreasing production. However, it should be noted that the low-cost producers quote low values for overhead, and they are the only ones who will operate in 1921. Every effort will be made to keep down overhead, and it undoubtedly will be no higher than in 1918.

Depreciation depends upon value of the investment and its use. If it were figured entirely upon investment, the amount per pound of copper would vary inversely as the output; if entirely upon the use of the equipment, the amount per pound of copper would remain stationary. A happy balance is necessary. It should also be remembered that 1918 was a good year to charge heavy sums to depreciation, both on account of short-lived rush construction, and the excess-profits tax. It is thought that this item will not increase in 1921 to much more than 1c. per lb. of copper.

Depletion is a fixed charge against a pound of copper.

Tolls will naturally decrease, as the labor and materials required to perform such service will decrease. However, this may be balanced by increase in freight rates, so let the value remain unchanged.

Credits, largely due to sales of byproduct silver, will decrease. In 1918 the price of silver was 97c. per oz.; if it be assumed to be 70c. in 1919, the amount of credit figures to 1.23c. per lb. of copper.

For the above reasons it appears that the average cost of copper in 1921 for all the producers reporting in 1918 will be conservatively:

Labor	$0.0410
Materials and supplies	.0322
Overhead	.0214
Depreciation	.0100
Depletion	.0072
Tolls	.0500
	$0.1618
Less credits	.0123
Net cost	$0.1495

This represents a decrease of 7½ per cent from that of 1918.

Table I of the Trade Commission's report gives a tabulation of the quantities of copper produced in 1918 at different rates per pound. The graph curve on p. 91 is derived from this data by decreasing the costs 7½ per cent, and plotting the cumulative quantities; and may be used to show the capacities available at any selling price. From this curve it appears directly that 1,470,000,000 lb. yearly capacity is available in America in 1921, and the product may be sold for 15c. per pound at Atlantic seaboard, if the stockholders are willing to forego dividends in order to keep together their operating forces and to remain as a going concern. And 970,000,000 lb. of that copper can be got at a cost which, if sold for 15c., would pay 6 per cent interest on the investment (27c. invested for each pound yearly capacity).

The year 1921 will doubtless be a lean one for dividends from coppers (and lean ones usually follow fat ones), but there seems no likelihood that the industry will die of starvation. The combined incidence of lower labor and commodities and improved organization, mining, and metallurgy should set the market on a new and stable foundation.

E. E. THUM.

New York, N. Y.

Ouija and the Water Witch

It sounds like the title of a fairy tale, doesn't it? And some of the stories of water witching are just as interesting as a fairy tale—and just as true. Having had some experience in the study of underground waters, I have been much interested in the articles on divining rods that have appeared recently in *Engineering and Mining Journal*.

J. H. Eby's article, "The Forked Stick and Structural Geology," in the issue of Dec. 11, is of particular interest as being the first instance that I have seen of an attempt to correlate the revelations of the divining rod with scientific deductions. I agree with Mr. Eby that "there are more things in heaven and earth than engineers have ever dreamt of," and I confess to having felt some mysticism at times over instances I have known of manifestations of the divining rod and to have wondered if possibly there was something to the use of this instrument.

A Swiss has invented a so-called water finder that works on the principle of a galvanometer and is based on a theory that magnetic lines of force follow underground water strata. In Norway, Hertzian waves have been used in locating orebodies. An instrument projects waves into the ground, which, on coming in contact with a metallic orebody, are reflected. A receiving instrument is moved about until it intercepts the reflected rays, and the position of the orebody is calculated from the distance between the two instruments and the angle at which the rays were projected into the ground. This is a demonstrated phenomenon and is scarcely more than a step beyond the dipping needle, the practicability of which is unquestioned. Assuming that such lines of force exist as are claimed in connection with the water finder, can it be that there are some human bodies that are sensitive to them, as the galvanometer responds to an induced current? Personally, I think not, but "there are more things," etc.

The psychological theory is the reasonable one, and water witching can properly be classed with table tipping and the workings of the ouija board. Mr. Eby makes something of a point of the fact that the forked stick would not work when he wanted it to, and vice versa, but that confirms the theory rather than disproves it, as the forked stick works under the direction of the subjective and not the objective mind. Have not all of us resolutely asserted to ourselves that such and such a thing was so when back in our minds an insistent small voice told us that it wasn't? It is of such stuff that hunches are made, and the hunch is now a recognized scientific fact. Likewise, the intuition of woman, which is no longer considered the joke that it was a generation ago.

Being of a somewhat matter-of-fact disposition, I never could get any "kick" out of the forked stick, but I have had some success with the ouija board, and I quite well remember a friendship which, some years ago, was rapidly progressing beyond the "warm" stage, but which reached an abrupt termination when Ouija insisted on making some embarrassing revelations not only contrary to my will but also to my efforts. Many of us have witnessed the phenomenon of "table tipping." I have seen such a demonstration when four men were powerless to keep the table on the floor, so quite evidently it is not the conscious mind that controls in these manifestations.

Naturally the question arises, "How did Mr. Eby as a fourteen-year-old boy locate conditions that were beyond his knowledge at that time?" The logical answer is to be found in either telepathy or heredity, or both. He tells us that he had an elementary knowledge of geology, and it is entirely within the range of demonstrated phenomena that his mind might have been guided by an inherited knowledge not yet brought to the surface, or by the knowledge of someone else who was familiar with the geological conditions. If the latter, such knowledge might have been communicated wholly unconsciously to both parties or even between persons unknown to each other.

The most wonderful thing that Nature ever created, and the one of which we know the least, despite our boasted scientific progress, is the human mind. Beside it, such subjects as water witching are as the a b c's and the intricacies of geology are of the elementary grades. Its mysteries will be the last that science will unlock, and when she has done so there will be few things in heaven and earth that we have not only dreamt of, but understood. LEROY A. PALMER.

San Francisco, Cal.

Electrical Smelting in Norway

In your issue of Oct. 30, I find in an article by Matthew R. Blish, entitled "The Mining and Metallurgical Industry of Norway," under the heading "Copper Industry Suffering From High Costs," the following passage: "One company, the Sulitjelma mine, is experimenting now on an electrical method."

This is not quite correct. The electrical method used in Sulitjelma has been in actual work for several years, and is in fact past the experimental stage. Many thousand tons of ore were smelted during the war in the electrical furnace, with very good technical and economical results. At present the whole smelting plant in Sulitjelma is shut down; not on account of inefficiency of the methods used, but because the high price of sulphur in the ore, in connection with the high wages and other operating charges, makes it more profitable for the company to sell the sulphur to the sulphuric-acid producers, wood-pulp factories, and other users of the material.

The "Westly electric smelting method" is patented in most countries. The company owning the method has its office in Solligaten 1, Kristiania, Norway, and will be glad to give all further information.

Kristiania, Norway. HOLM HOLMSEN.

The McFadden Bill

In a circular entitled "The Industrial Gold Consumers' Subsidy," issued from the headquarters of the American Mining Congress, at Washington, D. C., Mr. H. N. Lawrie, "chief, precious metals division," argues in favor of the McFadden Bill. He begins by stating "There are 480 grains in an ounce of gold." In this he is correct, because the weight of gold is properly expressed in troy ounces. Continuing, he states, "By United States statute there are 23.22 grains of fine gold in the standard dollar." This statement is also correct. Still continuing, he says: "Dividing the number of grains in an ounce" (troy) "by the number of grains in a dollar, the quotient obtained is 20.6718 dollars"; and that is correct, too. But he adds that 20.6718 dollars is "the price of the fine gold ounce."

It seems reasonable to ask just here, wotinell, or elsewhere, does he mean by "the price of the fine gold ounce"? It is axiomatic that things which are equal to the same thing are equal to each other. Therefore, if an ounce of fine gold is 20.6718 dollars, and if 20.6718 dollars is the price of a fine gold ounce, then the price of a fine gold ounce is an ounce of fine gold. *Mirabile dictu!*

But whereinell, or elsewhere, are we at now? Let us see. Still continuing, he states, "the Government has arbitrarily fixed the price of gold"; and, from the foregoing, it would seem reasonable that it has done so (even if indirectly) if the price of a fine gold ounce can, consistently, be said to be an ounce of fine gold.

Similarly, as the Government has adopted avoirdupois weight, it can be stated, just as reasonably, that it (the Government) has, "arbitrarily," fixed the price of a ton of coal at twenty hundredweight of coal; because, if the price of gold can be stated in terms of gold, then the price of coal can be stated in terms of coal, and the price of cotton can be expressed in terms of cotton, and so on throughout the entire list of commodities and other things that can be "priced" in the sense that the Government has priced gold.

But, unfortunately for Mr. Lawrie's line of reasoning, all "prices" are relative, in the sense of being comparative; and, therefore, in expressing "price," it is customary to give or state the exchange value of anything in terms of *something else*, which means that at least *two different things* must be taken into consideration.

A prominent political economist says: "A price is a relation between two factors, one money and the other goods. A change either in money or in goods will affect the relation between them."

The principal civilized nations of the world have chosen gold as that particular "something else," or standard, in terms of which the worth, exchange value or purchasing power of all other commodities, as well as services, may be most readily and conveniently expressed or "*priced*."

The ex-Kaiser of Germany and his associates in crime, in an unsuccessful attempt to gratify their lust for power, brought the business of the world into a condition bordering on chaos, and it became necessary for most of the nations involved in the late war to issue what are, virtually, paper promises to pay gold, for use as money in place of gold. Consequently, in most of those foreign countries, prices are now stated in terms of such paper currencies, the exchange values of which are based, principally, upon the credit of their respective nations.

To the uninformed, much confusion of thought regarding "prices" has been caused by the fact that *paper* "money" is used in place of *gold* money, and such confusion has been aggravated by the fact that the same name is often used to mean two entirely different things.

For example, in Great Britain, gold is now "priced" in terms of *paper* shillings. Before the war, the unit of exchange value there was 133.+ grains of fine gold; which, at the time of its birth, was named a "sovereign," or "pound sterling." A real shilling is one-twentieth of a sovereign; that is, it is one-twentieth of 113.+ grains of fine gold; which is 5.65 grains. Normally, an ounce of fine gold is 84.95 shillings (480 grains ÷ 5.65 grains = 84.95s.) but, today, in Great Britain, gold is quoted in terms of paper currency, or *credit* money. If the "price" of gold there is 119 shillings per ounce, paper shillings are meant; and by subtracting 85 (for convenience, in place of 84.95) from 119, there remain 34 *paper* shillings; which is the premium paid for gold in paper currency, or credit "money." In other words, it takes 34 more paper "shillings" than gold "shillings" to buy an ounce of fine gold. Or, as expressed in percentage, (34 × 100) ÷ 85 = 40 per cent; or 119 paper shillings per ounce, gold, in Great Britain, is selling at a premium of 40 per cent in credit "money." To go back to the time of our Civil War for comparison, it would be the same as a quotation of 140, for gold, in "greenbacks," as our paper "dollars" were called in those days; or 28.938 paper "dollars" per ounce.

If the prices of commodities in any particular country are expressed in terms of the currency of that country, it follows, conversely, that the price of such currency must necessarily be expressed in terms of commodities.

The United States is on a gold basis. Our unit of exchange value is 23.22 grains of fine gold. The "prices" of commodities here, therefore, are expressed in terms of gold, and, conversely, the "price" of gold must be expressed in terms of commodities. In fixing, arbitrarily, what is (confusingly, to some people) termed the Mint "price" of gold, all that our Government did (in 1837) was to decide upon 25.8 grains of standard gold (nine-tenths fine) as the unit of exchange value; and of course in that event a troy ounce of fine gold furnishes enough gold to enable the Mint to make twenty of such coins (or a double eagle, or two eagles, or four half-eagles, or eight quarter-eagles) and have 15.6 grains (15.6 grains ÷ 23.22 = $0.6718) left over.

The late Horace White wrote: "We sometimes read of an 'ideal dollar,' a phrase implying that there may be a dollar whose value is not embodied in any tangible substance, but is purely a mental conception. That is impossible."

Since Mr. Lawrie, in his circular, says, "Had the price of gold ascended" (risen?) "to the average wholesale price of all other commodities," is it not entirely consistent, in the light of the foregoing, to ask him what is his "mental conception" of a "dollar"? Because, how can "the average wholesale price of all other commodities" ascend (rise) if the unit of value by which they are measured (or priced) rises to the same extent? Surely, if the unit rises in relative value, commodities must fall in "price," and, conversely, if commodities rise in "price" the unit (in terms of which prices are stated) must fall. The measure of value and the thing that it measures cannot both rise or fall at the same time!

What do you suppose constitutes Mr. Lawrie's "ideal dollar"? W. DE L. BENEDICT.

New York, N. Y.

Botany and Geology

I read with much interest F. M. Wichman's article on "Botany Applied to Mining," and the editorial on the subject, in your issue of Dec. 11, 1920.

A striking example of the effects of rock and corresponding soil differences may be seen on "Rocky Hill," a couple of miles east of Exeter, Tulare County, Cal. Rocky Hill is a rough granitic mass, intrusive into serpentine rock, gabbro, and other basic igneous rocks, the range being the western foothills of the Sierra Nevada Mountains. On Rocky Hill, Wislizenus oaks are growing, and it is of particular interest to note that these oaks grow only upon the granite, extending right up to the contacts of the basic rocks, which latter are here entirely treeless.

It is not a question of altitude, climate, or lay of the land, soil differences alone being apparently directly or indirectly responsible for the differences in vegetation. The decided preference of the oaks for this and for other granitic hills in the region may be due to several things, such as a lighter looser soil, different moisture conditions, lack of cracks in summer in the granite soil, no grass fires when the trees were young, and the presence of far more potash in the granite than in the basic rocks. Furthermore, reddish and green lichens and mossy growths are common on the outcrops of the basic igneous rocks here, but are rare on the granitic rocks. Some plants grow under conditions which would kill others, such as salt grass and certain salt bushes and samphires, which are able to put up with a good deal of salt and alkali. On the other hand, cranberries cannot grow in a soil that is the least bit alkaline.

In parts of California, prickly pear is abundant on the south sides of the hills, with quite a different vegetation, no cactus, and much better soil in many cases on the north slopes of the same hills. Again, white sage and lupines frequently take the place of the "greasewood" *(Adenostoma)* destroyed by bush fires. Desert regions have their own distinctive flora, adapted in various ways to withstand the hard conditions. The famous calamine violet *(Viola calamisaria)* of Westphalia, is an illustration of the effects of soil ingredients, for the flower, which is normally blue, is said to be yellow where the plant is growing on the decomposed outcrops of zinc ore deposits.

In eastern Riverside County, Cal., the creosote bush may be seen growing rather sparsely upon solid beds of gypsum, but it was noted that the other plants associated with the creosote bush in the vicinity largely avoided the gypsum beds. To one who has come under the spell of our southwestern deserts this creosote bush inspires much the same feeling as does the pine, beloved of the mountaineer. Certain pines, by the way, flourish where oaks would starve to death, and it is of extreme interest to note that the Torrey pine is known only in a small area on the coast of Southern California and on Santa Rosa Island, off the coast.

Altitude and the corresponding climate are also very important factors, and the natural vegetation of a region is separated into more or less sharply defined zones, characteristic of certain elevations above sea level. That weird plant, the tree yucca or "Joshua," *(Yucca arborescens)*, common in arid parts of the Southwest, grows up to an elevation of 6,000 ft., as at Goldfield, Nev., but I have never seen it as yet below an altitude of 2,000 ft. This yucca is pollenized by a certain moth, which acts as if it thoroughly understood the function of pollen.

Green algæ may be seen growing on rocks, alongside streams of nearly boiling water, at Arrowhead Springs, north of San Bernardino, Cal., and certain observations on algæ are mentioned by J. W. Shipley, in the *American Journal of Science* of August, 1920, in an article on the volcanic emanations and incrustations in the Valley of Ten Thousand Smokes, Katmai, Alaska. Mr. Shipley remarks: "Volatile ammonium compounds were detected in almost all of the vapors examined . . . a rather interesting relationship between the growth of blue-green algæ and the presence of ammonia compounds in the emanations was established. Algæ were found growing up to the edge of vents where the thermometer indicated one hundred degrees centigrade. No algæ grew where the vapors showed an absence of ammonium. This relationship held over the large areas where the gases were slowly exuding through the porous mud flow. Apparently, the evolution of ammonia compounds was quite general, for the afternoon sun disclosed the slopes surrounding Novarapta clothed in a coat of green provided by the growth of algæ."

Some striking illustrations of the effects upon vegetation of slight differences in environment are mentioned by E. J. Russell in his excellent book, "Soil Conditions and Plant Growth." For instance, in Romney Marsh there are pastures with rye grass, white clover, crested dog's tail and agrostis, easily capable of fattening sheep in summer without any other food. All round these pastures are others with the same type of vegetation, but the plants grow more slowly, produce more stem and less leaf, are less nutritious and are incapable of fattening sheep. Again, the grass on Lower Lias pastures in Somersetshire and Warwickshire causes acute diarrhœa or "scouring" in cattle, whereas grass on adjoining alluvial pastures does not. Finally, potatoes grown in the Dunbar district are remarkable for their quality and will stand boiling and subsequent warming up without turning black. The same varieties of potatoes grown in the same way in the Fens blacken badly under the same treatment, and consequently command a much lower market price.

In many places belts of serpentine rock may be identified from afar by the scanty vegetation upon them. On the other hand, soils derived from limestone are in many instances very fertile, although limestones contain on an average only about one-third of 1 per cent of potash. In weathering, however, much of the lime is removed in solution, whereas the potash is concentrated in the residual material. We have therefore to consider, in dealing with soils and vegetation, not only the composition of the parent rocks but also how these rocks weather into soils. In short, "Botany Applied to Geology" is a subject of great scientific and practical interest, and by making and assembling observations we shall know more about it than we do now.

Porterville, Cal. GORDON SURR.

Does a Vein Which Cuts a Bed Meet Said Bed Anywhere?

In your editorial entitled "The Utah Consolidated-Utah Apex Lawsuit," appearing in the issue of Nov. 13, 1920, you frankly confess that your "knowledge of the question in dispute is limited and perhaps inadequate" to enable you to take sides in so delicate a matter "among friends." I am quite convinced that there is no "perhaps" about it. You display a surprising lack of knowledge of the facts involved and of the nature of the testimony given in the case. However, you suggest some things of a geological nature that are new and strange to me, and possibly so to others, particularly so to those who were engaged as witnesses in the suit.

Your editorial says, "The sole point at issue, according to our correspondent, was as to whether certain limestone formations, known as the Highland Boy and the Yampa, which were ore-bearing formations, were the lodes in the legal sense, or whether the almost *vertical veins which cut them* at nearly right angles were the lodes. Orebodies were shown by the evidence to have occurred frequently at the *junction of the vertical veins with the limestone*." I am certain that the witnesses for the Utah Consolidated did not find the geological conditions to be as you describe them. I do not believe that the Utah Apex witnesses found such a curious geological freak, or, if they did, they were careful to keep this newly discovered geological phenomenon to themselves. Possibly Dr. Lindgren did not want to let Dr. Kemp in on it just at that time. It remained for you to enlighten us, and I for one am glad to know that you have found in the Bingham district a case where a vertical vein cuts a limestone and at the same time forms a junction with it. I congratulate you, Mr. Editor.

You tell us further that the "limestone formations" outcrop in Utah Consolidated ground and the "vertical vein-fissures" outcrop in Utah Apex ground, and since orebodies "occurred frequently at the junction of the vertical veins with the limestone" the following question of law naturally presented itself: "To which party belonged the ore at the junction?" Meaning, I take it, the "*junction*" between the "limestone formations" and the intersecting "vertical veins."

A good "apex law twister" might warp the apex law with apparent ease, but I do not believe his most vigorous massage treatment would cure a geological deformity like that. Is it any wonder that it cost two mining companies over half a million dollars, trying to make the geology in the case clear to a jurist who may never have seen "geology applied to mining"? It takes "journalism" applied to geology to make that kind of a stunt in geological gymnastics appear easy, to say nothing of bringing to light "quartzites which lie between limestone."

And, speaking of broad lodes and country-rock advocates, I have in mind a recent apex suit where one witness included within his broad lode a body of unmineralized quartzite 200 to 500 ft. thick and many hundreds of feet in length, and, Mr. Editor, the "sky" *was* his limit for a hanging wall, just as you suggest for your great "Bingham Canyon Lode," and that witness wasn't a country-rock advocate either. Happily, of course, his view was upheld by the court, so that you will, no doubt, refrain from classing said witness with the "country-rockers."

In the Utah case, the country-rock advocates may find some consolation in your keen observation that they limited their "testimony very conscientiously to the facts." Who told you that, Mr. Editor? Have you been out in Bingham checking up? It is too bad that the powers of observations of the Utah Consolidated witnesses were limited to such an extent that they could not see the "junction" between the "veins and limestone," because the lode locations owned by their client were senior to those of the Utah Apex Co. And, Mr. Editor, do you know that there isn't one word in the decision of the court about junctions between veins and limestones—not even a suggestion of such a thing? The Utah Consolidated witnesses couldn't find them, the Apex witnesses couldn't find them, the court couldn't find them. I guess "everyone was out o' step but the Editor."

It is evident from the decision in the case that the country-rock advocates did not prove to the court that black was white. The "legal brotherhood" couldn't do it either. Both having failed after forty years of trying, it now remains for the geolo-journalist to take up the task. After having discovered the existence of a junction between a fissure-vein and a limestone bed intersected by said fissure-vein, the black and white problem should be easy. RENO H. SALES

Butte, Mont.

An Apology

A contributor writes us in submitting his latest: "As you know, I have been very much occupied for the last six months or more in getting married and settling down after that. I am glad to say that all that is over now." Settled and glad it is all over! But it isn't. Like copper, a man must experience several blows after settling before it can truly be said that he is really converted. But that does not mean that he is 99 per cent. Some blister is badly roasted and runs as low as 98.8

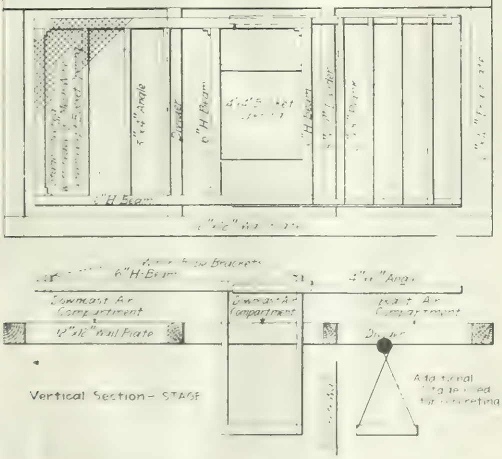
Alteration in a Ventilation Shaft

Placing a Reinforced-Concrete Divider in an Alabama Shaft, Used for Ventilation Purposes, Without Interruption to the Fan Service—Good Progress Was Made and Costs Were in Keeping With Current Prices

By J. H. Stovel*

Written for *Engineering and Mining Journal*

EARLY in 1920 it was necessary to increase the ventilation at the Mulga coal mine, of the Woodward Iron Co. at Mulga, Ala. The company's No. 2 shaft, 12 ft. x 24 ft., three-compartment, originally a hoisting shaft, was used for ventilation only, two compartments being downcast and one compartment upcast. The shaft timbers were badly rotted, and the loss of air between the upcast and downcast was heavy. It was decided to remove the shaft timbers entirely and to build a reinforced-concrete wall from the level to be ventilated to the surface, a distance of 225 ft. This work was done, under contract, by the E. J. Longyear Co. of Minneapolis, Minn.



PLAN AND SECTION OF SHAFT TIMBERS AND STAGE

The downcast airway was changed temporarily to the manway slope entry of the mine. The upcast feature of the shaft had to be maintained, as no interruption of the fan was possible without shutting down the mine. An air lock, of wooden construction, was built over the two previous downcast compartments, trap doors being provided in the floor for passage of the bucket and a door in the side of the building for the removal of material.

Stages Used in Removing Shaft Timbers

Owing to the dangerous condition of shaft timbers, these had to be removed from the top downward, and the stage for doing this work had also to be suitable for the later work of building the concrete wall. The form adopted is shown in Fig. 1 and proved excellent for both purposes. The main portion of the stage—that part over the two downcast compartments—was hung in the shaft before the air lock was completed. It was supported by steel cables, operated by hand winches. When the air lock was completed, the partition between the upcast and downcast compartment was torn out opposite the stage, thus converting the entire shaft into an upcast airway and permitting bolting to the main stage that part which projected into the original upcast compartment. A secondary stage was hung from the main stage, about 6½ ft. below it, in the middle compartment of the shaft, and an opening was left in the main stage directly above it, so that the bucket could always be lowered to it. The wire-mesh screen used for the flooring of the stage was adopted in order to allow a free passage of air, but it also provided a safe footing for the men.

In tearing out the timbers, the stage was lowered until the lower stage was about three feet below the dividers of the set to be pulled, and the men working on the lower stage chopped or sawed the dividers out. The guides and sealing between compartments were then torn out, loaded into the bucket, and hoisted to surface. The stage was then lowered until the upper part was about three feet below the set being pulled. The wall plates were chopped in two, and then it was only a question of loading timbers into the bucket and hoisting. To aid in loading, the bucket was kept about a foot below the level of the top of the stage, so that timbers could be slid into it with a minimum of effort. The crew for this work consisted of a foreman, four shaft miners, one lander, one hoistman, one teamster, and a carpenter, who was kept busy sharpening tools and building forms for the concrete work. Normally this crew could pull two sets in an eight-hour shift, but where much scaling was necessary, as was frequently the condition, this rate was not maintained. Only one serious obstacle was encountered on the way down, this being a heavy double-deck cage which had been left hanging in the shaft. It was cut into sections with an oxy-acetylene torch.

Panel Forms Obviate Use of Spragging

As soon as the level was reached and the debris cleaned out the concrete dividing wall was started. This wall was eight inches thick, with ¾-in. round iron bars, placed horizontally and vertically at about two-foot centers, for reinforcing, and it was carried up in the line of the dividers which had separated the upcast and downcast compartments. The forms for the first ten feet of wall were built in place, a 3-ft. x 5 ft. opening being left in the bottom. The remainder of the wall was carried up by means of wooden panel forms 14 ft. long and 5 ft. high. To place these panels on both sides of the wall, the floor of the stage over the upcast compartment was ripped out and a small stage was hung from the framework at the same level as the lower stage in the middle compartment. The panels were lowered by slings, attached a little off center, beyond the frame-

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*Mining superintendent, E. J. Longyear Co.

AIR LOCK AND MIXER AT MULGA SHAFT

work of the stage, and then raised into a horizontal position and set in place. The bottom of the panel which was being placed was fastened to the top of the one already in position by means of spikes partially driven in. Spaces between panel ends and the sides of the shaft were boarded up and caulked. The panels were wired together, a spacer of ¾-in. round iron eight inches long being used with each tie. These ties and spacers made it necessary to plumb only one side of the wall. As soon as a panel was finished the concrete was poured into it, for it was found by handling it in this manner that almost no spragging was needed to keep the wall in place.

A gasoline-driven mixer was set up close to the shaft, and the necessary sand, gravel, and cement were hauled while the crew was busy setting forms. The mixer discharged into a pipe, inserted through the air lock into the shaft, which was open only when the mixer was discharging, and emptied into a bucket that was used to lower the concrete to the forms. The crew for concreting and setting forms consisted of a foreman, four shaftmen, one lander, one hoistman, one carpenter, and a teamster and helper. Once in the swing of the work, this crew could erect and pour from two to three sets per shift, and on one occasion completed four sets (twenty feet) in that time. The actual concreting rarely took over thirty-five minutes.

Only fourteen sets of panels were made, necessitating stripping and re-using. This work was interesting only because of the manner in which the stage was used to accomplish it. The stage would be lowered until the framework projecting into the upcast compartment rested on the concrete wall. One set of winch cables, supporting the stage, was taken off and attached to the small stage in the upcast compartment. This stage was then detached from the main stage and lowered so that men working on it could strip the forms and lower them to the bottom of the compartment. The small stage was again fastened to the main stage, and the operation repeated, on the other side of the wall, with the lower stage in the middle compartment. On this side, however, the forms were hoisted direct to surface, and then the men went to the bottom and brought the forms from the other side of the wall through the 3-ft. x 5-ft. opening, which had been left in the wall, and these were then hoisted to the surface. The crew would strip off thirteen sets (sixty-five feet) of panels in three shifts.

The crew was employed on this work for 130 shifts, including the time of building, and later tearing down, the air lock. The whole operation was carried through without any interruptions to the fan service.

The costs per cubic yard of the concreting work were as follows: Forms, $7.13; placing forms, $11.88; pouring concrete, including reinforcing used, $18.06; removal of forms, $5.90; or a total cost of $42.97 per cubic yard. These costs are, of course, not comparable to ordinary concreting costs, but should be of interest to anyone considering similar work. It is well to remember also, in connection with these costs, that the work was carried out at the high peak of prices, both in labor and materials.

Cost of Carbide at Mines

Written for *Engineering and Mining Journal*

Quantities and costs of calcium carbide used in miners' lamps are presented in the table. The figures are from a Minnesota iron mine and were taken during a part of 1916. At the time the mine was operated on three eight-hour shifts. Carbide then sold for approximately 3c. per lb., or $60 per ton. It is now $106 per ton in the region east of the Mississippi and north of Chattanooga, and $126 per ton in the Western States.

CONSUMPTION OF CARBIDE IN UNDERGROUND MINING

1916	Carbide, Lb.	Working Days per Month	Average No. of Men	Carbide per Man-Shift, Lb.	— Cost per Shift per Man — $60 per Ton	$106 per Ton
January	4,130	25	416	0.40	$0 012	$0 021
February	4,664	25	405	0.46	014	.025
March	4,188	27	391	0.40	.012	021
April	3,806	24	394	0 40	012	.021
May	5,150	27	427	0.45	013	023
June	2,635	26	282	0.36	011	019
July	2,048	25	202	0 41	012	021
August	2,767	27	271	0 38	011	019
September	3,400	26	293	0.45	013	023
October	4,000	26	370	0.42	012	021

In the illustration graphic representation of carbide costs on the basis of 1,000 and 100 shifts is given for rates of consumption ranging from 0.35 lb. up to 0.5 lb. per man-shift. In the table the last column has been figured on the basis of carbide at $106 per ton for purposes of comparison.

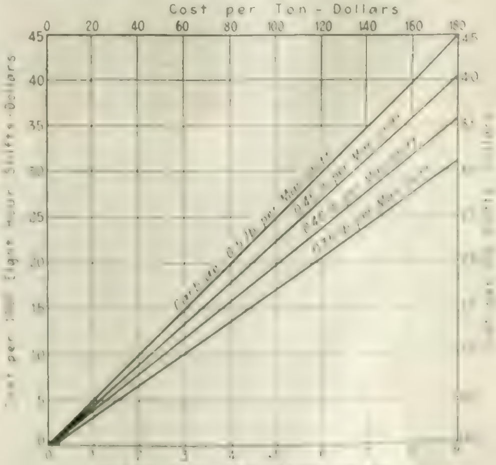

DIAGRAM FOR COMPUTING CARBIDE COST

Federal Tax Reform and the Mining Industry

Government Must Solve Problems Without Material Reduction in Revenue—Unanimous Opposition Testifies to Excess-Profits Tax Defects—Other Ways of Taxing Corporation Profits Proposed—General Sales Tax Defective

BY ROBERT G. WILSON

Written for Engineering and Mining Journal

UNCOMFORTABLE and ofttimes distressing experience with war-time taxes has forced recognition of the fact that Federal taxation is a science still inexact in practice if not in theory, and that the swollen revenue requirements of the Government, with the resulting need for more equality in the assessment, have made this science a highly complex and technical branch of political economy.

The present situation is a flux, a process of experimentation and struggle for the elusive ideal of tax distribution. Revision of the statutes is inevitable, not merely to eliminate the laws of expediency justifiable only under the emergencies of actual war, but also to refine and improve the operation of the more acceptable devices. There is the further consideration of the concern of the Government, in the period of deflation, for its revenues, now dependent upon inflated profits that to a large extent no longer exist. We may well interest ourselves merely in the nature and effect of revision. Legislative action is made certain by the pressing necessities of the Government itself.

However urgent the need for reform, the forthcoming changes cannot be viewed by industry without some apprehension. We are told by officials in high places that there can be no material reduction of the tax volume for several years; that the repeal of the excess-profits tax and modification of the operation of the income tax are contingent upon finding other sources for compensatory revenue, or upon increasing the rates of taxes remaining upon the statutes. It is probable that the income-tax rates will be advanced. The total appropriations of the last Congress were $4,859,890,327.30 for the fiscal year ending June 30 next. The present session has been asked for but $200,000,000 less for the year ending in 1922.

The last few years have clearly revealed that prosperity has a tendency to make for heavy taxation, and, inversely, heavy taxation retards industrial activity upon which prosperity depends. It is a somewhat dismal augury for the future and must lead to the conclusion that only by restricting the volume of taxation to the absolute minimum required for national welfare can the Government expect the co-operation essential to a successful program of rehabilitation. This may be said to be particularly applicable to co-operation from an industry which could readily postpone the development and conversion of natural resources to a more profitable period, and do so under economic pressures even now sufficient.

TAXATION BEYOND CERTAIN POINT CAUSES DECREASE IN YIELD

Economists agree that there is a saturation point in taxation, which if overstepped causes a decline in total yield. It is this consideration that will partly influence Congress in the probable abolition of the excess-profits tax and reduction of surtaxes. Its import should also be acknowledged in any movement toward increase of the income tax, one effect of which must inevitably be, with the elimination of the excess-profits tax, the shifting of part of the obligations of the highly profitable enterprise to the less profitable.

The mining industry has unqualifiedly supported the movement to abolish the excess-profits tax. "Excess profits," even profits in excess of the narrow and nondiscriminating standard of the existing law, are now rarely resulting from mining operations, particularly metal mining. The war brought temporarily increased income, which has subsided, but it also brought increased costs, which remain. We find on the one hand invested capital augmented by reinvested profits, and on the other decreased current income, with the result that the majority of even the most substantial mining companies now find their net taxable receipts equivalent to less than 8 per cent of the total capital. So far as the business of mining is concerned, the return to normalcy has already resulted in most instances in a situation distinctly subnormal. Metal prices have dropped with a suddenness that has accentuated rather than relieved the economic stress of the nation.

MINING INDUSTRY'S OPPOSITION TO EXCESS-PROFITS TAX CREDITABLE

As the *Engineering and Mining Journal* recently said of another matter, we are primarily interested in our own industry, believing that public-spiritedness begins at home. Repeal of the excess-profits tax probably means an increase in the rate of income taxes which even the concern with the narrowest margin of profit is obliged to pay, and the obvious corollary is that a larger tax payment by most companies must be the immediate consequence. Yet the excess-profits tax is abnormal and has no place in practical affairs. Perhaps no Federal statute has ever been more generally decried by the business community. The virtually unanimous opposition is proof of its defects. Nevertheless, it must enure to the credit of the mining industry that even those operators who can obtain no relief from its suppression, but, on the contrary, will find their obligations increased, have unhesitatingly joined in the demand for repeal. It is one answer to those who have protested that the industry is pulling too hard for its special interests, and those who, upon false and ignorant premises, have cried "discrimination" because the revenue laws finally contain special provisions applicable to mining, provisions which merely permit the taxation of income rather than capital under income-tax laws.

No real adjustment of the Federal system of taxation can be accomplished at the present short session of Congress, although hearings have been started before the House committee. The program is concerned more with appropriations for the spending of money than with legislation for raising it. The popular demand is for no mere temporary compromise of the existing difficulties, but for a stabilized system which will readily lend itself to simple adjustment by changes in rates from time to time, without necessity for constant changes in basic methods. It is doubtful whether there would be sufficient time for true tax reform before March 4, even were all other business set aside. Perhaps as a compromise the present Congress will enact H. R. 14,198, a bill which passed the House at the last session and which is designed to facilitate the administration of the Revenue Act of 1918, and some means may be adopted to effect an early clearance of accumulated war tax settlements.

Modification of the revenue laws is not the only or the most urgent taxation problem. The most imperative need of the moment is a definite determination of the liability of each taxpayer for prior years.

The American Mining Congress, mindful of the general uncertainty of business as well as with particular thought for the inherently complex problems of the mining industry, has recommended legislation authorizing the appointment of a temporary board of ten special commissioners of revenue, vested with sufficient authority to clear up the situation. Such a board would only pass upon the unsettled cases consequent upon the wartime period of 1917 to 1919, inclusive, and would have the power not now reposed in the Revenue Bureau to compromise in simple equity. It is a fact that in many instances a proper assessment of tax is impossible under literal application of the law. The administrative effort required of the authorities has in these cases merely resulted in alternate concessions and denials, or arbitrary interpretations frequently contested by the taxpayer. The natural outcome will be endless litigation unless steps be taken to dispose of the disputes otherwise.

This special board should have the additional power to postpone payment of taxes for reasonable periods or to provide for payment in instalments where deemed necessary to prevent undue hardship on the taxpayer. Final settlement of cases would be aided by provision for an agreement between the board and the taxpayer, which, under the necessary statute, would forever prohibit litigation, except upon a showing of fraud or misrepresentation of fact. The plan simply provides an effective means of relieving the existing situation, much in the same manner as the claims of citizens against the War and Navy departments were cleared under suddenly terminated war contracts. It becomes a part of the general effort to clean up and forget the "hangovers" of war. Considerable advantage to the Government itself would result from additional revenue realized in a time of urgent need. The cost would amount to but a fraction of the saving in interest alone

PROPOSED BOARD SHOULD INCLUDE THOSE FAMILIAR WITH MINING INDUSTRY

It is highly desirable that at least three members of the proposed Federal board, without necessarily directly representing the mining industry, should be thoroughly conversant with the practices and problems of mineral extraction and metal manufacturing. Perhaps a guide to the respective professional qualifications and industrial representation may be found in the proportionate payment of taxes. As nearly as ascertainable, the mineral and smelting industries contribute at least 15 per cent and metal manufacturing approximately the same percentage, or a total in excess of one-third of the total Federal taxes. This, however, is not the sole criterion. The mining industry has many problems peculiarly its own, but it also contends with virtually all of those met in other industries. Accountants, lawyers, and specialists familiar with the taxation of the agricultural or agricultural products industry, for instance, would probably not feel qualified to pass upon complicated mining cases, but specialists chiefly versed in mining could readily be called into consultation in matters affecting other lines. The scope of the board must be broad.

There is in this proposal no reflection upon the personnel of the Revenue Bureau, which is laboring under the difficulties of red tape, insufficient forces, and lack of authority. It has simply faced a task that requires more than ordinary means and methods of tax administration.

OTHER FORMS OF CORPORATION-PROFITS TAX PROPOSED

Looking to the future of taxation, it is likely that the laws will be revised at a special session called under the new administration. Without assuming prophecy, one may refer to the most probable substitute or substitutes for the excess-profits tax and means of modifying the income tax. The Secretary of the Treasury recommended to Congress that the excess-profits tax be replaced by another form of corporation-profits tax, preferably a tax on undistributed profits, or, failing that, a "corporation surtax" at a flat rate as a partial replacement. The latter would become virtually the equivalent of an increase in the income-tax rates. In addition, the Secretary suggested increasing excise and luxury taxes, and new sales taxes upon commodities of wide distribution, but *not* a general sales or turnover tax. Readjustment of the excessive surtaxes has been recommended for the reason that they have driven wealth into tax-free securities, thereby eliminating sources of revenue most easily tapped.

The recommendations of the Secretary of the Treasury closely approximate the proposals of the Allied Tax Committee in the report submitted to the National Industrial Tax Conference in New York City in October. That committee, however, distinctly determined upon a simple increase of the corporation-income tax as a partial replacement of the excess-profits tax, rather than a tax upon undistributed profits. The latter in many instances would have a highly inequitable application. It could not fail to act as a penalty upon reinvestment in necessary industrial expansion, even now restricted by other tax measures and economic influences in general.

The position is taken by many that with economy in Governmental expenditures, increased tariff, and other changes Congress could dispense with the excess-profits tax and require no substitute. Tax students, however, are endeavoring to preserve some sort of balance between the incorporated and unincorporated forms of business. Relatively high surtaxes upon personal incomes will remain in the law, however they may be adjusted, and the removal of all corporation surtaxes would necessarily penalize the individual and the partnership. There is also the ever-present sentiment that a premium should be paid, beyond the levy of a nominal capital-stock tax, for the privileges conferred upon corporations

The much discussed sales or turnover tax still has defenders, despite its desertion by many of the original advocates. In fact, the question of a general sales tax or a combined increase in income and limited excise taxes may become the principal taxation issue in Congress. The complications of the present system have caused a demand for simplicity, and relative simplicity is the chief virtue of a sales tax, if there be virtue in it. However, simplicity is not a concomitant of equity in taxation, particularly billion-dollar taxation. No simple device of general application can permit of even approximately equitable levies upon so complex an industry as mining, for instance. Many forms of sales taxes have been proposed, but the most organized propaganda is that which supports a flat duty of 1, 1½ or 2 per cent upon all turnovers of commodities, services, and property in general. It is intended as the only tax on "business," although graduated taxes upon personal incomes would remain. A sales tax to this extent has little chance. Congress is unlikely to rescind all corporation taxes, including those founded upon approved principles, to undertake a dubious experiment.

GENERAL SALES TAX DEFECTIVE

The chief defect of the general sales tax, and it is a glaring one, is that it ignores the capacity of the taxpayer to meet the obligation imposed. If it could not be shifted to the consumer, as frequently would be the case, it would rest upon one of the poorest determinants of tax liability, gross income. If it were shifted it would bear upon the necessities of the masses at the same rate as upon the luxuries of wealth. The political aspects are obvious. The proponents of the sales tax hold that it will be shifted, and that the existing excess-profits tax is passed on to the consumer. The extent of the latter practice is in dispute and will never be proved, but if it be so, it is a poor substitute that accomplishes the same result.

A well-administered income tax, as a single measure, is the nearest approach to a true equalizer of the tax burden, particularly a burden as heavy as that now imposed. It is true that the country has rushed to the extremes of direct income taxation and that a wider distribution would have many advantages, but that can be better regulated through excises upon luxuries and a few commodities of general use. Appreciable as the revenue would be in the aggregate, the small individual contribution would inflict no real hardship.

Nowhere would a general sales tax have more uncertain, capricious and inequitable effect than upon mining and all of the so-called wasting industries. It would distribute the burden widely but not wisely. The tax would apply in the periods of exploration and unprofitable operation, when "ability to pay" had not developed, at the same rate as upon successful ventures. The low rate of the proposed sales tax is deceiving. The pyramided effect of the shifting to the operator of even 1 or 2 per cent upon each turnover in the process of manufacture and transportation of all equipment and supplies essential to mining, and the additional tax upon gross sales that rarely could be shifted in turn, would be considerable in the aggregate.

Revenue Bureau records show that mining and the allied industries have been paying their full quota of Federal taxes. It is not likely that the sales tax would bring a reduction of the total obligation. "Ability to pay" has been found an acceptable principle, obnoxious only when excessive in application. Ergo, so radical a replacement as that by a sales tax can mean but an indiscriminate scattering, regardless of consequences.

Ontario's Nickel Production Curtailed

During the first nine months of 1920, a total of 925,378 tons of nickel ore was raised at the Creighton, Murray, Garson, Levack, Bruce, Victoria No. 1, and Worthington mines, according to the Ontario Department of Mines. Ore smelted at Copper Cliff, Coniston, and Nickelton totaled 809,022 tons, from which 44,922 tons of bessemer matte was produced. To the United States and Wales 31,800 tons of matte was exported, and 12,531 tons was treated in Canadian refineries at Port Colborne, Ontario, and Deschenes, Que.

At the beginning of the year smelting of nickel-copper ores was back again to a pre-war basis after the greatly curtailed production in the early part of 1919, which followed an abnormally large output in 1918. Although production increased from 30,942 tons of bessemer matte for the first nine months of 1919 to 44,922 tons for the corresponding period in 1920, conditions since Sept. 30 have considerably reduced this rate of production. The present market for both nickel and copper is dull, and stocks have accumulated. In consequence, the International Nickel Co. of Canada was obliged to curtail operations both at Copper Cliff and Port Colborne on Nov. 1 to the extent of 25 per cent.

In the bulletin for the half year ending June 30 it was stated that nickel-copper matte was in process of treatment at the new refinery of the British America Nickel Corporation at Deschenes. Electrolytic nickel and copper were produced during the latter part of the nine months' period. The International company markets a considerable part of the nickel.

During the period 135,023 short tons of ore was mined by the Algoma Steel Corporation and Moose Mountain, Ltd.

The furnaces of the Standard Iron Co. at Deseronto, the Midland Iron & Steel Co., and the Parry Sound Iron Co. have not been in blast since June, August, and October, respectively, in 1919. Four stacks were operated by the Algoma Steel Corporation at Sault Ste. Marie, two by the Steel Company of Canada at Hamilton, and one by the Canadian Furnace Co. at Port Colborne. Of a total of 1,036,229 tons of ore smelted, only 99,916 tons, or 9.64 per cent, was of Ontario origin. In steel making, 252,797 tons of pig-iron product was used. The total steel output at Sault Ste. Marie and Hamilton was 525,084 tons, worth $19,253,470.

Smelter Production of Zinc

The production of primary metallic zinc from domestic ores in 1920, according to the U. S. Geological Survey, was about 449,000 tons and from foreign ores about 14,000 tons, a total of 463,000 tons, compared with 452,272, 13,471, and 465,743 tons, respectively, in 1919. Of the output of domestic zinc in 1920 about 51,000 tons consisted of electrolytic zinc, as compared with 27,056 tons in 1919. In addition to primary zinc there was an output of about 20,000 tons of redistilled secondary zinc, compared with 19,748 tons in 1919, making a total supply of distilled zinc and electrolytic zinc in 1920 of 483,000 tons, of which 81,000 tons was high-grade zinc, 34,000 tons intermediate, 51,000 tons select and brass special, and 317,000 tons Prime Western. The production of the corresponding grades in 1919 was 45,377, 39,173, 140,917, and 260,024 tons, respectively, a total of 485,491 tons.

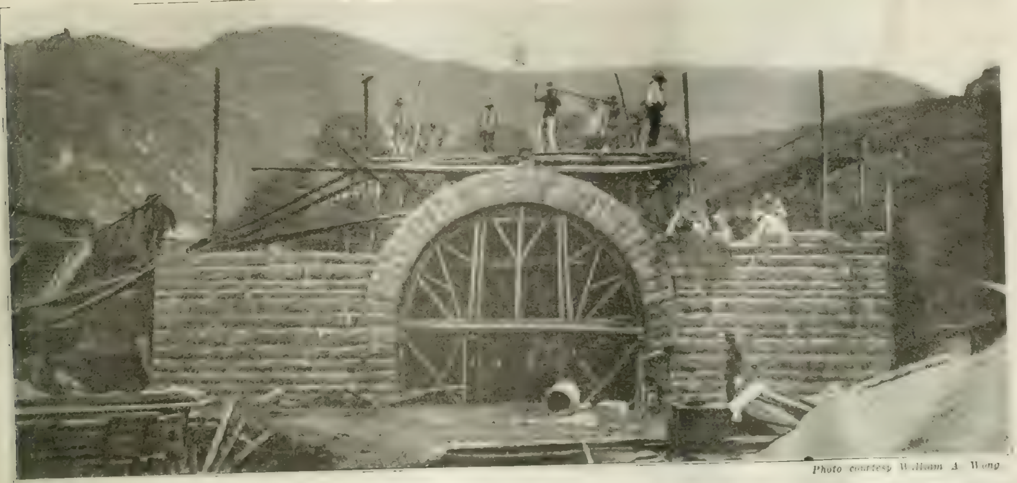

Photo courtesy William A. Wong

TAYEH MINES, TAYEH, CHINA, NEW LOADING STATION OF REINFORCED CONCRETE, FACED WITH LIMESTONE MASONRY. FIFTY-TON GONDOLA CARS WILL ENTER THE TUNNEL AND BE LOADED BY GRAVITY WITHIN FIVE MINUTES. TWELVE CARS CAN ENTER THE TUNNEL FOR LOADING. ON THE OTHER END OF THIS TUNNEL WILL BE A MODERN ORE-CRUSHING PLANT, WITH A CAPACITY OF 3,500 TONS A DAY

Iron Mining in China

TAYEH IRON MINES, TAYEH, CHINA, LOADING STATION MINE CARS ARE LET DOWN THE INCLINED PLANES, ENTER INTO THE TIPPLES, DUMP INTO 11-TON RAILROAD WAGONS, AND HAUL FIFTEEN MILES OVER STANDARD-GAGE TRACKS TO THE MINES RIVER TERMINAL FOR EXPORT. THE CENTER OF THE PICTURE SHOWS THREE INCLINED PLANES LEADING TO THREE STEEL TRESTLES FOR THE STORAGE PILE

Sidelights on the Cyanidation Process

A Tribute to the Research of MacArthur and Jennings—Counter-Current Agitation Advantages Questioned—Is Zinc Dust Better Than Shavings for Gold Ores?—Crowe Process the Outstanding Feature of Recent Practice

By ALFRED JAMES*
Consulting Mining Engineer, London, England

IT IS PROPER to note, at the outset, the loss the industry has sustained by the death of John S. MacArthur and Hennen Jennings. It is a coincidence that these two giants of our industry, brought together by my work in South Africa, should have died within a few days of each other. To John S. MacArthur the world owes the invention and introduction of the process for the recovery of gold from refractory ores by means of dilute solutions of potassium cyanide. But it owes to him more than that; to his resolution, optimism, tenacity and industry is due the evolution of a process free from the unexpected reactions which doom so many efforts. The methods of regenerating foul working solutions into original efficacy, including the gain to be derived from the use of sodium sulphide, were carefully examined by him, and the information obtained was freely thrown open to the industry.

And yet to me it is doubtful whether the large-hearted encouragement and enterprise of Hennen Jennings were not of almost as great benefit to the industry as the initial work of MacArthur. Up to 1890 the process had not been hailed with enthusiasm, or even adopted by any outside party, except in one or perhaps two instances, for the treatment of small lots of rich concentrate. Following on my widening the sphere of the process, from the limited field of the treatment by costly agitation in small vessels, of rich refractory ores and concentrates, into the cheap gravitation percolation of (not so very) low-grade tailings, Hennen Jennings offered an opportunity of treating the rich Robinson tailings on such advantageous terms as enthused me to design and erect, and the Gold Recovery Syndicate to provide the funds for, the largest and first tailing plant in the world. Hennen Jennings was big enough to realize that the profits to be derived would mean enormous advantage to the South African industry, then faced with disaster from the bottoming of the oxidized ores. He obtained the required results, and to him is due the unqualified success of the South African gold fields, more than to any other man, with the possible exception of Hermann Eckstein, who was also a great man.

The main value of a patent is apt to be the fostering care of the inventor and his associates, who nurse the infant through all its weaknesses, accidents and obstructions into adolescence and vigorous manhood. Of what use is it to belittle Crowe's discovery—to which I refer later? Belittle it and it dies; encourage Crowe and the industry gains immensely. It is most unfortunate for South Africa that with the departure of Hennen Jennings the big mind ceased to be visible in local control. An examination of the Proceedings of local societies and of the local journals gives food for serious thought.

Before leaving the Rand in 1891 I had shown, at the Robinson and Salisbury plants, that the effluent from the zinc boxes should not carry more than one or two grains per ton, and in New Zealand we had confirmed this. Why then should the Rand have retrograded in four years to the position disclosed on pp. 187, 291 and 297 of Vol. I, *Jour. Chem. and Met. Soc.*?

From time to time I have asked for experimental investigation into matters of universal interest such as:

(1) The economical limits of coarseness of feed to tube mills, and of irregularity and size of mine rock substituted for pebbles, with a note of the gain or loss resulting from this practice (1911).

(2) The benefits and disadvantages resulting from heating solutions: Caldecott showed an increase in tonnage amounting to 20 per cent for only 25 hp. (1912).

(3) The recovery of cyanide from solutions of great strength, such as those used at Pachuca.

I was rewarded by figures from various quarters on the second topic (see pp. 86-91 "Cyanide Practice, 1910 to 1913") and on crushing costs, but it seems difficult to obtain the other figures requested.

COUNTER-CURRENT AGITATION, SOLUTION AND CLASSIFICATION

This scheme looks attractive; the heavy increase in the price of filter cloth is all in its favor; but its advantages remain to be proved over Rand decantation in costs, recoveries, or lessened quantity of solution to be precipitated: Eames (*Trans. A. I. M. E.*, Vol. LVII) states 3 parts of solution to 1 of ore. It certainly should require a cheaper plant, less attention, and less power. But the handling of large quantities of solution per ton treated is an objection. It is not merely a question of a cost, with zinc dust at 1/- per pound, or, say, 2½d. per ton of additional solution precipitated; also must be considered the extra cost and loss, in realizing the larger quantity of lower value zinc precipitate resulting from the utilization of double or three times the amount of zinc dust to precipitate, say, 3 dwt. (0.15 oz.) of gold from two or three tons of solution instead of from one ton. In this connection I reproduce a sentence from this review for 1909: "What the industry is set on obtaining is a high extraction with the handling of only one or at most two tons of solution per ton of dry slime treated."

PRECIPITATION OF GOLD

The Crowe process is the one outstanding novelty advanced during the war. It goes back to early practice, the exhaustion by vacuum of all solutions after lixiviation and prior to precipitation, as adopted in every plant known to me which was laid down by the patentees and their trained chemists during the whole life of the patents. In all early plants solutions to be precipitated were led to the precipitation boxes protected from access of air: the effluent, on the contrary, was always arranged to cascade from a height into the sumps. In these

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*This is a part of Mr. James' [illegible] article [illegible] "Comments [illegible] and [illegible] in Gold and [illegible] Ore Treatment [illegible]." Most of the paper will be published in the *Jour. [illegible]* [illegible] 1921.

notes for 1911 I referred to the zinc-dust precipitation then being so energetically pushed, as resulting in the formation of impure precipitate. N. Herz (p. 140 to 143, Vol. LII, *Trans. A. I. M. E.*) shows impurity of from 8.5 to 21 per cent introduced with zinc dust as against 1.32 per cent total impurities in commercial zinc shaving (Laminoirs à Zinc d'Engis), and the special zinc I originally advocated in "Cyanide Practice" was superior to this. My criticisms were not openly accepted, but obviously they were based on fact and were taken to heart; otherwise why the production of oxide-free "Merrillite" to replace ordinary zinc dust?

The Crowe advertisement places on record the heavy consumption of zinc by the zinc-dust process, even where complete precipitation is not attempted—in spite of the obvious evils of circulating only partly precipitated solutions. In "Cyanide Practice" I gave a consumption for South Africa of 2.5 oz. of zinc per ton of gold ore. But the South African consumption has perforce been high owing to the local practice of destroying by acid a large amount of zinc at each clean-up. In India the consumption varies from 1¼ to 1⅓ oz. per ton treated. It is obvious from Crowe's results that the consumption of 0.407 lb. per ton of ore should never have been permitted. Ought not Crowe's figure of 0.191 lb. to be reduced to at least 0.17 lb. (African practice) or more accurately 0.07 lb. (Indian practice) by reversion to zinc shaving?

Operators should not be blinded by publication of consumptions per ton of solution instead of per ton of ore, which is the ultimate basis for records of costs. Otherwise a mill using five of solution to one of ore may thus be made, at 0.04 lb., to show a lower zinc consumption than when using two and one-half of solution to one of ore and showing 0.06 lb. per ton of solution.

The position is summed up by W. A. Caldecott (*Trans. A. I. M. E.*, Vol. LII, p. 69), who stated that "actual recovery of the gold, and not merely extraction from the ore, is the true objective. . . . Long experience has emphasized the desirability of maintaining the mill service water as free from gold as possible . . . if mysterious shortages of gold are to be avoided."

Bosqui had already stated (*idem*, p. 57) apropos his attempt to displace zinc (shaving) boxes at the New Modderfontein by the Merrill zinc-dust process: "The resultant gold-bearing weak or slime solution is comparatively simple in composition, with a very low metallic and cyanide content which rendered it extremely difficult to precipitate satisfactorily on zinc dust without additions of cyanide and lead acetate. Various measures were tried . . . but without success; and at this plant it was finally decided to revert to the older zinc-shaving method."

Again (p. 57): "Zinc dust . . . requires more care in manipulation than the zinc-shaving method, is liable to erratic fluctuations in efficiency without assignable cause, and requires the use of stronger solutions than are actually needed for dissolving purposes."

On the other hand, Herz (*idem*, p. 139) claims that "zinc dust has, with silver solutions, an efficiency double or treble that with gold solutions", and his paper on zinc-dust precipitation contains food for reflection and matter for continued reference. It offers justification for the adoption of zinc dust for the precipitation of silver from its solution, a justification I have yet to find in the case of gold, where a thoroughly efficient process has stood the test of years, and has proved superior to every method brought against it. Because the inventor of the zinc box, who happens to be me, did not patent it, or stick his name to it, or seek royalties, license or payment, but made a free present of it to the industry, it has been worth the while of no one to protect the industry against the claims of those who have endeavored to supplant it, with the results now admitted by the Homestake and Portland metallurgists.

The zinc-dust claim to an entire clean-up is disposed of by such statements as that of A. H. Jones (Vol. LII, *Trans. A. I. M. E.*, p. 117) regarding his partially precipitated working solutions. Is it not a confession of waste that acid should so generally be used in the zinc-dust clean-up?

In the discussion on Kirke Rose's paper on the volatilization of gold (*Trans. Inst. Min. & Met.*, March 20, 1919), Sulman shows the heavy gold losses encountered in his use, at Day Dawn, Western Australia, of zinc fume as a precipitant, and the effort he made to overcome this. Picard later had a similar experience at Deloro, and, to avoid this, briquetted the precipitate with syrup. But the adoption of zinc dust distilled in a reducing atmosphere, plus the use of the Crowe process, has so increased the purity of the precipitate as to render fusion once more possible without previous acid treatment.

PRECIPITATION OF SILVER

The efficiency of the standard process for the precipitation of gold by zinc shaving does not blind me to the point raised by Herz. Solutions used in the extraction of silver are so much stronger in cyanide, so high in alkalinity, so much richer in metal content, that one is forced to the use of much thicker shaving than that used with gold, or to some other method of moderating the violence of the reaction in the zinc boxes, with consequent heavy consumption of reagent and mechanical loss of fine precipitate. In the precipitation of extremely dilute solutions of gold it is ideal to have an excess of zinc in such form as effectively to precipitate the gold without wasteful reaction—that is accomplished by the present zinc-shaving system. In the precipitation of strongly alkaline solutions of silver it is ideal to have so little zinc as shall give the most effective precipitation possible without wasteful reaction—that is, not accomplished by the fine zinc-shaving method. Merrill's zinc-dust process has the advantage of a well-developed modus operandi using a deficiency of zinc; although, as I have previously stated (these notes, 1910), I prefer Colbath's modification. The placing in the market of zinc dust of high purity removed one of the worst objections to the use of the process on silver ore.

A great objection, avoided by Colbath, to the Merrill method, is the circulation of only partly precipitated solutions. To circulate such solutions in ore containing "fills" and decomposed sulphides is simply to invite loss.

I have referred to the Crowe process as the outstanding feature of the last few war-laden years. I can quite understand why some should inveigh in print at the Patent Office, but why should not a man be allowed to derive benefit from his application to new purposes of an old known apparatus or method? I introduced the vacuum chamber to the cyanide process; I had no thought but of assisting filtration, and until Crowe's message had I knowledge from any one of the great benefits which he has since proved to result from the application of his method. Advantage should not be taken of an inadequate patent law, but due reward should be given to the man who has done so much to improve zinc-box practice and to relieve operators of the worry resulting from white precipitate and other troubles. The results reported from Mexico and elsewhere are remarkable. At one mine I find no saving in cyanide but an extraordinary reduction in the consumption of zinc to less than one kilo of zinc to one of silver. This may be overdone. The partly precipitated solutions at this mine carry double their previous silver content. It will probably pay to use a little more zinc and to lose a little less silver in circulation. But just as the dilution of solution was for a time overdone at the Robinson without detriment to the cyanide process itself, so the heavier silver content of certain solutions at Pachuca is no detriment to Crowe's discovery. The least amount of zinc for the greatest recovery of silver will adjust itself in time.

The shortage of cyanide has induced large operators to purchase a low-grade cyanide produced from cyanamide. J. G. Kirchen states his experience with this material (see *Eng. and Min. Journ.*, Sept. 25, 1920) on a month's run. I hope Mr. Kirchen will follow by giving his experience on at least a year's run. Faced at the outset with low-grade cyanide, works were erected, patents purchased, chemists of world fame employed, and ultimately an almost chemically pure article was produced. The proper remedy for a shortage of high-grade cyanide is surely greater production rather than the substitution of a low-grade compound, introducing much undesirable material.

MEXICAN COSTS

By the courtesy of T. Skewes Saunders I am able to give some present-day costs at the Dos Estrellas.

COSTS AT THE DOS ESTRELLAS MILL

Milling, 1.20 in pesos per metric ton. Cyaniding, 2.00. On a basis of 1,000 tons per diem; or 3.20 pesos per ton from breaker bins to bullion bars.

Crushing (Blake)	0.0024	Handling slime and solutions	0.1271
Weighing and sampling	0.0208	Clarifying solutions	0.0215
Stamping	0.2814	Butters filter	0.1570
Tube mills	0.5987	Precipitation (Merrill-Crowe)	0.3441
Classifiers	0.0839	KCN (and other reagents)	0.7956
Tube-mill rock	0.0208	Concentration	0.0253
Laboratory	0.0211		
Thickeners	0.0170		
Agitation	0.1301		

To these costs are to be added, general expenses, taxes, and marketing of bullion.

The description of Bosqui's New Modderfontein mill by Weston (*Eng. and Min. Journ.*, Jan. 24, 1920,) reminded me of the publication by Bosqui of his paper in Vol. LII, *Trans. A. I. M. E.* At that time I was unable to read the paper or to comment on it, but I deprecate most strongly the unfairness of the practice observable in certain writings which seem directed to create an impression that the cyanide process grew up, like Topsy, without the care or attention of anyone, until it had achieved such great success as to cause large companies to be formed in Africa, Australia and America for the working of it, had settled the future of South Africa, and had converted both the enthusiastic champions of the rival chlorination processes.

Now all this meant initiative, courage, work and ability. But these writers would apparently have people believe that the conception, initiation, experiment, research, fostering care, and eventual triumph over the difficulties attending the introduction of an entirely new method in metallurgy all took place without the aid of MacArthur—at any rate he is not mentioned in this connection—and that the design, erection and successful starting-up and running of the pioneer Salisbury (refractory ore and concentrate) and Robinson (tailing) plants took place quite apart from myself. Even Hamilton, in his recent "Manual of Cyanidation" refers to MacArthur (see index) merely as the inventor of a zinc-lead couple. Surely it must be just want of thought; for able men like Bosqui and Hamilton, to whom the industry is under an obligation for valuable service, must be above the pettiness of intentional omission; and I feel assured that they will both be anxious to make ample apology and reparation now that the matter is brought to their notice.

The original design of the new mill at Modderfontein was subjected to severe strictures passed on it by the leading lights of the C.M.S. as a reversion to the condemned practice of laying down a plant liable to that enrichment of working solutions animadverted on by Butters (*Trans. Inst. Min. & Met.*, Vol. XIII, p. 77); an enrichment which was one of the causes of the abandonment of double treatment. Bosqui's knowledge of the evil effects arising from the enrichment of solution, resulting from the use of fixed submerged vacuum filters on rich material, must have warned him of the ill effects to be anticipated from any failure to keep his battery water unvitiated by contact with cyanide solutions.

But once more Bosqui has led the way to progress, not merely by his insistence upon absolute classification, air agitation, and filtration, but by adoption of most effective washing prior to crushing and grinding. Whether primary and secondary washing are really necessary I cannot yet say, but the milling increases resulting from the diversion (by washing or screening) from ball mills, stamps and tube mills of material already of the grade of the respective products, all go to prove Bosqui well advised, well inspired and absolutely correct. It will be observed that his system, with slight modifications, would lend itself admirably to the floating off or diversion of those fragments of wood which cause such trouble at Pachuca.

Mr. Söhnlein's reference to his furnace (*Min. & Sci. Press*, p. 688, Nov. 13, 1920), recalls the successful treatment in New Zealand of antimonial gold concentrate (referred to in these notes for 1906) by means of roasting in a reducing atmosphere, with special attention to the heat of the operation, followed by chlorination. A hand-rabbled reverberatory was used, and it was found necessary to roast in batches intermittently, each charge being kept separate from the next. On a similar problem arising later on in Rhodesia I patented (No. 957/13) there a furnace of the Merton type, in which reducing, oxidizing and chlorinating roasting may take place without any one of these roasts interfering with the operation of the other. I have not yet been able to investigate the working of Mr. Söhnlein's furnaces, but from his letter I should judge that his rabble work is novel and that his furnaces are effective.

The organizing of the Kolar Mining and Metallurgical Society is welcomed. India has been much too modest—or too disinclined—to publish technical papers, and yet, in the excellence of the sanitation of its underground workings and of its zinc-box (precipitation) practice, it has probably led the world. The new society should publish papers on the treatment of decomposed tailing heaps requiring oxidation; on the employment of "acid" versus alkaline solutions; and on the advantage of the basket (Moore) filter over the fixed-submerged (Thompson-Davies-Cassel-Butters-Moore) type.

The Development of the Silver Market*

A Short History of the Use of Silver in Monetary Systems and the Rise of London in the Market—Americans Manifesting an Increasing Interest in the Metal—The World's Silver Stocks Are an Important Factor in the Silver Situation, and an Open Market Is Desirable

By C. W. Wheelock†

THE beginning of the fourteenth century is usually taken as marking the establishment of the monetary system of Europe. About that time the change from a currency system based entirely on silver to one which was bimetallic—based on silver and gold—became operative.

In their struggle to maintain their supremacy in the commerce and banking of the world, the Hollanders, about the beginning of the nineteenth century, developed the theory that if they could take away the money function, or right to unlimited coinage, from one of the precious metals, it would naturally increase the demand for, and the value of, the remaining one. The exploiting and development of this theory and practice constitute the real beginning of what we have now come to recognize as the problem of the "silver market." This occurred about a century and a quarter ago. During the intervening period, Holland, because and in spite of those who held this theory, has been on a silver basis; then on a bimetallic basis; again on a silver basis, and finally on a nominal bimetallic basis, though, more accurately, on a gold basis.

In the meanwhile England too had been studying money, its uses and effects, as well as developing her world trade, commerce, shipping, and banking. Although the English disagreed with the Hollanders, who were advocating a silver basis, they none the less indorsed the principle involved. They fully appreciated that if they could take the money function away from one of the metals, either gold or silver, it would make the other, slowly but correspondingly, more valuable—the while it enhanced the values of fixed investments such as bonds and mortgages. Further, through the favorable position England had acquired by the end of the Napoleonic era, as the world's creditor and banker, it would enable her to buy more cheaply in silver-using countries, and, at the same time, sell for relatively higher price, to the silver-using countries, her own products. Accordingly, in 1816, England, as the dominating financial, banking, trading, creditor and shipping country of the world, put this theory into practice, and went on a gold basis. In this position England had the "power to exact a settlement of the trade balance in gold alone instead of gold or silver at the debtor's option as heretofore."

Subsequent to 1816 the English gold theory made little actual progress until the early '70s, when Germany, France, the Latin union and the United States were put on a gold basis, from which time, 1873, the depreciation of silver began. The year 1873 is therefore the date of the beginning of the silver market as we know it, with all its fluctuations.

During the previous 200 years the average yearly price of silver, stated in terms of gold or the gold price, was about $1.35 per oz. Its lowest yearly average price was in 1813, $1.27. Its highest was in 1760, $1.46. The extreme average fluctuation in 200 years, quoted at the gold price for it, was therefore 19c. per oz. Since 1873 it has fluctuated 94 or 95c. Or, conversely, when prior to 1873 practically all the world except England was on either a silver or bimetallic basis, the price of gold, during the same 200 years, stated in terms of silver, varied from an average of $19.443 to $22.392 per oz.—or only 8.6 per cent. Today, when we frequently state the price of gold in terms of commodities, we know it has fallen 40 per cent or more in the last six years.

Why London Controls the Market

The market for silver is unlike that of any other commodity, unless an exception is made of gold. Markets of all other commodities are more or less localized. The market for silver is substantially world-wide, and in reaching the distributing points the question of rapid transportation, prompt handling and delivery, settlement of trade balances, banking, and insurance are all factors of great importance. It was therefore natural that England, the premier banking, insurance, trading, shipping, and distributing country of the world, should be able to become, subsequent to 1873, the great silver market of the world.

Further reasons are evident, owing to the demonetization of silver. America was not consuming its own output. Buyers for our surplus had to be found. This country had none of the facilities necessary for sale and distribution to other countries of the world, especially to China and India. On the other hand, London had every facility, so, perforce of circumstance, London naturally became not only the prime silver market of the world, but also the main distributer of the metal.

If in the handling of our silver the English and their dependencies have made more profit out of it than we as its producers have made, we simply have to admit they have been smarter than we have, without holding any grudge against them in consequence, for their statistics are available to any who care to study them, and a knowledge of their general theory, policy, and practice is open to all.

Prior to the Great War London "fixed" the price for silver each day. The price of silver, in London, is quoted in pence per troy oz. sterling, or 925 fine. In New York it is quoted in cents per troy oz. 999 fine. Hence the seeming difference in price under normal exchange rates.

The fixing of the price in London is done each day by the four concerns which constitute the London silver market, namely Messrs. Mocatta & Goldsmid, Samuel Montagu & Co., Pixley & Abel, and Sharp & Wilkins. In some recent correspondence [illegible] has been accorded me, the statement is made that all transactions and the fixing of the price are confined exclusively to these four firms, because of the fact that they operate "under patents from the crown."

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*Read Dec. 8, 1920, at the meeting of the [illegible] of the American Institute of Mining and [illegible]

†The author wishes to acknowledge [illegible] tended him in the preparation of [illegible] Questions, Messrs. Handy and Harman, [illegible] Trust Co., the International [illegible] department of the [illegible] Bank, the Director of the Mint, and [illegible]

The concerns named, or their representatives, meet each day at about 2 p.m., or on Saturday at 11.30 a.m., and with the data in hand as to supplies in stock and available, all the way from New York to London, Bombay, Calcutta, Shanghai, Hongkong and San Francisco, disclose to each other their buying and selling orders, without, however, disclosing their principals. On taking stock of the world situation, together with the day's requirements, and any other necessary items, the price for the day is then "fixed." Any excess of demand or supply determines whether the previous day's price is advanced or lowered. The dealings are closed on the day's official price so fixed. The fixed price is then cabled to the other markets. This fixed price in turn governs the prices at the other points, exchange rates, freights, insurance and trade balances being considered.

Two prices are fixed each day—one for "cash," that is for delivery within one week, at the option of the seller; the other price for "forward" delivery—two months from the date of sale. The spread between the "cash" price and the "forward" price depends upon a variety of factors. Options or "puts and calls" on silver are also freely traded in. The vendor pays no selling commission, but the purchaser pays a commission of one-eighth of 1 per cent.

GOVERNMENT PROFITS IN SILVER COINAGE

The price of any article depends normally upon the demand for it. Until silver was demonetized the market for it was unlimited, and the price showed small fluctuation, as previously stated. Since it was demonetized its market has been limited to the demands from the industrial arts and to such amounts as the governments of the world have seen fit to use for coinage, together with any amounts required by China in settlement of trade balances.

Outside of the United States statistics of the quantities used in the industrial arts seem lacking. World estimates have been made all the way from 40,000,000 oz. to 120,000,000 oz. per year. Accepting even the top estimate, it will be seen that there still remains a considerable yearly surplus, probably averaging fully 100,000,000 oz., which acts as a depressing factor.

It is obviously to the advantage of any government to purchase silver for coinage as cheaply as possible, for the government makes the seigniorage, or the difference between the cost price and its circulating value. For example, the cost price may be 60c. per oz. After being coined it circulates at the rate of from $1.33 to about $1.45 per oz., according to the coining ratio. It will therefore be seen that if purchased at 60c. and coined at, say, a $1.35 rate, there is a profit of 75c. per oz. to the government doing the coining. On this basis the government makes considerably more profit than it has paid the silver miner for the bullion.

The governments are very canny buyers, as is shown by the following extract from a letter from a firm of London bankers: "Very soon after the start of the war the demand for coinage slowly absorbed the floating supply of silver. Purchases for the governments were pooled, and were made with such care that the price of silver did not act on it, but actually declined."

The Indian government and the Chinese bankers and merchants are the principal buyers of silver. In the last sixteen years India has absorbed an average of 35 per cent of the world's yearly production. In 1919 she took 112 per cent of that year's world production. In the last two to three years China has absorbed substantially an amount equal to two years' production. These excess demands were met by the Treasury of the United States, as a war measure. It is evident, therefore, that to a degree the price of silver is governed by the requirements of the Asiatics.

It is palpably not to the interest of the Indian government, which in turn is controlled by the British government, to pay a high price for silver. The Indian government has built up a gold fund reserve of about £35,000,000 from the profits from silver seigniorage. The government would be loath to give up this profit.

The Chinese people, like those of India, however, prefer a high price for silver, as it enables them to buy more abroad, as well as to receive higher prices for their own exports. This condition, however, is always combated by European interests which largely control the Chinese markets.

In addition to the purchases by the governments and by those who use it in the industrial arts, there is normally a large speculative position in silver. The foreigners have found silver to be an excellent medium of speculation. This speculation extends all the way from London to China.

Because of the fact that the United States alone of all the countries of the world had on hand a large stock of silver—which during the time of its accumulation had been the source of bitter argument and recrimination—we were able to come to the rescue at the time of the war crisis, and prevent an utter collapse in Asiatic, and also probably European, financial conditions. According to the Director of the Mint our "loss by conversion and sale" of this silver was in 1918 alone over $59,000,000. However, we saved a critical situation—even though in so doing we again bowed to London.

INCREASING AMERICAN MARKET INTERESTS

There is now great satisfaction in knowing that certain large New York financial interests have recently become an important factor in the silver market, and are maintaining a most influential position with regard to it. These interests are entirely separate and distinct from any of the mining, milling, or smelting companies.

The concern that is now doing the largest silver-bullion business favors high, rather than low, prices for silver. This concern acts as broker, at a commission of $1 per $1,000, plus cable charges—or it will buy and sell for its own account. It also makes loans on bullion at a reasonable rate of interest. All this is a pronounced advance, so far as a silver market in New York is concerned. A still greater co-operation with these interests by miners outside of the United States would inure to the benefit of foreign silver miners.

In addition to the foregoing considerable work and investigation are being carried on by mining interests, with the view of attempting to create definitely a permanent open market for silver in the United States, hoping thereby to establish and maintain a high price for silver. As long as the Pittman Act remains in operation the producers of silver in the United States are assured of practically $1 per oz. If this act is not repealed or altered this condition will probably obtain about four years longer. Yet, four years in the history of silver is but a brief period.

In considering broadly the market for silver certain fundamental elements must be kept constantly in mind. All commodities may be roughly divided into two classes, viz.: consumable and non-consumable. In the consumable class are all the ordinary commodities of commerce and agriculture, such as copper, coal, iron, wheat, cotton, and other necessaries. Substantially each year's product is either actually consumed, as are wheat and coal, or is locally utilized for some specific purpose, as are copper and iron. These consumable commodities are thus removed from the market. In the non-consumable class are the balance of the commodities, such as works of art, precious jewels, and precious metals that may be visualized as constituting a permanent stock on hand, to which small yearly accretions are made.

Therefore, in considering a market for either of the precious metals, gold or silver, due consideration must be given to the world stock on hand. Since 1860 there has been a world production of over twelve billion dollars of gold and over seven billion ounces of silver. As both metals have been produced for ages, no one can determine the actual stock on hand of either one. The world's silver stock may be divided into two classes, that which has been used in the arts and that which has been coined. At what price, or in what amount, silver that has been used in the arts will come on to any given market, or in what time, is wholly unknown and thoroughly problematical. However, it is estimated that about 20,000,000 oz. of "old silver" came on to the London market the first ten months of 1920. Part of this was from melted coins and the rest from the arts. It is believed that, owing to the prohibiting laws of the European governments and the seeming exhaustion of supplies, there will be little silver, at least from melted coins, coming on to the European market in the near future. What may come further from the arts is anyone's guess.

On account of this world stock of silver, statistics covering but one or two years' probable production and consumption are likely to be most dangerous and misleading. Only about a year ago these yearly statistical estimates seemed to indicate a shortage in 1920, according to those who made the several estimates, of from 40 to 155 million ounces. Based on these estimates, many people anticipated continuing high prices during 1920. The worth of such statistics and estimates for any single year without consideration of the world's stock and *many other factors of importance* is illustrated by the fact that foreign silver is quoted under 70c. per oz., instead of holding above $1.20, as anticipated.

Some authorities assert that the price of silver is governed by the price of Asiatic exchange; others that Asiatic exchange is governed by the price of silver. Under differing conditions either conclusion, it would appear, may be correct. As a matter of fact, the producer of silver, unlike the producer of other articles, never is allowed any voice or option in determining the price of his product.

DESIRABILITY OF AN OPEN MARKET

The world's yearly output of silver has recently varied from about 225 million ounces in 1911 to probably 150 to 160 million ounces in 1920. Citizens of the United States own and control about 75 per cent of the total. As only about 25 million ounces are used in the industrial arts in the United States, a considerable surplus is left, which has to find a market some place in the world. For this reason some preliminary work has been done, hoping to devise some means, probably through an open United States market, by which a higher price for silver can be maintained. It is highly problematical whether such means could, under existing conditions, succeed.

However, assuming there are adequate reasons for such an open silver market in the United States, would it not be preferable, if possible, to have silver listed on the New York Stock Exchange rather than attempt to establish it in an isolated market by itself? Considering the high esteem in which the New York Stock Exchange is held by many in the West, it will not be difficult to divine their reply to this suggestion. None the less, it must be borne in mind that it requires money and monied interests to handle silver in quantity and to deal with governments. Through the Stock Exchange access could be had to reasonable financial resources, and possibly assistance and co-operation in selling to foreign governments. Further, those who speculate would be afforded means of ample action.

All this on the hypothesis that silver will continue in the position it has occupied since 1873—part money metal, part ordinary commodity, a source of far greater profit to speculators and to governments than to its producers, whereas the method of utilizing it has been to the disadvantage, as well as to the oppression, of certainly more than one-half of the population of the world.

SILVER AS A BACKING TO GOLD RESERVES

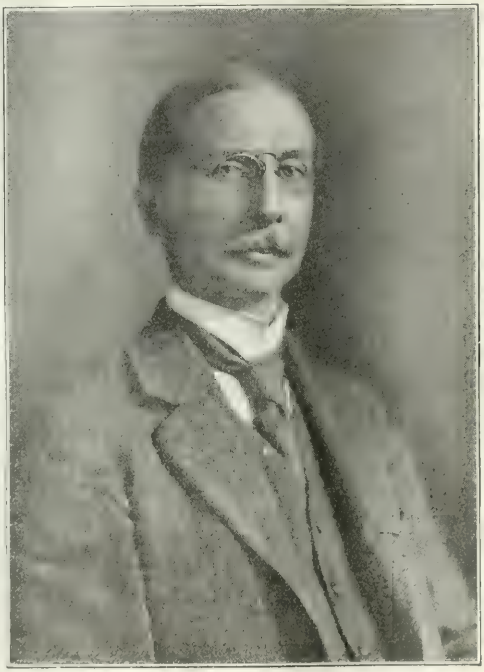
Silver, so long as it is primarily an article of commerce, will always fluctuate widely in price, and will undoubtedly continue, as bullion, greatly under the price at which it is current after coinage. The problem today would seem to be, more than ever, not what can be done for silver, but, rather, what can silver be made to do to help mankind? As pertinent to the problem, it is interesting to note that the national debts of the world have increased since the beginning of the war from 43 billion to 300 billion dollars. During the same time the amount of paper money has increased from 7½ billion dollars to 81½ billion dollars, while the total gold reserves have increased only 2½ billion dollars, according to statistics recently published by the National City Bank. The gold reserves of the world held against paper currency were 66.3 per cent in July, 1914. In November, 1920, they were 9.2 per cent. The gold reserves of Europe and India, but excluding any consideration of Russia, are but 5.2 per cent. There is therefore an inverted pyramid of national debts and currency, practically all calling for payment in, or conversion into, gold, amounting to about 380 billion dollars resting on a base of but 7½ billion gold—less than 2 per cent. In addition, the state, municipal, corporate and private debts are also payable in gold. The stack of gold has got to work more than union hours to keep this inverted pyramid from toppling over. Meanwhile the production of gold is falling off, which fact probably none appreciate as do mining engineers. It is just this situation that makes many bankers and economists pessimistic.

Fortunately for us the United States is in the strongest position as to gold reserves of all of the great nations. However, if unfortunately some of the others do have trouble, we shall not be immune from some of the consequences. In view of world conditions it would seem apparent that the question of silver and the market for silver should not be studied from the narrow point of view of better market and price for the metal and the miner. Rather does it behoove the governments and financial interests of the world to promptly study this largely unused asset, and to devise some means of better utilizing silver for the benefit of mankind in lieu of kicking it as a speculative football

Mining Engineers of Note

Robert Peele

ONE of the striking characteristics of many successful and prominent mining engineers is the highly varied succession of activities in which they have been engaged, which illustrates the versatility of the profession and warrants the inference that, although specilization is a desirable modern prerequisite to success, there is much of value in general experience. Robert Peele's career is no exception to the general rule. Graduating from the Columbia School of Mines in 1883, he acquired successively assaying and general mining experience (as most graduates do) in North Carolina and Colorado. After a year at this work he became foreman of the Silver King Mining Co.'s mill, in Arizona, where chloridizing roasting and amalgamation was being practiced. This position enabled him to acquire valuable training in mill work, although the reduction process employed is now obsolete. Then successively came an engagement as superintendent of a small silver mine in Horseshoe Gulch, near Fairplay, Col.; examination of mines in Arizona, New Mexico, and North Carolina, followed by an investigation of placer deposits in Colombia and Dutch Guiana. Respecting the work in Dutch Guiana Prof. Peele says: "Not a mile of railroad existed in the country at that time, and in carrying out prospecting work in three different gold placers areas, laborers, provisions, and supplies all were transported partly by launch but mostly by dugouts. After reaching in this way the nearest point to the concession to be prospected, the remainder of the journey was made on foot over trails cut through thick, tropical brush, the chief guide being a compass used in connection with rough and inaccurate sketch maps." The next jump was to a colder clime, for in 1889 as the superintendent of the Oregon Gold Mining Co. in Cornucopia, Ore., Mr. Peele became familiar with the destructive effects of snowslides in the Blue Mountains and their results on mining operations. From 1890 to 1892 he conducted examinations of gold, silver, tin, and coal mines for the Peruvian Exploration Syndicate, of London. As this syndicate was the subsidiary of the Peruvian corporation organized in the interest of the foreign bondholders of the Peruvian railroads which at that time occupied an important place in the political and commercial life of the country, a splendid opportunity was given him to become acquainted with the mining regions of certain parts of the West Coast of South America. His field was broad, necessitating constant travel, and extended far into the interior of Bolivia, Peru, and Colombia. The interesting silver mining districts of Colquechaca and Porco, Bolivia, and numerous undeveloped tin deposits in the elevated region to the east of Oruro, were examined—elevations ranging from 14,500 to 16,000 ft. Work of similar nature took Professor Peele close to the district now made famous by the copper mine at Chuquicamata. Many of these trips were extended muleback journeys—one to Cochabama was particularly long and arduous then, although easily made by rail today. Other examinations were made in Peru in the Callejon de Huaylas district and vicinity, also in a remote region east of Bucaramanga, Colombia, near the Venezuelan border. Considering the wide experience in mining which Mr. Peele's career had afforded him, it was no wonder that he was invited to accept the post of adjunct professor of mining at Columbia University, a tender that he accepted in the fall of 1892. However, his professional work partly continued. In 1896, the firm of Olcott, Fearn & Peele was organized, afterward Olcott, Corning & Peele, consulting mining engineers.



ROBERT PEELE

Not contented with his globe trotting up to this stage of his career, two circuits were subsequently made around the world. In 1910 a trip was taken to the Transvaal and the Kimberley diamond mines of South Africa, returning via South America.

Professor Peele has made two notable contributions to engineering literature, the first, "Compressed Air Plant," now in its fourth edition, and the second, "The Mining Engineer's Handbook," an exceedingly useful volume which represents a great amount of labor on the part of his associates and himself. Articles on mining subjects in the Encyclopaedia Britannica are also the work of his pen. Professor Peele is widely known and honored as one of the foremost authorities upon mining matters.

BY THE WAY

Keno Hill

History seemingly repeated itself at Keno Hill, the scene of the important silver discovery in the Mayo area, in Yukon Territory, about 150 miles west of the great gold center at Dawson. One is reminded of the early days at Leadville, where the placer miners in California Gulch cursed the heavy carbonate of lead that impeded their washing operations, not knowing its nature or its valuable silver content. In similar manner, prospectors, led by the lure of gold years ago to Duncan Creek, at the foot of Keno Hill, ignored the galena float they found in their sluice boxes and eventually passed on, leaving their chance to fame and fortune behind them. It remained for Louis Beauvette, a seasoned prospector, to discover the rich silver ore and stake the discovery claim, on July 10, 1919, on the hill where years before he had often hunted the mountain sheep. Over 500 claims have been staked. Keno Hill is a wedge-shaped ridge about eight miles long and five mile wide lying between creeks, according to Dr. Cockfield, of the Dominion Geological Survey. Its northern slope is rugged, even precipitous in places, and the southern slope is gentler, being controlled by the dip of the strata. The rocks exposed are schists and gneisses cut by greenstones and smaller bodies of quartz porphyry and granite porphyry. The main veins of the hill striking N.30-40 deg. E. and dipping 50 to 70 deg. southeast are persistent for considerable distances and are cut off by a series of transverse fractures at an angle of about 70 deg. The most extensive work to date has been done by the Yukon Gold Co., which secured options just after the first few claims were staked, since which time it has taken over the six central claims on which silver was first found. These are to be developed by a subsidiary company known as Keno Hill, Ltd. The warning given by a writer in the *Dawson News* is worth repeating. "The development of a rich camp like Mayo is certain to attract speculators of a kind who will be more anxious to obtain options and float companies on terms more beneficial to themselves than conducive to the welfare of the country."

You Can Dine Well in Yukon

Childrens' restaurant is our pet aversion, and in our lighter moments we are fond of comparing the menus of other establishments far and near with that which it puts forth. In the last two years we have heard how miners were leaving Alaska and other parts of the North; how costs were mounting and conditions steadily worsening. Perhaps things have taken a turn for the better. At any rate the Arcade Café, in Dawson, puts forth a menu, an "All-Yukon" menu it calls it, which compares more than favorably with many New York bills of fare. To quote from it, chicken à la Eldorado is but a dollar a throw; Bonanza Basin dill pickles and Quartz Creek pickles two bits a portion each. Boiled Yukon salmon, baked Galena Creek grayling, or fried Tullibee, the latter with Twelvemile silver chips, may be had for six bits each, to say nothing of the All-Yukon dinner for the same price. Among the *entrées* are grilled caribou steak with Mount Rambler mushroom sauce at six bits and Lookout Mountain moose steak with bacon at a dollar. Grilled Keno Hill ptarmigan, à la Axel Erickson, is more expensive at a dollar two bits. Leg of Sixtymile caribou with wild current jelly is listed at six bits, and Duncan Creek grouse, à la Louis Beauvette (Louis discovered Keno Hill), at double the price will conclude the recital, though the half has not been told. The Arcade calls itself "the most famous restaurant of the Land of the Midnight Sun—Mecca of the tourist and home of the sourdough—Headquarters of the All-Yukon dinner, the meal that keeps the money at home, and proves that Yukon is the great food-producing belt of the continent."

Comparatively Warm

Keno Hill enjoys a climate that, though not exactly comparable with that of Palm Beach or Bermuda, is such that some in the Far North consider it a not unpleasant place to be in. There, it is said, the temperature seldom ever registers more than 15 to 20 deg. below zero in winter, though in the valleys below it drops in cold spells to 50 and 60 below or even further, sometimes reaching a point where no doubt even the currency contracts. In spite of its mild climate, however, there will be many who will wait till warmer weather before rushing to the district.

An Episode of the North

The romantic adventure of the three naval balloonists, who were blown by a blizzard from the vicinity of New York to the southern shore of James Bay and at this writing are making their way by dog team back to civilization, has focused the attention of all upon them, and their story is eagerly awaited. Newspaper men and photographers have hastened to meet them. It is therefore with some distaste that one reads in the day's paper that Secretary Daniels has wired the ballonists to say nothing of their adventure until their statements to the Navy Department have been received and given to the public. One is reminded of the master of ceremonies at a ball, who to display his authority over the musicians ordered them to stop at the height of the dance. Then he informed the guests that dancing might be resumed; but nobody danced.

A New Oil Rush

A mechanical engineer in building air castles might be forgiven if he inadvertently reached the conclusion that because this old globe revolves so smoothly there must be a lot of oil around the poles. However this may be, there is a rush up toward the Arctic Circle again. This time it is for oil, not for gold. Prospectors are heading for the Mackenzie River to the new oil field at Fort Norman. Although winter is closing in, hundreds of adventurers are said to have set out with pack trains and dog sleds to stake claims before the rush starts in the spring. Indeed, it looks as if the rush had already begun. In order to protect the foolish against themselves the North West Police are forbidding all to continue who are not fit or adequately provisioned.

On the Kougarok

Of the Kougarok River near Nome, Alaska, it is said that he who drinks of its waters never tells the truth again. The miners who once [illegible] about the Kougarok diggings drew on their [illegible] so liberally in dealing with others that the [illegible] "Divide by eight what the Kougarok miner says."

CONSULTATION

Quotation Comparisons

"As you are aware, we have always been somewhat critical of the prices appearing in the *Engineering and Mining Journal* as compared with other current quotations for copper in New York, and recently this disparity has been so marked we feel we should like to have some explanation. To our knowledge the journal in question has on more than one occasion, owing to complaints, endeavored to explain the justice of its quotations, but evidently not to general satisfaction, as the complaints appear to have been renewed from time to time.

"We have taken out a list[1] of quotations of electrolytic copper from the Nov. 1 issue, and those given in the London *Financial News* based on cables from New York, which quotations we may say we have verified from time to time, with the cabled New York prices given in other papers, such as the *Times*. You will see that the *E. & M. J.* prices are invariably below the others, and in the last quotation, that of Dec. 1, the *E. & M. J.* price is given as 13.25c., against the mean cabled figure of 13.875c. The lowest price mentioned here recently was a reported sale at 13⅜c., which was lower than the quoted figures, but this was recorded as an exceptional instance, and even so this price is above the 13.25c. quoted by the *E. & M. J.*

"The statement made by the *Engineering and Mining Journal* that its prices are an appraisal based on the results of actual business done in the major markets is taken into account, but even so we cannot understand why there should be so marked a difference, as current quotations must surely reflect the course of business which has happened (nominal quotations excepted), and taking into account forward sales, which under usual conditions command higher prices, we cannot see how these lower quotations of the *Engineering and Mining Journal* are justified. 'Spot' transactions generally command the lowest prices, but a considerable margin between these and the *E. & M. J.* figures always appears to exist, although presumably their prices cover both 'spot' and 'forward' sales."

The London metal dealer who was instrumental in forwarding the above letter informs the *Engineering and Mining Journal* that "a large number of contracts for the sale in America of copper-bearing material are based upon the copper quotations appearing in your journal," so that the following explanation may prove illuminating to other interested metal producers abroad besides the South African producer making the inquiry:

Copper, unlike other metals, is commonly quoted on a "delivered" basis, the seller paying the freight charges to the consumer's plant. However, in order to have the metal quotations all on the same basis, copper is quoted, in the regular table of the Market Section, f.o.b. New York refinery. It has been decided, after proper investigation, that the delivery charges will average about ¼c. per lb., so that for the time being this amount is deducted from the delivered prices as reported to us. Recently, below the table, the delivered price is also quoted, so that there can be no misconception. Other publications almost invariably quote the delivered price, which is about ¼c. more than the seller actually receives after deducting transportation charges. This, therefore, accounts for ¼c. of the difference.

Further, *Engineering and Mining Journal* prices represent actual sales, and not strictly quotations. Recently, for example, sellers of possibly 75 per cent of the American copper production have been quoting 14c. per lb. and unwilling to sell at the prices, around 12½c., realized by smaller interests. When these quotations are purely nominal and no sales at such prices are made, they are neglected utterly. This fact has a tendency to make the quotations lower than those published elsewhere.

Most other quotations are reported daily and are obtained by inquiring from one or more selling agencies for the price at which they are holding copper. It is to the interest of metal producers of course to have such published quotations high, so that a cut under those prices will prove more attractive to an actual purchaser. The quotations published in the *Engineering and Mining Journal* are a review of past sales, and do not appear until from one to eight days after business has been consummated, so that sellers do not have the incentive to influence the market by misleading quotations. All of the facts above set forth tend to make *Engineering and Mining Journal* quotations lower than others, particularly in a declining market such as the recent one.

A word as to how these prices are obtained: Once a week producers and consumers in New York supply confidential information as to what they have sold or bought during the preceding week. In general this information is given to no one else, and is given only on condition that no confidence is violated, but that the information is only used to arrive at just quotations. Producers and consumers tell us that they do not give this same information to the financial papers and the daily press, which must, therefore, depend on gossip and on the quotations of the New York Metal Exchange, on which comparatively little business is done. Sales made for delivery far in the future and sales made at contract prices we are disposed to neglect. Prices therefore represent the figures at which metal was actually sold for early delivery in the open market. Sales are weighted as to quantity, and a lot of 1,000 tons at 12½c. is given ten times the consideration that a sale of 100 tons at 13c. receives. This also tends, in many cases, to make our prices seem low. The sales information given by our informants is often automatically checked, that is, a sale reported by a metal producer is reported by a consumer as a purchase.

The *Engineering and Mining Journal* is neither owned, controlled nor edited by anyone having any interest in the metal markets other than that high prices make the mineral industry more prosperous, which of course would redound to the advantage of this publication. Certainly, therefore, we have no reason for quoting prices lower than are justified.

The best way in which *Engineering and Mining Journal* quotations can be checked is to compare them with an actual record of sales or purchases, as the case may be. A comparison with other quotational services will almost always show marked discrepancies, as the press in general is not supplied with the sales information given to this publication.

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[1] The list is not quoted here for lack of space, but comparison [illegible] *Financial News* [illegible] *Engineering and Mining Journal* [illegible]

THE PETROLEUM INDUSTRY

Texas Advances to First Place Among November Oil-Producing States

THE following statistics of the production of petroleum in the United States east of California in November, 1920, and the two preceding months, based on reports filed with the U. S. Geological Survey, show the quantity of oil removed from producing properties by pipe-line and other marketing companies and by refineries that receive petroleum through private pipe lines or in tank cars or boats directly from the wells. Data concerning oil consumed on the leases and producers' storage cannot be obtained in time for use in the monthly reports, but are used in compiling the annual figures showing production. The production reported for California is the average shown by figures collected by the Standard Oil Co. and by the Independent Producers' Agency and includes all petroleum brought to the surface.

The daily rate of production of petroleum in the United States continued to increase during November and attained the record of 1,303,000 bbl., making a total for the month of 39,090,000 bbl., almost seven million barrels more than in November, 1919. Imports during November also reached the highest mark yet attained, amounting to 13,750,199 bbl., an increase of more than two million barrels over the imports during October and of almost nine million barrels more than in November a year ago. Consumption, however, did not keep pace with the increase in petroleum available; instead there was a slight decrease in total consumption of crude oil as compared with October, and stocks were increased more than three million barrels. Stocks of domestic petroleum were increased by 2[illegible] million barrels and stocks of Mexican petroleum held by importers in the United States by almost one million barrels. Large gains were made in stocks of Oklahoma-Kansas and North Central Texas grade and of Gulf Coast grade, and the steady decrease of California stocks that has persisted for so many months is reported to have been checked. Losses are recorded in stocks of other domestic grades.

The event of the month in domestic production was the increase reported for Texas, amounting to a daily average of more than 17,000 bbl. Texas accordingly advanced from third to first place, surpassing Oklahoma and California. Among the smaller producing states Montana went ahead of Indiana and New York. Increased rates of production are also reported for California, Kansas, Louisiana, West Virginia, and Illinois; decreased rates are recorded for the other states.

During the first eleven months of the year 409,000,000 bbl. of petroleum was produced in the United States, as compared with 345,000,000 bbl. during the corresponding months of 1919. It seems assured, therefore, that 450,000,000 bbl. will have been produced in the United States during 1920, an increase of more than 70,000,000 bbl. over the output in the year 1919. The outstanding facts of 1920 in regard to crude petroleum in the United States have been not only the record-breaking production but the even greater increase in rate of imports and consumption.

PETROLEUM PRODUCED IN THE UNITED STATES IN SEPTEMBER, OCTOBER, AND NOVEMBER, 1920

(Barrels of 42 U. S. gallons)

State	September, 1920 Total	September, 1920 Daily Average	October (a), 1920 Total	October (a), 1920 Daily Average	November, 1920 Total	November, 1920 Daily Average
Central and Northern Texas	5,743,000	191,433	6,659,000	214,806	6,714,000	223,800
Coastal Texas	2,144,000	71,467	2,619,000	84,484	2,775,000	92,500
California	9,128,000	304,267	9,459,000	305,129	9,340,000	311,333
Oklahoma	9,093,000	303,100	9,437,000	304,419	9,031,000	301,033
Kansas	3,615,000	120,500	3,601,000	116,161	3,578,000	119,267
Northern Louisiana	2,644,000	88,133	2,511,000	81,000	2,462,000	82,067
Coastal Louisiana	132,000	4,400	150,000	4,839	153,000	5,100
Wyoming	1,573,000	52,433	1,676,000	54,065	1,340,000	44,667
Illinois	903,000	30,100	872,000	28,129	846,000	28,200
Kentucky and Tennessee	766,000	25,533	761,000	24,548	734,000	24,467
West Virginia	672,000	22,400	673,000	21,710	656,000	21,866
Pennsylvania	626,000	20,867	646,000	20,839	603,000	20,100
Central and Eastern Ohio	453,000	15,100	446,000	14,387	437,000	14,567
Northwestern Ohio	187,000	6,233	182,000	5,871	165,000	5,500
Montana	37,000	1,233	56,000	1,807	92,000	3,066
Indiana	86,000	2,867	85,000	2,742	81,000	2,700
New York	78,000	2,600	82,000	2,645	75,000	2,500
Colorado	9,000	300	9,000	290	8,000	267
Totals	37,889,000	1,262,966	39,924,000	1,287,871	39,090,000	1,303,000

(a) Revised

Oil Indications in Uruguay

Investigations for oil have been carried out in Uruguay by the Instituto de Geologia y Perforaciones, according to *Commerce Reports*, and indications have been found in various parts of the republic, notably in the northern and northeastern parts, where the oil-bearing or bituminous strata of southern Brazil extend into this region. Borings have been made near the city of Melo to a depth of nearly 1,640 ft., passing sedimentary strata of shale and sandstone. At a depth of about 500 ft. flows of water were encountered having a strong odor and taste of petroleum.

NEWS FROM THE OIL FIELDS

Wildcat Drilling in Harris County, Tex.

From Our Special Correspondent

Some wildcat drilling is now being done that is of considerable interest. The Willow Creek Oil Co. has brought in a gas well near Louetta, Harris County, twenty-six miles northwest of Houston. The gas was struck at 1,400 ft. and was under sufficient pressure to blow the mud from the hole. Deeper drilling will be done to test for oil. The East Houston Syndicate has been organized to drill on company ground just north of East Houston. It is said there is a gas showing there and every indication of a dome. Besides work on these coastal wildcats, work will be resumed by the International Oil Co. on its well in Maverick County near Eagle Pass. The well is 3,150 ft. deep, and is said to have shown considerable oil when bailed. Equipment has been installed capable of drilling to a depth of 4,000 ft.

Several new producers have been completed recently in the Hull field, and at West Columbia there have been few new completions and the Texas Co.'s No. 49 Hogg well and two of the Humble Oil & Refining Co.'s Japhet wells, three of the largest producers in the field, have sanded up. Although the production in this field has fallen off considerably, construction is under way, including a tank farm by the Texas Co. covering fifty acres, and an electrically equipped pumping plant by the Humble Oil & Refining Co. The only completion of importance at West Columbia recently is the No. 1 well of the Big Belt Oil Co., flowing 2,000 bbl. This well is between the old field and the north extension.

At Blue Ridge, the Texas Co. finally succeeded in reopening its No. 1 Robinson well, but it is making only 100 bbl. per day. This is the well that came in as a big gusher and lasted only a short time, but caused the present intensive campaign of drilling by a dozen or more companies. In one well, the No. 1 Bentley of Jerry Kinney et al., salt has been struck at a depth of 2,780 ft.

Senator McKellar Introduces Oil Protection Bill

A bill to protect the oil resources of the United States and which asks reciprocity on oil and shale deposits between the United States and other nations which make no restrictions upon the exploitation by Americans of petroleum within their dominions, and retaliation against such nations as discriminate, was introduced on Jan. 3 by Senator McKellar, Democrat, of Tennessee. The bill was referred to the Foreign Relations Committee.

Sixth Completion Made by Iowa-Wyoming Company in Wyoming Field

From Our Special Correspondent

The Iowa-Wyoming Oil Co. has just completed its No. 8 well in the Bolton Creek field, making an initial production of 100 bbl. daily from 1,065 ft. This is the sixth completion by this company in this field. Two other wells are ready to be drilled in.

It is reported that the Pahaska Syndicate has struck oil at about 445 ft. on its lease three miles east of Cody.

The Midwest Refining Co. has a flow of 10,000,000 cu.ft. of gas from its well on the Golden Eagle dome near Thermopolis. The gas is coming from 2,475 ft., and an attempt is being made to shut off the flow so that deeper drilling can be done. Other gas flows have been found in this district at 2,110 and 2,185 ft.

The Salt Creek Producers' Association has declared its initial quarterly dividend of 1 per cent and an extra of 2 per cent payable Jan. 31 to stockholders of record Jan. 15.

Mexican Oil Notes

From Our Special Correspondent

The Indiana Mexican Petroleum Corporation brought in its first producer in the Mexican fields recently. It is known as the company's No. 1, on a fraction of Lot 134, Chinampa. The pay was struck at a depth of 1,907 ft., making it one of the shallowest wells in the field. The estimated flow is 30,000 bbl. daily.

The Transcontinental Petroleum Co.'s well on Lot 198, Amatlan, is still blowing gas and a spray of oil, and consequently it is difficult to drill. It is expected that the oil will be encountered in the next five feet. The well has over nine hundred pounds' pressure on it, which is rather high for the district. The depth of the well is now 2,028 ft.

The work on the Transcontinental Co.'s pump station on Lot 214, Amatlan, is progressing rapidly, and it is expected that it will be in operation within the next four months. There will be fourteen pumps with twenty-eight boilers to furnish the steam. The estimated capacity of the plant is between 250,000 to 300,000 bbl. of oil daily. This will be the largest pump station in Mexico.

Much of the drilling in Zacamixtle is being held up on account of litigation. This will probably regulate the extensive drilling program and add a few months of life to the pool, which promises, from present indications, to be one of the largest in Mexico.

The deep test of the Azteca Co. on Lot 188, Amatlan, is changing from standard to rotary tools in order to carry the hole down to 4,500 ft.

Many Good Strikes in Old Areas of Kentucky

From Our Special Correspondent

In Lee County, Ky., where most of the eastern Kentucky development is centered, the Petroleum Exploration Co., drilling on the Rogers lease, has two 10-bbl. wells, as has also the superior Oil Co., drilling on the Hall-Burke lease. The Southwestern Petroleum Co., drilling on the Lyon lease, has a 15-bbl. well. The Ohio Fuel Co., on the Smyth lease, has a well of 50-bbl. estimated capacity.

In western Kentucky, the Warren County field shows a number of wells making up to 100 bbl. In the Davenport pool the Big Jack Oil Co. is reported to have a showing for 200 bbl. in its latest puncture on the Charles Davenport lease. Activity in western Warren has extended into Todd and Logan counties, each of which is now undergoing a thorough test. The latest completion reported from Logan County was an advance test drilled on the Wilhelm lease, making 15 bbl.

Simpson, Allen and Barren counties are receiving more attention than ever, Simpson especially with respect to lately completed work. Two new completions on the Mitchell lease are reported to have a showing of 100 bbl.

In Barren County, on the Myers lease, the Elam Oil & Gas Co. has a 25-bbl. producer. A pipe line will be extended from the Woodson production to Glasgow, where a loading rack will be built.

The Grande Prairie Oil Field

From Our Special Correspondent

The Imperial Oil Co. has leased 30,000 acres near the British Columbia boundary to the west of Grande Prairie, Alberta. Its holdings are located along both banks of the Pouce Coupe River, a tributary of the Peace River, extending for fifteen miles along either bank. The new field forms as it were a bay, or valley, in the eastern foothills of the Rocky Mountains, and according to gelogists shows similar characteristics to the Caspar, Wyoming, field. It is estimated that the new field covers an area of approximately forty by sixty miles. Since the Imperial Oil Co. placed its filings, from sixty to seventy thousand acres have been filed on by other corporations and individuals. The Imperial Oil Co. has two drilling outfits in transit from Edmonton, and it is reported that several outfits are being moved down from Peace River to the new field.

Recent dispatches from Athens state that Great Britain has been given concessions in newly discovered oil fields in northern Greece.

Book Reviews

The Cost of Mining. By James R. Finlay. Cloth; 6¼ x 9¼; pp. 532; third edition; charts and tables. McGraw-Hill Book Co., Inc., New York. Price, $6.

Mr. Finlay states in his preface to this edition that some doubt existed as to the fitness of the title of the book, but we are glad to note that it remains the same as that of the two previous issues. The inclusion of the several discussions of economic features of the industry makes the volume a particularly strong presentation and one which will appeal not only to those connected directly with mining but to those associated in any way with the industry. The former issues dealt more particularly with the technical side of mining costs; in this issue the author has dealt with the subject in a broader manner and has not only given the reader the benefit of his wealth of experience in the mining business under diverse conditions, but has also presented a liberal interpretation of the importance which may be attached to the economic factors concerning the industry.

The early chapters of the book are devoted to broad discussions of the economic influences of the industry, the basis of valuations of mines, financial considerations and cost analysis. The remaining chapters deal with the production of specific minerals, their costs and relation to the world's business.

D. E. A. C.

Derecho Minero Cubano. By José Isaac del Corral. Paper; 7 x 10½; pp. 675. Tomo I. Published in Spanish by Sociedad Editorial Cuba Contemporánea, Habana, Cuba. Price, $5.

This is the first of three volumes. It is a compilation of laws and regulations on Cuban mining law from the earliest period up to date, and covering the requisition and working of mining property of every description. The work likewise discusses the mining laws of other countries and the origin of Cuban practise.

A Textbook of Chemical Engineering. By Edward Hart. Cloth; 6 x 9; pp. 211. Published by the Chemical Publishing Co., Easton, Pa. Price, $4.

This book is evidently written for the purpose of familiarizing students in their earlier courses in chemical engineering with some of the machinery with which they will come in contact. It embodies short chapters on the following topics: Materials, Location of Works, Boilers, Prime Movers, Plumbing, Crushing, Dissolving, Filtration, Tanks, Evaporation, Crystallization, Drying, Distillation, Absorption of Gases, Mixing and Kneading, and Containers. As the book contains about 200 illustrations and only 211 pages, the space left for discussion of all of these subjects is necessarily limited. The treatment is, therefore, incomplete and decidedly sketchy. The author does not attempt to go into the theory of the processes to any notable extent or to discuss the comparative virtues of the machinery described, but in general merely uses information gained from manufacturers' catalogs and articles published in the technical press and handbooks. We think too large a proportion of the text, in consequence, is quoted matter.

As an elementary textbook—and it is only fair to say that this is all the book purports to be—this work of Dr. Hart's will no doubt be acceptable. The field remains wide open, however, for some one—and he will need collaborators—to write an authoritative book on chemical engineering which will be complete, modern, and a valuable reference for the practicing engineer.

E. H. R.

Annual Statistical Report for 1919 of the American Iron and Steel Institute. Cloth; pp. 96; 6¼ x 9½; tables. Issued by the American Iron and Steel Institute, 61 Broadway, New York.

This eighth annual report contains the statistics of the iron and steel and allied industries of the United States and Canada for 1919 and preceding years. Among the compiled tables are those relating to the production of pig iron, steel ingots and castings, rolled iron and steel, tin plates, galvanized sheets, pipes, tubes, nails, rail joints, and charcoal blooms, the production and shipments of iron ore, coal and coke, miscellaneous production statistics, imports and exports, average monthly and yearly prices and statistics for Canada. As a reference book, this little volume will prove invaluable to those interested in any of the industries relating to iron and steel production. Although the included tables have already been published in bulletin form either by the Institute or other credited sources, the collection of them in this convenient form will be greatly appreciated by all interested in the industry.

D. E. A. C.

The Platinum Metals. By A. D. Lumb. Paper; 5½ x 8½; pp. 63. John Murray, 50 Albermarle Street, W. London. Price, 3s. 6d.

This paper gives the occurrences, characters, uses, production and sources of supply of the platinum metals and contains a bibliography upon the subject. It resembles in outline the paper on platinum prepared at Washington as part of the "Political and Commercial Control" series, but is considerably more detailed, particularly in its treatment of foreign platinum deposits. It is published by the Imperial Institute, a British organization which is a center for the exhibition and investigation of minerals with a view to their commercial development and for the supply of information respecting the sources, composition, and value of minerals of all kinds. The paper brings the subject up to date and gives much valuable information.

Technical Papers

Ontario Mining—Part I of the Ontario Department of Mines report for 1919 has been published and is obtainable on request to the Department at Toronto. The volume includes a statistical review; a list of mining accidents in 1919; short descriptions of all the mining operations in the province; the second report of the Joint Peat Committee; the results of a geological reconnaissance into Patricia; a report on the Windy Lake and other undeveloped nickel areas; and a chapter on Haileyburian intrusive rocks.

Queensland Mining Industry — The annual report of the Under Secretary for Mines for the year 1919 has been published and is obtainable on application to the Department of Mines, Brisbane, Queensland. It is a very complete book. A large colored map of Queensland showing the mining districts is a feature.

Oil Shale—In the Bulletin of the American Association of Petroleum Geologists (Vol. IV, No. 2, 1920) appears a paper, "Notes on the Oil Shales of Southwestern Wyoming," by E. F. Schramm. The article deals entirely with the oil-producing shales of the Green River formation, and one section, totaling 1,784 ft. in thickness, is completely classified. Results of distillation of samples are given. In addition, twelve other sections showing the position and thickness of the shales are plotted. The paper is illustrated with photographs of typical outcrops.

Slate Mining—The U. S. Bureau of Mines *Reports of Investigations*, Serial No. 2,181, has five pages devoted to slate mining in Maine in the vicinity of Monson. The deposits are unique and demand special methods of operation. The bulletin is free.

South Australian Mining—A review of mining operations for the first half of 1920 has been published by the Department of Mines, Adelaide, South Australia; obtainable on request.

Manganese—A report on the manganese deposits of Horseshoe Range, Peak Hill Goldfield, Western Australia (thirty-one pages), may be obtained from the State Mining Engineer, Perth, Western Australia. The deposits so far have not been worked, but it is estimated that 1½ million tons of ore of marketable grade could be secured from the top crust of these deposits.

Ontario Gold—Part IV of the twenty-ninth annual report of the Ontario Department of Mines (Toronto, Ont., free on request), is a fifty-[illegible] page pamphlet devoted to the Kirkland Lake gold area. This is next to Porcupine in importance as a gold producer in Ontario. Estimates place the [illegible] production at one million dollars. Most of the gold occurs native and is recovered by the cyanide process. [illegible] maps, colored plates, and sketches are given.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Conditions at Colorado School of Mines as Seen by a Graduate in Residence

System of Trusteeship Blamed—Would Put School Under State University—Urges Alumni To Act

In the December, 1920, issue of the *Colorado School of Mines Magazine*, C. Erb Wuensch, the editor of that publication, calls attention to the existing conditions, as he sees them, at the Colorado School of Mines. The following quotation from p. 231 of that magazine presents Mr. Wuensch's views:

"Conditions are fundamentally wrong at Golden and require immediate correction. The present system of trusteeship by appointments made by the Governor has had a long trial and been proven a failure. The reason is because of the difficulty of selecting men of the proper character—men free from local prejudice—who possess the proper educational ideals. The only immediate solution lies in placing the school under the authority of the regency of the University of Colorado. If this is done, you will then be able to secure the services of a proven executive for president, and you will be able to attract and retain efficient teachers from other universities. Some will object to this because they imagine this would result in the Colorado School of Mines losing its individuality. This suspicion is born of ignorance; many of the other schools of mines are under the authority of their state universities, and yet they have retained their identity. Others in all honesty maintain that the regents are virtually political appointees; they are elected by the people instead of being appointed by the Governor, as are the trustees. They, therefore, cannot see how this would remove the influence of politics. Experience has shown that this system works, just as it has shown that our system is a failure. The reason is that the people have a voice in the selection of the regents. If undesirable candidates are nominated, the alumni of the various schools have an opportunity to organize an effort to bring about their defeat.

"We would suggest that all the state's schools be put under one board of regents; thus all prejudices would be appeased and many economies could be effected which would accrue to the benefit of the state.

"I have attempted to speak the truth regardless of consequences. I have called 'a spade a spade,' because I felt that any half-hearted statement of facts would fail to arouse the association from its lethargy. The reason for this indifference is quite evident to one from within: conditions at Golden are so nauseating, and the school has received so much unpleasant notoriety of late that they hate to have a hand in the affair. The hour has arrived when the association must either stand up to attain the ideals for which it was formed, or else disorganize at once. I fully appreciate the value of the association in this regard as well as a means to enable the graduates to keep in touch with one another, and the school's activities, so as to perpetuate the memories of their school days, as it were. It was from these motives that I assisted in reviving the Alumni Association in January, 1919, and later took over the editorship of the magazine. There is not sufficient compensation to make it worth while to do this work, and if it were not for the fact that I have sufficient outside activity to keep me busy, with which the Alumni Association work does not interfere, I could not have afforded to have done this. If the Alumni Association cannot unite in an effort to bring about these fundamental changes, I cannot further sacrifice my self-respect to be identified with it as editor of its magazine or as its assistant secretary-treasurer."

Mining and Metallurgical Society Holds Annual Election and Dinner

Lindgren, Retiring President, Announces 1921 Medallist—Kemp and Mathewson Speak—Spurr Elected President

The annual meeting of the Mining and Metallurgical Society of America was held on Tuesday, Jan. 11. In the afternoon session the postal ballot for officers was reported, and other business matters of the society were despatched. In the evening a smaller number of members attended the annual banquet at which the retiring president, Prof. Waldemar Lindgren, of the Massachusetts Institute of Technology, was master of ceremonies. His remarks reviewed the progress of the study of ore-deposition during the past few decades. Prof. Lindgren also announced that the 1921 medal of the society had been awarded to Charles W. Goodale, director of the Anaconda company's bureau of safety, for his distinguished service in increasing safety in mining and metallurgical occupations. This award met with the general approval of the assembly.

Prof. James F. Kemp, of Columbia University, and E. P. Mathewson, two gold medallists of the society, were called on for addresses. Prof. Kemp briefly reviewed the changing views as to what is the chief ore of copper, chalcocite having come to occupy the pre-eminent position formerly conceded to chalcopyrite. Mr. Mathewson's remarks were entertaining and in his usual vein.

The master of ceremonies then introduced J. E. Spurr, his newly elected successor as president. Mr. Spurr modestly acknowledged his appreciation of the action of the members in selecting him for this honor, and went on to outline his hopes for the society during 1921.

Underground Moving Pictures Shown at A. I. M. E. Meeting

New York Section Sees Films of Standardized Operations at North Butte Mining Co.'s Properties

The regular monthly meeting of the New York section of the A. I. M. E. was held at the Engineering Societies Building on Jan. 6 with E. P. Mathewson in the chair. The only speaker of the evening was Robert Linton, president of the North Butte Mining Co., who showed the moving pictures of standardized underground operations at his company's properties. It was these pictures that attracted such favorable comment when shown at Minneapolis during the Lake Superior meeting of the Institute.

In his introductory remarks Mr. Linton gave as the cause of the lack of smooth operations in many enterprises the fact that operating units have increased so in size that there is not close enough contact between the management and the men. This also results in loss of identity by the workman and in time causes loss of initiative, all of which has a marked effect on a man's work. Referring to his early coal-mining experience in Pennsylvania Mr. Linton said the mines he had to do with were small but they produced skilled men. Today, on the other hand, there is a dearth of skilled miners, especially since the beginning of the war.

It was in recognition of these facts, said Mr. Linton, that the North Butte company undertook to increase the efficiency of its miners. Time studies were undertaken and various standards of work established. The next step was to put these standards into effect, starting first with the shift bosses, who were accustomed to meet once a week. It was at these meetings that photographs were first employed. For instance, bad spots noted underground by the safety engineer were photographed and the effect of these photos when thrown on a screen for all present to see was marked. This work was so successful that it was extended for the benefit of the rank and file. Moving pictures were taken of standardized underground operations as performed by skilled workmen. These, said Mr. Linton, are displayed twice a week.

MEN YOU SHOULD KNOW ABOUT

Matthew Van Siclen, mining engineer, of the Bureau of Mines, was in New York City recently.

C. P. Ross, who has been investigating oil geology in South America, has resumed his work with the Geological Survey.

Carl J. Calvin, assistant chief engineer of the Arthur Iron Mining Co., has left for Los Angeles, Cal., on a month's visit.

Charles L. Burdick, mining engineer, of the Chile Exploration Co., sailed from New York City on the "Santa Luisa," on Dec. 29.

George W. Stose, geologist, of the Geological Survey, has been elected president of the Geological Society of Washington, D. C.

K. C. Heald, who has been classifying oil lands in Montana and Wyoming for the Geological Survey, has returned to the Washington office.

S. M. Soupcoff, mining engineer, with the Garfield Smelting Co., Salt Lake City, Utah, was in New York City on professional business on Jan. 7.

James T. Kemp, with the International Nickel Co., Port Colborne, Ont., was in New York City over the holidays. He has returned to Port Colborne.

N. H. Darton, who has been doing geological work for private interests in Mexico for the last nine months, has resumed his duties for the Geological Survey.

T. C. Hopkins, of Syracuse University, is in Washington to undertake some special work for the Geological Survey's section of Foreign Mineral Reserves.

Henry C. Perkins, mining engineer, of Washington, D. C., has been appointed a member of the advisory board of the Super-power Survey. Mr. Perkins is a member of A. I. M. E.

Dr. C. D. Walcott, former director of the Geological Survey and vice chairman of National Research Council, will succeed the late Dr. Bumstead, at least temporarily, as active chairman of the council.

J. M. Callow, mining engineer of Salt Lake City, Utah, and president of the General Engineering Co., has been in Superior, Ariz., on professional affairs. He is expected to return to Salt Lake City by Jan. 18.

A. C. Oliphant is acting assistant secretary in charge of the Washington, D. C., office of American Engineering Council. His address is care of McLachlen Building, 10th and G Streets, N. W.

Glenville A. Collins, mining engineer of Seattle, Wash., has taken over the management of the Drum Lummon Mines, Ltd., replacing W. Porteous Sloan. The property is situated near Hartley Bay, Douglas Channel, B. C.

Charles F. Thompson, recently connected with the metallurgical department at the Burro Mountain branch of Phelps Dodge Corporation, is reported leaving that service to go into the mining and milling department of the Mine & Smelter Supply Co.

E. L. Jörgensen, formerly general superintendent of reduction for the Chile Exploration Co., Chuquicamata, Chile, and for fifteen years with Guggenheim companies, has opened an office as consulting engineer, at Suite 1429, 150 Nassau St., New York City.

CHARLES W. GOODALE

Charles W. Goodale, mining engineer, and chairman of the bureau of safety of the Anaconda Copper Mining Co., Butte, Mont., is the 1921 recipient of the gold medal of the Mining and Metallurgical Society of America.

Herbert S. King has been appointed superintendent of the Chandler Mining Co.'s Chandler mine, at Ely, Minn. Mr. King is one of the directors of the company. The former incumbent, Capt. Frank A. Kent, resigned, and has gone to San Fernando, Cal., to spend the winter.

George E. Farish, consulting mining engineer, has resigned as managing director of those Central American properties to which he has exclusively devoted his time for the past two years. Mr. Farish is resuming his general consulting practice at 25 Broad St., New York City.

Walter R. Crane, mining engineer, who has been chief engineer for the War Minerals Relief Commission during the past year, has now taken up his duties as superintendent of the Tuscaloosa, Ala., experiment station of the Bureau of Mines. His headquarters are at Birmingham, Ala.

George C. Mackenzie has been appointed secretary of the Canadian Institute of Mining and Metallurgy, and has assumed his duties at the institute's headquarters in Montreal. Mr Mackenzie was recently president of Electric Steel & Metals Co., Welland, Ont., and formerly served at Ottawa as secretary of Munitions Resources Commission.

Dr. Henry M. Ami, F.R.G.S., for many years connected with the Canadian Geological Survey, and for the last four years attached to the British Embassy at Washington conducting studies in war metals and minerals, has gone to the south of France for a prolonged rest. He will resume work in connection with the Canadian Geological Survey on his return to Canada.

OBITUARY

A. P. Watt, metallurgist, of New York City, died Dec. 29, 1920, from the effects of an attack of influenza which he contracted a year ago.

Henry Andrews Bumstead, chairman of National Research Council, died on the train while returning to Washington from convocation week at Chicago. As scientific attaché of the United States Embassy at London in 1918, Dr. Bumstead was in immediate charge of the exchange of confidential scientific data with the Allies. He was born in 1870, at Pekin, Ill., and had been professor of physics at Yale, and director of the Sloane Physical Laboratory there since 1906.

Herman Garlichs, metallurgist, of Brooklyn, N. Y., and during the World War an advising metallurgist as a "dollar-a-year man," died on Saturday, Jan. 8, at his home. Mr. Garlichs was born in Brooklyn, May 23, 1859. He was graduated from the Columbia School of Mines in 1880 and soon after went to Colorado, where he became a United States Deputy Mineral Surveyor. As mining expert and metallurgist he was associated from 1884 to 1908 with the Aurora, Omaha and Grant, Velardeña, Kansas City, American and St. Louis smelting companies in the West, and later with the Balbach Smelting Co. in Newark, N. J. He retired from active business a few years ago but retained membership in A. I. M. E. and M. & M. S. A.

Ferdinand Schlesinger, of Milwaukee, Wis., one of the directors of the Newport Mining Co., operating the Newport mine, Ironwood, Mich., and owner of other extensive holdings on the Marquette and Gogebic ranges, died suddenly on Jan. 3, while aboard a train on his way to California. Mr. Schlesinger, many years ago, was connected with the Chapin mine, Iron Mountain. Subsequently he acquired interests in many mines in the Lake Superior district, and had considerable holdings there when he gave up active business a few years ago. At that time other interests joined him in organizing the Steel & Tube Co. of America, taking over the Newport mine, the Anvil-Palms, at Bessemer, Mich., and the Isabella, on the Marquette Range.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

WEEKLY RÉSUMÉ

Wage decrease and curtailment of output continue the most prominent features of the industrial situation. Following its recent act in cutting salaries below $5,000 the American Smelting & Refining Co. has announced a general reduction in pay of all day workers. Wages have also been reduced by mining companies in the Cobalt district and by the New Jersey Zinc Co. A cut of 10 per cent has been put in effect by independent operators on the Cuyuna Range. At Duluth the Zenith Furnace Co. has blown out its furnaces. In Washington the American Mineral Production Co., a magnesite producer, has shut down, owing to the importation of the Austrian product. In Mexico the Cananea Consolidated has closed down two mines. In Arizona a number of branch railroads have been adversely affected by the decreased tonnage available. Of interest is the fact that Anaconda has turned out its first bar of aluminum at the Washoe Reduction Works, though this is in the nature of an experiment. After refusing to allow a decrease in freight rates on Coeur d'Alene ores shipped to East Helena and Northport the Interstate Commerce Commission reversed itself and granted permission. Stockholders of the A. S. & R. have been sent a pamphlet by Simon Guggenheim in which the development of the company under Guggenheim control is emphasized, in an effort to refute Karl Eilers' charges.

Simon Guggenheim Replies to Eilers' Charges

Points Out Development of Company Under Family's Control in Letter to Stockholders

Stockholders of the American Smelting & Refining Co. and of the American Smelters Securities Co. have received from Simon Guggenheim, president of both concerns, a pamphlet containing a denial of charges made against the Guggenheim Brothers in their management of the properties by Karl Eilers, formerly an officer and director of the company. The pamphlet includes a copy of Mr. Eilers' statements. Mr. Guggenheim says:

"I emphatically deny, both on my own behalf and that of my brothers, all charges of improper conduct made by Mr. Eilers in the following pages, and assert that at all times my brothers and myself have sought honestly and faithfully, to the best of our ability, to further the interests and welfare of the American Smelting & Refining Co.

"Our connection with the company's affairs began in 1901, and it is with pardonable pride that we point to the development of the company in the intervening period, as shown by the following comparison:

"That the policy of the present management has been successful is evident from the fact that in the fiscal year of the company ending April 30, 1901, the net earnings of the company were $3,828,000, representing 3.83 per cent of the then outstanding capital stock; during the six and two-thirds years ending Dec. 31, 1911, the average annual net earnings were at the rate of $12,145,000, or at the rate of 8.15 per cent of the then outstanding capital stock; during the three years ending Dec. 31, 1914, the average annual net earnings of the company were at the rate of $12,165,000, or 8.28 per cent of the then outstanding capital stock; during the three years ending Dec. 31, 1917 (these being war years), the average annual net earnings of the company were $21,375,218, or at the rate of 15.19 per cent of the then outstanding capital stock; in the year ending Dec. 31, 1918, the net earnings were $13,887,000, being 11.10 per cent of the then outstanding capital stock; during the year ending Dec. 31, 1919, the net earnings were $11,248,000, being 9.09 per cent of the then outstanding capital stock, the latter year being a reconstruction year following the signing of the armistice, during which industrial and commercial conditions were generally unsettled. (All figures for net earnings are without allowing charges for depreciation, as the company's records, prior to 1911, were kept on that basis.)

"While my brothers, because of advancing years, have been compelled to restrict somewhat their business activities, so long as any of us are connected with the company, we shall continue, as in the past, to work faithfully and unselfishly for the company's best interests, and to exercise our best business judgment in the management of its affairs.

"It is regrettable that a sensational and wholly unnecessary suit should have been brought in a period of drastic readjustment of all security values, inevitably causing a needlessly severe and unjustifiable fall in the market price of the stock of the company."

A call for proxies for the next meeting has been sent out by Mr. Eilers.

Flin Flon Option Expires Before Spring

Principals Must Decide If It Is To Be Taken Up or Dropped—Construction of Road Up to Purchasers

Engineers for the Flin Flon syndicate are now on the property in northern Manitoba for the purpose of making the final decision as to whether the option held by Colonel Thompson and associates should be taken up or dropped.

The matter of a railroad has been put up to the purchasers by the Manitoba government. The latter will build the railway if the former will guarantee certain expenditures and construction of a smelter. The Dominion government will also operate the road under a favorable lease.

American Smelting Cuts Wages After Salary Decrease

Perth Amboy Refinery Down—Tacoma and Baltimore Plants Curtailed

A cut in wages of about 15 per cent has been announced by the American Smelting & Refining Co., effective at its various smelters and refineries. This follows closely upon the flat 15 per cent cut in salaries for officers and office workers getting less than $5,000 per year. No reduction has been made in the salaries of those getting $5,000 or more per year for the reason that none of these received an increase.

The Perth Amboy copper refinery has been shut down for six months. The Tacoma refinery is running at 75 per cent capacity and the Baltimore plant at 60 per cent. The Garfield smelter is sending some of its output to Tacoma to get the benefit of the ocean freight east.

Comstock Miners Agree on Six Months' Wage Scale

Miners of the Gold Hill section of the Comstock lode at Virginia City, Nev., are now working under a six months' wage-scale agreement, providing for a minimum wage of $5.50 and ranging up to $6.50 for mechanics. The agreement was reached at a meeting called by Governor Boyle at his office at Carson City and attended by heads of the miners' union and by Bulkeley Wells, president of the United Comstock Mines Co. Several hundred men are affected by the wage agreement.

Anaconda Turns Out First Bar of Aluminum

Made at Washoe Reduction Works—Achievement Said To Be in Nature of Experiment

A feature of the past week in mining and smelter circles at Butte, Mont., was the production at the Washoe Reduction Works of the Anaconda Copper Mining Co. of the first bar of aluminum made by the company, marking a metallurgical achievement which is confidently looked forward to as having many possibilities in the direction of the copper corporation's probable entry into the field of aluminum production.

While the initial output of metallic aluminum by the Anaconda can hardly be said to be other than in the nature of an experiment and does not represent anything as yet on a commercial scale, still the research work in this line of endeavor has attained such results that the engineers of Anaconda express confidence in their ability to secure the necessary economies in the reduction of the metal. When this is achieved the prediction is made in interested circles that Anaconda will revolutionize the aluminum industry, much in the manner that it did the treatment of refractory and complex zinc ore by the introduction of the electrolytic process, as employed in its plant at Great Falls, Mont.

Anaconda officials have hitherto been hesitant to speak of the company's interest in the possibilities of aluminum in view of the very heavy electrical expense attendant upon the treatment of bauxite, which is the common ore of the metal.

R. W. Howell Shot From Ambush in Northern India

Details of the death of Ralph W. Howell, an American geologist, who was killed while doing oil work in northern India, just have reached this country. Mr. Howell and his interpreter were riding 200 yards in advance of other members of the geological party when shots from ambush killed both Mr. Howell and the interpreter. The military escort, which had been furnished by the British Government for the party, would have joined the geologists within less than an hour. In fact, the geological party was just eight miles away from the point where it was to have met its escort.

Wages Cut at Cobalt

The mining companies of Cobalt, Ont., have announced a cut of 75c. per day in wages for all classes of labor. This will be effective Feb. 15.

New Jersey Zinc Cuts Wages.

The New Jersey Zinc Co. at Palmerton announced Jan. 8 a 10 per cent cut in wages and the elimination of an 8 per cent bonus system, effective Jan. 15. The plant will return to full operation.

Freight Rates Reduced on Cœur d'Alene Ore

Shipments to East Helena and Northport Smelters Affected—Rates Same to Both Points

The reduction in freight rates on ore from points in the Cœur d'Alene district, Idaho, to East Helena, Mont., and Northport, Wash., effective Jan. 1 and Feb. 1, respectively, which were finally approved by the Interstate Commerce Commission, will prove of tremendous benefit; in fact, without it some of the mines would probably have to close down. The rates to both points are the same. Shipments to the East Helena include those from the Morning, Bunker Hill, Hunter and numerous leasing companies. Shipments to Northport are confined to the Hercules and the Tamarack mines. According to the new tariff, ore valued at not over $30 has a rate of $3 per ton. For each increase of $10 per ton 25c. per ton is added up to $100, and ore valued at over $100 will pay $5 per ton. A comparison of these rates with the old schedule makes the advantage strikingly apparent. Under the old tariff $60 per ton was the minimum valuation and the rate on that class was $4.25 per ton. On ore valued at not over $65 the rate was $6.50 per ton, and on ore valued at not over $100 the rate was $9.37½ per ton.

New Wage Schedule Adopted by New Mexico Companies

The following wage scale, effective from Jan. 1, has been adopted in the Lordsburg district in New Mexico and, it is expected, will also be adopted by companies operating vein mines elsewhere in the state:

Machinemen Drifters	$4.25
Machinemen Stopers	3.50
Timbermen	3.80
Muckers	3.00
Nippers	3.40
Miner Helpers	3.50
Trammers	3.00
Skip Tenders	4.00
Skip Tender Helpers	3.50 & 3.00
Motormen	3.50
Motormen Helpers	3.00
Ore Sorters	2.75
Ore Loaders	3.00
Trackmen	3.80
Trackmen Helpers	3.25
Pipemen	3.80
Pumpmen	3.75
Hoisting Engineer	4.80
Carpenters	5.30
Carpenter Helpers	3.75
Blacksmith	5.30
Blacksmith Helpers	3.75
Drill Sharpener	4.60
Drill Sharpener Helpers	3.75
Watchmen	3.80
Drill Repairmen	4.80
Machinists	5.30
Machinist Helpers	3.75
Laborers	2.75
Engineers, Power Plant	[illegible]
Hoisting Engineers, Dinky	3.80
Firemen	4.50

Wages Reduced by Cœur d'Alene Mining Companies

Muckers To Receive 25c. Less Than Miners—Bunker Hill & Sullivan Issues Statement

Effective Jan. 1, mining companies of the Cœur d'Alene district, Idaho, reduced wages of all employees $1 to $1.25 per day. The cut of $1.25 applies only to muckers, who have been receiving the same pay as miners and who will now receive 25c. less per day. This applies to all mining companies of the district except the Bunker Hill & Sullivan, where a difference in pay of miners and muckers has always prevailed. Wages in this district are fixed under a sliding scale adopted Feb. 1, 1916, which adds 25c. per day for each half cent increase in the price of lead above 5c. per lb. The maximum increase provided in the scale is $1.25 per day, with $3.50 per day as a base. However, during the war when the price of lead was soaring around 10c. and the cost of living was keeping pace with it, Cœur d'Alene operators continued to advance the rate of pay above the requirements of the sliding scale until $5.75 per day became the underground pay. This rate was maintained until the reduction just made. Under the sliding scale, when lead is under 5c. per lb. no bonus is required, but in spite of this provision the rate is now equivalent to a bonus of $1.25 per day, miners receiving $4.75 per day and muckers $4.50, corresponding to 6½c. lead.

The following notice was posted at Kellogg at the Bunker Hill & Sullivan Mining Co.'s mines:

"Notice to all employees: The price of lead has fallen from 9c. per lb. September last to a present price of 4⅜ and 4½c. per lb. This is the lowest lead price in over five years and no longer makes possible the further payment of the present bonus of $2.25 per shift. The bonus additions, 50c. each, announced July 20, 1919, and Feb. 16, 1920, are withdrawn. Beginning with the 7 a.m. shift Jan. 1, 1921, the bonus paid all employees will be reduced $1, and the payment of a bonus of $1.25 continued."

The wages paid under the above schedule will be $4.75 for miners and muckers $4.50. It is believed that the employees will accept the reduction without any complaint, as they have been expecting a reduction.

The general manager, Stanly A. Easton, gave out the following statement:

"The bonus to employees was instituted by the local mining company Feb. 1, 1916, and the sliding scale then published was as follows: Hereafter when lead is 5c. a lb. or higher, a profit-sharing bonus will be paid in addition to the minimum scale of wages as follows:

"Twenty-five cents per shift when lead is 5c. a lb. and under 5½c.

"Fifty cents per shift when lead is 5½c. and under 6c. a lb.

"Seventy-five cents per shift when lead is 6c. a lb. and under 6½c.

"One dollar per shift when lead is 6½c. a lb. and under 7½c.

"When the average price of lead in New York is less than 5c. no bonus will be paid and the regular scale applies.

"The advances in the bonus as indicated by the above scale were regularly made, but because of living and other conditions the maximum bonus of $1 per shift indicated has been more than doubled. The bonus for the larger part of 1920 has been $2.25 per shift, which the metal market has made it necessary to reduce, although the bonus still remaining far exceeds the amount indicated by the Feb. 1, 1916, announcement, the literal application of which would result in no bonus at all being paid.

"It is planned that local operations will continue at their present full scale and that there will be no curtailment or layoff of men or cutting down of improvement or construction jobs."

Northwestern Lead Co. Has Been Agent for Bunker Hill Lead

The Northwestern Lead Co., of Seattle, in which, according to a recent announcement, the Bunker Hill & Sullivan Mining & Concentrating Co. has taken over a substantial interest, is engaged in the manufacture of lead pipe, sheet lead, lead traps, bends and other supplies for the plumbing trade. This company has been the selling agent for "Bunker Hill" pig lead in Washington, Oregon, Idaho, Montana, Wyoming and Alaska, and under the new arrangements the company will extend its field for Bunker Hill lead to California and all other Western states.

Recent Production Reports

New Cornelia produced 2,688,456 lb. copper in December compared with 2,670,000 in November.

Calumet & Arizona's December output was 3,000,000 lb. against 3,236,000 in November.

North Butte's production in December was 485,686 lb. copper (1,342,029 in November), 14,540 oz. silver and 29 oz. gold.

Utah Copper produced 7,500,000 lb. of copper in December compared with 9,120,000 in November.

Chino Copper produced 2,999,000 lb. copper in December as against 4,000,000 in November.

Ray Consolidated's December output of copper was 2,975,000 lb. as compared with 3,975,000 in November.

Nevada Consolidated produced 3,000,000 lb. copper in December compared with 3,950,000 in November.

Miami Copper produced 4,373,123 lb. copper in December against 4,505,232 in November.

Greene-Cananea produced 3,700,000 lb. copper and 164,000 oz. silver in December compared with 3,500,000 lb. copper and 159,100 oz. silver in November.

Burma Corporation produced 2,906 gross tons of lead in November from 6,688 tons of lead-bearing material. Refined lead production was 2,203 tons. Refined silver production was 278,750 oz.

Cerro de Pasco produced 4,258,000 lb. copper in December.

Backus y Johnston produced 1,604,000 lb. copper in December.

The output of gold on the Rand in South Africa in December totaled 632,000 fine ounces, as compared with 633,000 fine ounces in November.

East Butte produced 1,538,760 lb. copper in December compared with 1,658,860 in November.

Anaconda produced 10,500,000 lb. copper in December compared with 11,100,000 in November.

Shattuck Arizona's December output was: Copper, none; lead, 746,750 lb.; silver, 37,621 oz., and 452 oz. gold.

United Verde Extension produced 3,204,258 lb. copper in December.

U. M. du Haut Katanga (Belgian Congo) produced 3,174,624 lb. copper in November.

Inspiration produced 5,000,000 lb. copper in December.

Oriental Consolidated (Korea) obtained $104,650 from its December clean-up.

Phelps Dodge produced 8,318,000 lb. copper in December, as follows: Copper Queen Branch, 4,418,000; Moctezuma Copper, 2,468,000; Burro Mountain, 1,060,000, and custom ores, 372,000.

NEWS FROM WASHINGTON

By **PAUL WOOTON**
Special Correspondent

House Committee To Consider Revision of Mining Laws

Proposal to Change Assessment Work Year Favored—Views as to Best Time Conflict

Revision of the mining laws is one of the things which Representative Rhodes, the chairman of the House Committee on Mines and Mining, has in mind for early consideration. It is improbable that any action will be undertaken at this session.

The committee is also considering the advisability of legislation which would allow the assessment-work year to end some time in the summer or autumn. At present the assessment-work year is on a calendar year basis. For various reasons it frequently is desirable to do work of this character near the end of the period. With the assessment-work year ending on Dec. 31 there are at least two months prior to the expiration of the period in which little work can be done on mining claims, due to weather conditions.

A bill is now before Congress providing for the ending of the assessment year on June 30. Some object to this on the ground that the snow is not off the mountains in a considerable part of the mining area in time to do the work during the month of June. Some are of the opinion that it would be better to terminate the assessment-work year July 31. Others want it to end Aug. 31, while still others think it would be best to have the assessment-work year end Oct. 31.

No Notice Needed Under Recent Assessment-Work Act

No notice is required by the act of Congress extending the time for performing the 1920 assessment work on mining properties. In former acts, claim holders were required to give notice prior to the end of the year, but the only requirement in the present act is to perform the work prior to July 1, 1921. There is some talk of relieving claim holders of this obligation altogether, but all indications point to the improbability of such action. The text of the assessment-work act follows:

"[S. 4565.] An act extending the time for the doing of annual assessment work on mining claims for the year 1920 to and including July 1, 1921.

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the period within which work may be performed or improvements made for the year 1920, upon mining claims as required under section 2324 of the Revised Statutes of the United States, is hereby extended to and including the first day of July, 1921; so that work done or improvements made upon any mining claim in the United States or Alaska on or before July 1, 1921, shall have the same effect as if the same had been performed within the calendar year of 1920: *Provided*, That this act shall not in any way change or modify the requirements of existing law as to work to be done or improvements made upon mining claims for the year 1921.

"Approved, Dec. 31, 1920."

Chemical Manufacturer Asks Tariff on Cyanide

On Free List in Underwood Act—Claimed Industry Would Have Wrecked Except for War

A duty of 33⅓ per cent ad valorem for cyanide salts has been requested of the House Committee on Ways and Means which is now conducting hearings with regard to tariff information. The request was filed by P. Samuel Rigmey, of the Roessler & Hasslacher Chemical Co., of New York. Mr. Rigmey testified that his company was the first to manufacture cyanide salts in this country and is the only manufacturer producing these salts in commercial quantities. He explained to the committee why sodium is a better carrier for cyanide than is potassium, since it is able to carry a higher per cent of cyanide than potash. He said that the American industry has been much encouraged by the Payne-Aldrich tariff act which allowed a duty of 25 per cent ad valorem on sodium cyanide. The industry received a very serious set-back, he declared, when it was placed on the free list in the Underwood tariff act. The war was all that saved the industry, he intimated. It was stated that during the year ended June 30, 1914, German cyanide to the extent of 8,000,000 lb. was used in the United States. During that year Mr. Rigmey's company sold 13,000,000 lb.

In explaining about the shortage of cyanide in 1916, Mr. Rigmey said that his company had done everything humanly possible, realizing that it was the sole source in this country for the supplies needed by the mining and other industries. A part of his company's plant at Niagara Falls could not be operated for lack of power which went preferentially to the manufacture of munitions. He told of building a new plant at Perth Amboy, N. J. When the plant was ready for operation the power company was unable to comply with its contract and the plant was obliged to shut down. In addition, there was opposition from the government, he declared, as it attempted to build a sodium cyanide plant at Saltville, Va. Several millions were expended, he declared, but the results were nil. He said the plant has now been scrapped.

During the first nine months of 1920, he said, 6,500,000 lb. of cyanide was imported. This came partly from Germany and partly from Canada. He pointed to that as an indication that foreign competition is being revived. He attached special importance to Canadian competition.

Government's Silver Purchases

Silver purchases under the Pittman Act totalled 31,054,361 fine ounces at the close of business Jan. 8.

Bain's Appointment as Director Likely To Be Confirmed

Confirmation of H. Foster Bain as director of the Bureau of Mines is assured. Positive statements to that effect have been made by influential Republican Senators. Due to the imminence of the change in administration, practically none of the President's nominations is being confirmed by the Senate. Those nominations classed as political, will remain unconfirmed, but appointments to the directorship of most of the technical bureaus are not regarded as being political ones. Although even these appointments will probably go over for confirmation at the extra session, there is every probability that Mr. Bain's nomination will be confirmed by the Senate at that time. Mr. Bain has entered upon his duties.

Two War Mineral Relief Awards Recommended

An award of $24,834.53 has been recommended by the War Minerals Relief Commission to cover the claim of the Pocahontas Manganese Corporation. The company's claim was for $50,542.69. In addition, the Commission reconsidered the claim of Arentz & Perkins, which previously had been disallowed. An award of $452.12 was recommended. This is 16 per cent of the amount claimed.

NEWS BY MINING DISTRICTS

Special London Letter

Capital Still Hard To Get—Doubt Silver Demand for Coinage Purposes—Broken Hill Mines Also Handicapped

By W. A. Doman

London, Dec. 27—Markets wound up the last week in a far from Christmassy mood. There are so many claims upon the restricted amount of credit that the banks are able to give, that the numerous mining companies in need of additional capital seem temporarily at least to be faring rather badly. Gold, silver, copper, lead, and tin undertakings are all in the same predicament. They have something to offer in the way of property and ore in reserve, but partly on account of the fluctuating prices of the metals, possible lenders are shy. Santa Gertrudis notes are still quoted at a heavy discount despite the prospects of the company. Silver plays a not unimportant part here and in consequence of the relapse in the metal it is said that the management has under consideration a rearrangement of program. It had been argued that in consequence of the reduction in the output of gold all European countries would compete for silver for coinage. Doubt now exists as to whether this demand will materialize, as nickel is becoming the fashion in greater or less degree as token currency. Santa Gertrudis apparently will concentrate operations upon the gold areas under its control.

The Broken Hill mines are no better off. The Sulphide Corporation after so many months of idleness owing to the miners' strike is resuming in a small way, but some of the mining companies are still further retarded as a result of the cessation of work by the Broken Hill Associated Smelters during the holidays and a week or so longer. While in a sense the long strike at the Barrier Range may have benefited the metal position by enabling stocks to be worked off, it has caused considerable harm to the mines and also to the Commonwealth. Silver, lead, and spelter are quoted at relatively low prices, though it is noticeable that the managements of the companies take quite a cheerful view of the future. There is no steam left in Esperanza; interest vanished when assays fell from the abnormal to something approaching average. A few pennyweight of gold and the "teens" in ounces of silver are all that have been reported for some weeks.

The Rhodesia Broken Hill, a lead-zinc proposition, is also feeling the effect of the fall in the price of lead. From about 15/- the shares have declined to about 7/—. In this property, which covers about 30 square miles, as a concession, over 100,000 tons of actual metal is already proved, so that it has great potentialities when prices right themselves. Experiments are being made in connection with the zinc ore and it is thought that laboratory tests will be equally successful when bulk treatment is undertaken. The company had sold its output well ahead so that it has not suffered so greatly as some other mines.

Further Rand gold mining companies have declared their dividend for the current half year. They are satisfactory in every way. The public, however, recognises that they are in the main the result of the gold premium, and doubts as to how long this will remain high, and as to when working costs will be reduced, and whether the reduction will compensate for the loss of premium, still cause hesitation. Prices were rather better when the market closed on Thursday for the holiday, but the movement was of only a half-hearted character.

CANADA

British Columbia

Production Statistics of Last Year Furnish Surprise—Mining in Eastern Section Reviewed

Victoria—Semi-official estimates of the mineral production of British Columbia for the year 1920, based on reliable figures, furnish a surprise. The unexpected results of the year's work are to be found in connection with the output of silver and copper. Silver, it appears likely, will show a slight increase over 1919, the improvement amounting to about 1,800 oz. The explanation, of course, lies in the activities of the northern mines, chiefly the Dolly Varden at Alice Arm, although it was not thought possible that the blight with which the Slocan silver mining camps were afflicted through labor troubles would be overcome. There was approximately 300,000 lb. more copper produced in the province than in the previous year. Lead will show a decline of nearly 8,000,000 lb. but zinc is put down for an advance of over 20,000,000 lb. All things considered, therefore, the last year has been very creditable to the mining industry of British Columbia.

Vancouver—The necessity of encouraging the production of gold in British Columbia is becoming increasingly apparent and the latest public body to take action is the Mining Bureau of the Vancouver Board of Trade which recently passed a resolution offering a number of suggestions to the Dominion and Provincial Governments. One is the removal of all taxation on gold mines until "such time as conditions return to normal"; another "the return to Canada of all gold produced from exported ores and the purchase thereof by the Mint at Ottawa and the Dominion Assay Office at Vancouver"; and a third "that all gold sold by the beforementioned institutions for industrial purposes should be so priced as to cover the normal cost of production, any surplus revenue to be distributed among the gold mining companies in proportion to production."

Nelson—The year just closed has been marked by considerably decreased mining activity in the Boundary and East and West Kootenay districts of southern British Columbia. Labor shortage and high cost of supplies have been factors partly to blame for an unfavorable season, while during the latter part of the year, prevailing low prices of metals, particularly of silver, lead and copper, with absolutely no market for zinc, have had a retarding effect.

With elimination of Granby's plant at Grand Forks and the Canada Copper Corporation's smelter at Greenwood, practically all of the ore smelted in Kootenay and the Boundary has been taken care of by the Consolidated plant at Trail. Some Slocan output found a market on the United States side, notably high-grade tonnage from Silversmith, Utica and Whitewater, but the aggregate of this is small as compared with the total handled at Trail, the quantity given domestic treatment amounting to 363,687 tons crude and 7,588 tons concentrates, contributed by over 100 widely scattered properties.

The total valuation of mineral output of the Kootenay and Boundary for 1920 is estimated at $8,896,200, of which $8,161,200 received domestic smelting, the balance, $735,000, representing the estimated value of metals in exported ore.

Of metal mine production, the mines of Consolidated M. & S. Co., contributed the great bulk in point of tonnage. Rossland and Sullivan mines of this company are credited with a joint production of 335,797 tons; Nelson and Arrow Lakes with 993 tons of crude and 398 tons of concentrates; Slocan, 6,107 tons crude and 4,533 tons concentrates; Boundary and Similkameen with 10,556 tons crude and 594 tons concentrates.

Considering the many discouraging factors that have prevailed, the year's result, on the whole, may be regarded as satisfactory. Immediate indications are not favorable to a larger output for 1921. With the first of the year wage reductions have become effective in many parts of the country but while this may make it easier from an operating standpoint, a number of other unfavorable factors may retard production and new developments for some months to come.

Ontario

Eleven Silver Mines Working in Cobalt District—Plan New Company To Merge Teck-Hughes and Orr

Cobalt — Owing mainly to power shortage only eleven of the nineteen silver mines that were working during the fall are now in operation, employing about 1,200 miners as compared with the normal number of 2,000. The mines now working are the Nipissing, Mining Corporation, O'Brien, Coniagas, La Rose, University, Princess, Kerr Lake, Crown Reserve, Bailey and Ruby of which the Nipissing is the only one that has not considerably curtailed operations. Although the shortage of power has been the determining factor in the decision to close down or limit operations, the low price of silver has had an appreciable influence with mine managers in this direction. The supply of power remains better than was anticipated and is regarded as being assured in sufficient volume to maintain operations at the present rate until late in February, which is, of course, dependent on the weather. At the Beaver and McKinley Darragh, which have closed down, the workings are being kept clear of water so that work can be resumed in the spring without delay.

The high-grade surface veins discovered at the Kerr Lake last summer have proved disappointing at depth. A raise on one of them has been carried within 30 ft. of the surface with no silver content, and the indications are that the surface enrichment of the veins only extends a few feet downward

Kirkland Lake—The shaft of the Lake Shore has reached the 600-ft. level, and sinking has been discontinued until a level has been established and a crosscut run to No. 2 vein under Kirkland Lake. When this work is completed the shaft will be put down to the 800-ft. level.

The King-Kirkland has ordered a mining plant, and as soon as it is installed development work will be begun on a substantial outcropping ore shoot.

A shipment of gold bullion valued approximately at $30,000 produced during December has been made from the Kirkland Lake mine.

The plan under consideration for the merger of the Teck-Hughes and Orr mines involves the organization of a new company, capitalized at $5,000,000, with shares of the par value of $1, of which 2,500,000 shares will be distributed among the Teck-Hughes interests including the bondholders, 1,500,000 shares going to the Orr shareholders, and 1,000,000 remaining in the treasury.

Porcupine—Diamond drilling on the sand plains southwest of Timmins through an overburden of 400 to 500 ft. of sand and gravel, which is being financed by English capital, has been suspended during the cold weather. Some of the drill holes have been put down to a depth of 700 ft. and veins carrying gold content are stated to have been encountered.

Elk Lake—At the Regent a shaft has been put down 35 ft. on a vein containing silver content including wall rock over a width of from 2 to 3 ft. A car of ore will shortly be shipped to Cobalt.

AUSTRALIA

New Mount Quamby Company Formed To Work Gold Property in Cloncurry Field—Cobalt and Mica Also in Same District

By Our Special Correspondent

Brisbane, Nov. 28—The vast mineral belt embraced in the Cloncurry field in Queensland, 600 miles inland by rail from the northern port of Townsville, has for years been regarded as a copper area only, but indications of late point to its becoming something more, and, in view of the fact that copper is just now down to a price at which it can barely be produced with profit, satisfactory developments with regard to other minerals will be welcomed. A company has lately been floated, with a capital of £100,000, known as the Mount Quamby Gold Mining Co., to work a property in this district which, it seems, has long been known as gold-bearing. It is a large conglomerate deposit that was worked for alluvial gold for some years prior to the war by two brothers, who on the outbreak of hostilities went to the front. On their return the mine was tested with the aid of capitalists from the south and the company was formed. The sampling already done, extending over a length of 600 ft. from north to south and 100 ft. from east to west, has given assay returns ranging from

6 dwt. to 6 oz. 4 dwt. per ton, the average being 1 oz. 12 dwt. This result is considered so satisfactory that six new leases, each covering an area of 25 acres, have been taken up.

Cobalt has also been discovered in the Cloncurry district, twenty miles south of Selwyn, the headquarters of the Mount Elliot company. The property is being tested by two prospecting shafts sunk to a depth of over 50 ft. on the ore channel, exposing an orebody varying from 2.12 ft. to 5 ft. in width and extending a length of 300 ft. The last report to hand showed that both shafts were in ore averaging about 5 per cent metallic cobalt. On the surface this occurs as cobalt bloom (erythrite) and lower down as cobaltite. The prospects are promising, and it is intended to take the prospecting shafts to a depth of 100 ft.

Good finds of mica have likewise been made in the Cloncurry field, as well as in the Chillagoe and Etheridge districts further north, but nothing has been done to develop them.

the 150-ft. level, according to the report of the consulting engineer, Frank W. Royer. The main orebody has been opened for a length of 240 ft. and is from 8 to 30 ft. wide. Three levels have been driven above the 150 and a 50-ft. winze from the latter is in ore assaying 35.6 oz. silver. The main orebody is estimated at 50,000 tons and work on another vein has exposed 3,800 tons sampling 24.7 oz. silver. A mill will be provided this year.

Chihuahua

Potosí Company Cuts Forces—Buena Tierra Doing Extensive Exploration Work—Manta Making High-Grade Shipments

Santa Eulalia—The general tendency in this district indicates conservative curtailment. Several of the larger operating companies have materially reduced their forces and work on the lower grade deposits is being temporarily stopped. A number of the companies have also made reductions in their scale of wages. The chief cause for retrenchment is obviously due to the declining market quotations. To add to this condition the Mexican coal miners' strike has seriously threatened the coal supply of at least one company. Nearly all of the various mine officials are moving into the camps now with their families. It is the first time in several years that conditions have been considered stable enough to warrant such a move.

The Potosí Mining Co. has recently reduced its forces by releasing about 200 men. A small reduction has also been made in wages. This company has lately installed a large Worthington pump at the company wells at Hacienda Robinson. Water is pumped from these wells to supply the mines at Santo Domingo. Not long since a large [illegible] boiler was added to the power plant of this company. For several weeks past a large crew of men has been engaged in straightening curves and [illegible] the tracks of the narrow gage railroad of the Potosi company, running between Santo Domingo and Hacienda Robinson, preparatory to putting into service the new locomotives bought some time ago.

The properties of the American Smelting & Refining Co. are operating on a more conservative scale. All work on the San Antonio and the Dolores mines has been discontinued, and forces of the Velardeña and the Sin Nombre mines have been materially reduced. The Mina Vieja mine alone is proceeding without any pronounced curtailment of forces. In all, about 400 men have been released from the various mines of this company. Construction work is well under way on the new home for the superintendent. W. J. Deavitt, superintendent of the Santa Eulalia Unit, recently returned from a trip to various eastern points in the United States. W. M. Benham has been transferred from Sierra Mojada, Coahuila, as engineer for the A. S. & R. Santa Eulalia Unit.

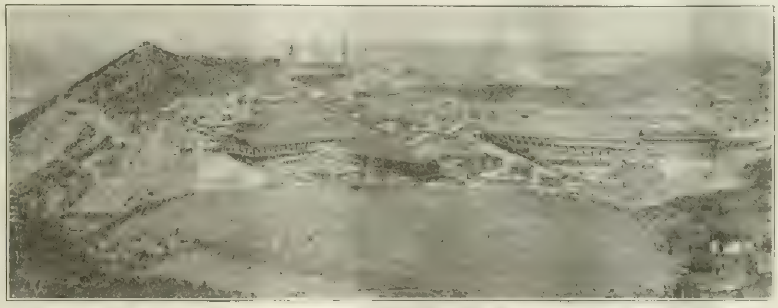
The Buena Tierra Mining Co., Ltd., is carrying on extensive exploration work at present. Besides the crosscutting under headway on the various levels this company is also engaged in sinking both of their main shafts. Diamond drill work has been discontinued for the present. A machine shop is now under construction and a complete equipment of tools and machines has been purchased. The headquarters and offices of the company have been moved from Chihuahua to the property at Santo Domingo.

The Cia. Minerales y Metales has temporarily suspended operations because of the coal shortage on all of the properties it was operating in this district, with the exception of Inglaterra and Cosineras group. It is reported that two ore caves have lately been encountered on the Inglaterra property. John M. Brooks is superintendent of the Santa Eulalia Unit.

The Reina de Plata mine is continuing exploration work, and is making small shipments of ore regularly. Lindsay Brown is superintendent.

El Cristo mine is being operated under the direction of George M. Hillary. Regular shipments of ore are being made to the railroad at Santa Eulalia by burro train.

The Manta Mining Co., of which W. J. Deavitt is [illegible], is shipping four to five cars of high-grade silver ore monthly. The ore is carried



GENERAL VIEW OF CONCENTRATOR OF CANANEA CONSOLIDATED COPPER CO., LA CANANEA, SONORA, MEXICO

MEXICO

Sonora

Calumet & Sonora's New Power Plant Almost Finished—Cananea Consolidated Closes Two Mines

Cananea—The Calumet & Sonora Mining Co. has almost completed its new power plant, which will be put in operation about Jan. 15. Alterations at the mill will be finished as soon as some necessary equipment arrives. Operations at the mine have been of development character only. The shaft has been sunk to the 800 level and will be continued to the 900. The mill should be in operation before the end of the month.

The Cananea Consolidated Copper Co. has closed down the Capote 15 and Cananea-Duluth mines. These mines produce the concentrating ore. The mill will be run until the ore on hand has been cleaned up. The pumps at the Cananea Duluth will be pulled but those at the Capote will be operated during the close-down.

Arizpe—The Carmen mine, purchased by the Florence Divide Mining Co. of Nevada, has developed over 50,000 tons of 20 to 28 oz. silver sulphide ore above by burro train to the railroad at Santa Eulalia. Systematic exploration work is going on at the same time; the shaft is being sunk 150 ft. deeper and the program calls for extensive crosscutting.

Johnson and Davidson and associates of Chihuahua have stopped the prospecting they were doing on La Sirena property in the East camp, near the San Antonio mine of the A. S. & R. Co. One or two cars of high-grade zinc ore were shipped.

Oscar Trevino is working the Spartaca mine in the East camp.

CHOSEN

Tabowie Mine Stope Fire Still Burning

Unsan, Dec. 6—The November cleanup of the Oriental Consolidated exceeded expectations, partly because the Tabowie surface dump, on which the mill has been running since Nov. 11, is of better value than estimated and partly because better sorting was done in the Taracol mine than expected. The Tabowie surface dump will last another three or four days after which the Tabowie mill will be closed down until hoisting ore in the mine can be resumed. The Tabowie mine stope fire is still burning; the fire is now between No. 8 and No. 9 level, very close to No. 8 level. There is no more fire below No. 9 level. The management states: "We are still working day and night fighting the fire and perfecting the bulkheads whereby the fire will be isolated east of the ore bearing section of the mine. The gas continues bad. The bulkhead on No. 5 level in the main drift at 1,020 ft. E. took eight days and nights of continuous work with mine rescue apparatus on, as the gas was very thick at this point. The bulkhead was built of concrete and brick and is 9 ft. wide, 9 ft. high and 2 ft. thick. It was an awful struggle to get it completed. No one has been killed or injured so far, for which we are thankful. The 20th, 19th, 18th, 17th and part of the 16th levels are now flooded; we are unable to send water to the surface as all the water is needed for pumping on to the burning area."

ALABAMA

Steel Corporation's Purchase of Brazilian Manganese Properties Interests Birmingham

Birmingham—Purchase of the Morro da Mina manganese property in the state of Minas Geraes, Brazil, by the United States Steel Corporation, announced from New York by Judge Gary recently, is of interest to those in the Birmingham district as ore from that section is now being imported here via Mobile and thence up the Warrior River in barges to the Port of Birmingham, thence by rail to the furnaces at Bessemer, 12 miles from Birmingham. The Tennessee Coal, Iron & Railroad Co., the subsidiary of the Steel Corporation, uses considerable manganese ore. A cargo of 6,500 tons of Brazilian ore has just been brought up the river. The deposits in Brazil are said to be of such proportions as to guarantee the corporation a supply for many years to come, and make it independent as to this ore. The government, in addition to the Warrior River transportation facilities, is now constructing a coal and ore storage plant at Mobile which will provide apparatus for discharging cargoes quickly and loading lighters.

The Alabama Co. has taken an option on the Hammond ore mines, north of Gadsden, in Etowah County. The option is for six months. Indications are that the deal will be consummated. This will give the Alabama Co. a more bountiful supply of ore for a number of years to come. The Hammond mines have been property of J. W. Hammond and C. E. Buek and the ore is of a good quality. The company has two blast furnaces in Gadsden, not so very far from the ore mines.

Y. A. Dyer, who some time back took over the brown ore mines at Cave Springs, Ga., is installing a washing plant and will in the next few weeks be delivering washed ore to a consumer in his vicinity, the ore to be hauled from the mine by motor-truck.

The Woodward is still working on the shaft sunk to its ore veins, not far from Woodward; the Gulf States Steel Co. is getting a little ore from the immense slope at Shannon, the big deep-ore mining project a few miles below Birmingham, and the Republic Iron & Steel Co. is putting in improvements at its brown ore mines near Woodstock. Undeveloped ore fields in the state are being examined and some drilling is being done.

MINNESOTA

Mesabi Range

St. Louis County Tax Report Out—Laure Mine Suspends — Wabigon Shuts Down Temporarily Until Warmer Weather

Hibbing—The taxes on mineral lands, as shown by the figures of the auditor of St. Louis County, Minn., comprise 74.63 per cent of the total taxes collected, which amount to $24,453,002. Of this the mines will shoulder $18,250,364, which tends to show the enormous value of the iron ore of Northern Minnesota.

The percentage of taxes paid by the mining companies has been gaining every year. In 1915 the amount paid was $6,249,005 which was 66.80 per cent of the total taxes in comparison with the 74.63 per cent for 1920. The assessed valuation of mineral lands for 1920 shows a gain of $7,905,631 over 1919 with a total valuation of $273,967,081.

The M. A. Hanna Ore Co. reports a total shipment of 3,606,820 tons in 1920 from its mines in Michigan and Minnesota, those in Michigan shipping 1,646,704 tons and those in Minnesota 1,960,116.

The Laure mine of the Inland Steel Co. received orders to close down indefinitely. The heads of departments were retained but 125 men were released.

Chisholm—The Harold, Leonard No. 3 and the Alexandria mines of the M. A. Hanna Ore Co., are operating with one shift at present. The Alexandria has temporarily stopped all production owing to the work of deepening the shaft. It is anticipated that production can be resumed in the near future in conjunction with the shaft work.

The Shenango Furnace Co. has closed the Shenango mine indefinitely owing to market conditions and to the adequate stock piles of the furnace companies at lower lake ports. The closing order does not effect the Webb or Tioga mines of the same company, which will continue with present crews.

Buhl—Owing to the inability of the No. 300 electrically-driven shovel to handle the frozen overburden of the Wabigon pit with a drag line, the property, which is operated by the M. A. Hanna Ore Co., has temporarily closed until the weather moderates. Although the banks were blasted ahead of the shovel yet the frost penetrated to such a depth that the drag line could not operate economically. The Thorne mine of the same company has temporarily closed until next shipping season.

Three shifts of miners have been placed at the Shiras mine of the Oliver Iron Mining Co. to increase production until the lease terminates which will occur soon, and to accommodate some of the miners of the Alpena mine near Virginia which recently was worked out.

Gilbert—Pickands Mather & Co. report total shipments of 4,702,194 tons for the 1920 season from the various ranges divided as follows: Mesabi Range, 2,357,427; Cuyuna, 113,121; Menominee, 902,238; and Vermillion 200,076.

Cuyuna Range

Cuyuna Producers Cut Wages 10 Per Cent — Zenith Furnaces Down—Feigh Mine To Remain Closed

Crosby—Independent iron ore producers of the Cuyuna have made a general wage cut of 10 per cent effective Jan. 1. It is reported that one independent will make a 20 per cent reduction in wage schedules but will work full time through the winter season. There are now only four properties on the range producing and stockpiling ore, and one or two of these are taking steps to reduce their working force and output. At the Armour No. 2 mine of the Inland Steel Co., the largest on the range, seventy men were laid off New Year's day and it is expected that further reduction in the force may be made. It is planned to put this property on one shift per day with no work on Saturdays, thus cutting a normal 1,000-ton per day production 3,000 tons per week.

The Zenith Furnace Co. of Duluth, independent pig iron producers, blew out their furnace on Jan. 1 for an indefinite period dependent upon change in market demands. This is the first time these furnaces have been idle in ten years. All ore shipments to the furnaces were stopped in December, and this has caused the closing down of the Bonnie Belle mine of the Marcus Fay interests at Ironton, which had been a small but steady shipper to the Zenith for the past three years following its development in 1918. The management has not announced what action will be taken in the spring. The Sagamore mine at Riverton operated by John A. Savage & Co. is another Cuyuna mine which will be affected by the closing of the Zenith furnace as this property supplied all the manganiferous ore used by the Duluth firm. For its iron ores the Zenith also drew on the Utica Mining Co. of the Mesabi and the Section 30 Mining Co. of the Vermillion Range.

Ironton—M. A. Hanna & Co. have cancelled orders for reopening the Feigh mine this month and it is unlikely that the property will resume mining before spring. Installation of new surface equipment is nearly completed. When again in running order the Feigh will have one of the most modern surface plants on the Cuyuna. Engine house equipment consists of two new Ottumwa electrically operated hoists designed for 600 ft. depth. A 100-hp. motor drives the larger hoist operating two 2½-ton skips in balance, and the cage hoist is 75-hp. A single stage, automatic control electric compressor, of 550-ft. capacity and a 125-kw. Skinner engine generator set for emergency use completes the layout.

MICHIGAN

Marquette Range

Ford Preparing to Unwater Imperial Mine — Isabella Iron Transferred to Steel & Tube Co.

Ishpeming—The Ford interests are preparing to unwater the Imperial mine, located in Baraga County at the extreme western end of the Marquette district. Repairs will be made in the shaft, a new hoisting plant installed, the equipment to handle 1,500 tons of ore daily. Ore will be smelted in the Ford blast furnace near Detroit.

Articles of association for the Michigan Iron, Land & Lumber Co., a two-million-dollar corporation, have been filed with the County Clerk of Houghton County by Henry Ford, Edsel Ford and Clara Ford. The company's capital stock is divided into 20,000 shares of $100 par value each, of which one-half, or $1,000,000, was issued.

Final papers have been signed in the transfer of the property of the Isabella Iron Co., Palmer, Marquette County, to the Steel & Tube Co. of America. The purchasers will add a new hoisting plant and run rock drifts that underground haulage may be installed. Deposits of high grade ore have been developed, this in a section where very little ore of this grade had previously been found. The Cascade is attracting attention because of this development. It possesses a big tonnage of 40 per cent silicious ores.

Negotiations for the sale of the Negaunee Breitung Hematite mine are under way between the owners and the Jones & Laughlin steel interests. The property is located in Negaunee city and has a good record.

The Beaverboard Granulithic Co. has just completed a plant for the manufacture of grits for roofing purposes, near Morgan Heights, Marquette County, and will secure its rock from a prominent outcrop of greenstone at that place. The concern desires rock of green color for covering felt shingles which it manufactures. Other works of similar kind are now in course of construction on the Ishpeming marble range in Marquette County.

The Pioneer Furnace Co., Marquette, reduced the wages of its employees 15 per cent on Jan. 1.

Menominee Range

Penn Iron Co. Reduces Wages—Work on Ford Plant Stopped

Iron Mountain—All work at the new body plant of the Ford interests at Iron Mountain, has been ordered discontinued, and an order for machinery for this place has been cancelled although the work was well along. A wood contractor who was getting out 5,000,000 ft. of logs for the plant was also notified to stop all shipments. With wood camps established, swamp roads made and with ideal winter weather, this is a decided hardship on the contractor.

Vulcan—The Penn Iron Co. has made a wage reduction of from 10 to 15 per cent and is working its mines only four days a week.

COLORADO

A. V. Smelter Running Four Furnaces —A. V. Shaft Idle Temporarily

Leadville—At present the Arkansas Valley plant of the American Smelting & Refining Co. is operating four blast furnaces, the ore being smelted not coming from Leadville mines alone but from Aspen and other territories. The average number of men employed is about 450, and during the summer months considerable difficulty was experienced in securing a sufficient supply, owing to the general shortage all over the country. Mexican labor has largely displaced other classes at the A. V. plant, and during the last few weeks there has been much less difficulty in securing men, owing to the general conditions of unemployment.

Work of driving a tunnel on the old Lyon's placer was begun early last summer under the management of John [illegible], the purpose of the exploration work being the search for the continuation of the Lillian ore shoots which, it is expected, will be intercepted by the tunnel, at present into the hill for a distance of [illegible] ft., which will be continued through to the Empire Gulch side of the hill. Work on the tunnel, which is being driven in a southerly direction, has for the present been stopped and a raise is being driven toward the surface for the purpose of introducing an air way. Another raise was driven previously and there was evidence that a contact was being approached together with indications of ore near by. Small bodies of low-grade zinc ore have also been uncovered since the start of the present operations.

At present the famous A. V. shaft is idle, a temporary closing of the property having been necessitated by the cutting off of contracts for manganese ore of which the A. V. shaft is said to have the best grade of all local properties. Lessees are confident that the shut-down will be of short duration and that their contracts will be renewed within a very short time; 3,000 tons of the camp's best grade manganeses ore was the record of production for the A. V. shaft in 1920.

Alice—The Roosevelt Co. is erecting a wire-rope tramway, about ¾ mile long, between mine and mill. Additional stamps will be installed in the mill, and other equipment, which will double the capacity of the plant.

Naturita — The Standard Chemical Co., the largest producer of carnotite and vanadium ore in southwestern Colorado, has closed its plant, and discharged about 100 men.

UTAH

Holidays Cut Shipments from Park City and Eureka

Park City—Shipments for the week ended Jan. 1 amounted to 1,518 tons of ore and concentrates as compared with 2,328 tons the week preceding, the decrease being due to the holiday intermission. Shippers were: Judge allied companies, namely, the Judge, Daly West, and Park-Utah, 615 tons of ore and concentrates and 40 tons spelter; Ontario, 333 tons; and Silver King Coalition, 530 tons.

Eureka—Shipments from the Tintic district for the week ended Jan. 1 amounted to 116 cars as compared with 172 cars the week preceding, the decrease being due to the holiday intermission. Shippers were: Tintic Standard, 49 cars; Chief Consolidated, 17; Iron King, 12; Eagle & Blue Bell, 10; Dragon, 10; Victoria, 7; Iron Blossom, 5; Gemini, 2; Bullion Beck, 1; Centennial Eureka, 1; Mammoth, 1; Swansea, 1.

MONTANA

Anaconda Suspends Production of Manganese Ore—Butte & Superior's No. 3 Shaft Reaches Rainbow Vein

Butte—Anaconda has suspended the production of manganese ore and shortly will close the ferro-manganese plant at Great Falls, in consequence of the falling off in the demand for ferro-manganese from the eastern steel mills.

Sinking of the No. 3 shaft of the Black Rock mine of the Butte & Superior has reached the Rainbow vein on the dip at a depth [illegible] below the 2,300 ft. level, showing a promising mineralization with streaks of silver-zinc ore.

The shaft will be in this vein for some time, it is believed, as the fissure is standing farly straight. The No. 3 will be sunk to the 2,600-ft. level. The Butte & Superior has mapped out a six months' development program, consisting principally of shaft sinking and the crosscutting of the Rainbow vein at depths below the 2,000-ft. level. Development work is being prosecuted easterly on the 1,800-ft. level of the Black Rock into the adjoining Four Johns' claim.

CALIFORNIA

Lease on You Bet Claims Taken Over by S. B. Wood—Grass Valley Did Its Assessment Work Early

You Bet—Sydney B. Wood has announced the taking over of the bond and lease from W. A. Hilliard, W. E. Davis, R. A. Davis and John Hussey on the 1,300 acres making up the You Bet claims. Mr. Wood is brother-in-law of Bainbridge Colby, Secretary of State. The old company had secured three permits from the debris association to mine by the hydraulic process and Wood will seek to secure further concessions from the commission with the idea of developing the property to its fullest extent in the method best adapted for its exploitation.

Grass Valley — Locators of mining claims in Nevada County did not take any chances on the enactment of the bill providing for the extension of time for filing proofs of assessment work until July 1, 1921.

NEVADA

Western Chemical Co. Tries Out New Plant—Conditions Normal at Tonopah and Divide

Tonopah—In the Tonopah district conditions are normal, and no new developments of importance have been reported of late. On account of the complicated geology of this district, with irregular intrusions of later volcanics and consequent faulting in the vicinity of contacts, it is necessary to do considerable development work, usually in the nature of crosscuts and raises, with no more definite idea in view than that of cutting up the ground and prospecting for favorable formation. The formations in which ore occurs are pretty well known and as there are a great many veins in the camp, both large and small, with general east-west strike and dips ranging from flat to vertical, but more usually above 45 degrees, any time favorable formations are encountered they are worth crosscutting north and south. For this reason considerable development work has always been done in the mines of the district. Scarcity of efficient men in the past few years has curtailed this development to a certain extent but conditions have improved and more work is being accomplished.

Ore production of the Tonopah Belmont, Tonopah Extension, West End, Tonopah Mining and Rescue mines for the week ended Jan 2 was normal. Profitable operations are being carried on by lessees in the Montana Tonopah, Midway, Jim Butler and Halifax properties. West End profits for November were $51,057.39 from 5,278 tons of West End mine ore of an average grade of $21.50 per ton and 455 tons of Jim Butler lease ore.

Divide—In the Tonopah Divide mine the southeast drift on the 800 level has passed out of the ore shoot recently encountered and is now in low-grade material. On the 1,000 level there is no change in conditions, the drift being in low-grade vein material. This drift has reached the projected position of the ore shoot as developed on the 800 level and improvement in values is expected any day. Very good progress is being made on both levels. Production continues at the rate of 50 tons of ore per day, the ore being shipped to the Belmont mill.

A pump is being installed in the Gold Reef shaft and pipe line laid to storage tanks on the hill above the Divide mine. All water for both mining and domestic purposes is at present being hauled from Tonopah, a distance of approximately five miles, so that considerable saving will result.

The Kernick, Brougher, Gold Zone, Dividend, Silver and other smaller Divide properties report regular operations with no important developments up to the present.

Blair Junction—The Western Chemical Co., owning a potash alum property near Blair Junction reports that for the last three weeks its plant has been given a thorough tryout. Minor mechanical defects have been corrected. It has been found necessary to install a larger engine for the tube mill and this has been ordered.

Pioche—Ore shipments from the Pioche district for the period from Dec. 9, 1920, to Jan. 6, 1921, were up to the recent average, totaling 7,302 tons. Shippers were: Prince Con., 3,710 tons; Virginia Louise, 1,905; Bristol, 1,125; Black Metals, 355; Bristol Wade-Godbe Lease, 65; Lee Mathews Lease, 50; Stella, Culverwell Crowe Lease, 35; Pioche Assay Office, 30; and Bristol Rex Mathews Lease, 27.

The Prince Consolidated Mining & Smelting Co. has mailed all its present stockholders notice of their preferential right to subscribe for 200,000 shares of treasury stock of the company at 30c. per share. The receipts from the sale will be used in development work. The principal work will be the resumption of sinking the present working shaft to the 825-ft. level.

NEW MEXICO

Ore Shipments from Lordsburg District

Lordsburg—The total ore shipments from the Lordsburg district for the month of December amounted to 73 carloads, or 3,575 tons, having an approximate value of $70,000. The total shipments for 1920 were 1,108 carloads, or 56,284 tons of an approximate gross value of $1,125,680.

ARIZONA

Shannon Has Small Force at Gleason—Small Producers at Bisbee Cease Shipping

Gleason—The Shannon Copper Co. is employing less than a dozen men at its Gleason mine. Some development work is being done. Other than this the camp is closed tight.

Bisbee—At a recent county taxpayers' meeting Grant H. Dowell, manager of the Copper Queen branch of the Phelps-Dodge Corporation, declared that his company annually paid taxes representing a charge of $300 for every man employed and that the tax represented a charge of $2 on every ton of ore produced. The expenses of Cochise County, mainly paid by the mining companies, has increased from $29,545 in 1915 to $1,216,643 in 1920, while the population gain had been slight if any.

Shipments of ore have been discontinued by the Boras Leasing Co. The shaft is being sunk.

Shipping of ore has been discontinued by all other small producers at Bisbee. These include the Shattuck, Denn, Wolverine & Arizona, Night Hawk, Higgins and the Boras.

Phoenix—Shutting down of operations at Christmas by the Gila Copper Sulphide Co. has deprived the Arizona Eastern R.R. branch of several hundreds of tons of freight daily. Application has therefore been made to the Corporation Commission for permission to abandon service on the nine-mile stretch affected.

The Corporation Commission has refused permission to increase freight charges to the Swansea R.R., which has been deprived of the major part of its income by the closing of the Swansea mines.

The Southern Pacific R.R. from Cochise to Courtland and the Southwestern road to the same point from Douglas have cut their schedules to three times a week on stoppage of the mining operations in the Courtland-Gleason mining district.

Miami — Several thousand dollars damage has been done near Miami by fire at the Live Oak shaft of the Inspiration workings, which destroyed the blacksmith shop, the tool-sharpening department and did other damage.

Prescott—The Jerome-Superior stockholders' row has been taken from Los Angeles to Arizona in a suit filed at Prescott by the plaintiffs, who had failed in the coast city on demurrer that their corporation had entity in Arizona.

Douglas—A further reduction of employment and of production has been announced by L. R. Budrow, manager of the Lucky Tiger Combination Mining Co., operating a silver property south of Douglas in Sonora.

Kingman — Hackberry Combination has installed a new hoist and compressor and will buy machine drills. D. D. Martin is in charge at Hackberry.

THE MARKET REPORT

Daily Prices of Metals

Jan.	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
6	12.50@12.75	34.00	38.00@38.50	4.75	4.65@4.75	5.50
7	12.50@12.75	33.75	38.00@38.50	4.75	4.70@4.80	5.45@5.50
8	12.50@12.75	33.75	38.00@38.50	4.75	4.70@4.80	5.40@5.45
10	12.60@12.75	34.25	38.25@38.75	4.75@4.85	4.75	5.45@5.50
11	12.75	34.50	38.75@39.00	4.75@4.85	4.70@4.80	5.50
12	12.75	34.00	38.25@38.50	4.75@5.00	4.75@4.85	5.50

*These prices correspond to the following quotations for copper, "delivered": 12.75@13, 12.75@13, 12.75@13, 12.85@13, 13, and 13c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Jan	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
6	72¾	73¾	80	208¼	213¼	22¼	23½	25¼	26¼
7	73	74	80	210½	215¾	23½	24	25⅜	26⅛
8	...							...	
10	74	74¾	81½	210	215	24	24½	27⅛	27⅞
11	74	74	81	209	213¾	23¾	24¼	26¾	27½
12	74	73¾	81	205	210¾	23½	24	26½	27⅜

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Jan	Sterling Exchange	Silver			Jan	Sterling Exchange	Silver		
		New York Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York Foreign Origin	London
6	364	99½	68⅝	42½	10	365½	99½	65⅛	40⅛
7	362½	99½	66¾	41½	11	373	99½	65¼	39½
8	362½	99½	65⅝	40⅞	12	373	99½	66	40

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, Jan. 12, 1921

The better tone which characterized the metal market in the first week of the new year has continued, and prices generally have tended upward. The improvement in the stock market has no doubt had an influence. No buying of consequence has resulted, however, and it is generally agreed that this must await a better demand for manufactured products. Pressure to sell appears to have decreased considerably, and most of the metal for sale now seems to be in hands which are able to carry it. A decrease in money rates helps, of course, in this regard. The advance in foreign exchange has made the export situation brighter.

The speculative demand is generally active, particularly for future delivery, but producers generally are not willing to sell in these quarters, even at premiums. Both the demand and the unwillingness to sell are encouraging factors.

Copper

The chief feature of the copper market for the last week has been a much improved export demand, in which both the Copper Export Association and outside agencies have shared. The increase in the value of sterling and francs has helped sales to England and France, and Germany has also been a buyer of no great importance. The prices charged have netted producers on this side about the same as has been realized on domestic business.

Sales for domestic consumption continue of very meager proportions, and the big buyers are not in the market. The prices asked by the large producers are about the same as those asked by others, a situation which has not existed for some time. Some sellers are asking 13¼c. delivered, but the price today is generally 13c. for January delivery, with a premium of about ⅛c. for each month beyond this. It begins to look as if copper was in for a gradual return to higher prices as long as foreign exchange and the general sentiment in business circles continue to improve.

Lead

The A. S. & R. official price of 4.75c., New York and St. Louis, continues unchanged.

Lead has continued firm, with a widely distributed demand for shipments of one hundred tons and less. Large consumers seem well supplied at current rates of consumption. The speculative demand is active, especially for futures, and 5@5¼c. New York has been realized on such sales. Old customers, however—reputable consumers—have had no difficulty in buying at the prices which we quote. There is little likelihood of the price going much above 5c. under present conditions, for Spanish or German lead would then be imported. The statistical position, however, is excellent, with producers well sold up, dealers pretty well cleaned out, and consumers' stocks low. The battery business seems to be improving a little. The coming installations of automatic telephones in New York will require considerable lead for battery purposes, and the automobile business is expected to improve in the spring.

Some business in second-quarter metal has been done at 4.875@5c.

Zinc

No demand, either speculative or consuming, seems in evidence, and the lethargy of this market continues. Too much zinc is available in Europe to allow any marked advance of the price on this side, and no immediate change is in prospect. The demand for futures is entirely confined to speculative interests.

Tin

The improvement in exchange has had its effect on tin prices, but business in all varieties continues small, and buying is done very carefully. Speculators in tin and sterling exchange seem to be doing what little [illegible] there is.

Straits tin for future delivery: Jan. 6th, 38.75@39; 7th, [illegible]; 8th, 38.50@39; 10th, [illegible]; 11th, 39.50@39.75; 12th, [illegible]@39.50.

Arrivals of tin: none.

Silver

During the last week the London market dropped from 42½d. to 39½d. This fall was occasioned by heavy selling for China account, part of these sales being against previous purchases. The Indian bazaars have also been buying, but offerings were too heavy for the price to hold. The market in New York has fluctuated between 65 and 69c., the strength here being due largely to the sharp advance in sterling exchange.

Mexican Dollars—Jan. 6th, 52¼; 7th, 50¾; 8th, 50; 10th, 50; 11th, 50; 12th, 50¾.

Gold

Gold in London: Jan. 6th, 112s. 2d.; 7th, 113s. 3d.; 10th, 112s. 6d.; 11th, 108s. 10d.; 12th, 108s. 11d.

Foreign Exchange

Foreign money advanced generally during the last week. The advance in sterling was violent and seemed to have its origin in the selling of dollars in London. The market continues thin, however. Conditions are better in South America. Some foreign countries are reported to be arranging the sale of bonds in this country. It is to be hoped that they meet with success, as such sales would have a direct influence in promoting export trade from this country, and it is on this trade that copper producers and others must look for prosperity. On Tuesday, Jan. 11th, francs were 6.185c.; lire, 3.53c.; and marks, 1.44c. New York funds in Montreal, 14¾ per cent premium, the decline being due to the advance in sterling here.

Other Metals

Aluminum—List prices of 28.3@28.5c. are purely nominal.

Antimony — Chinese and Japanese brands, 5¼c.; market quiet. W.C.C. brand, 6¼@6½c. per lb. Cookson's "C" grade, shipment from England, 9¾c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony[1] (200 mesh), 7@7¼c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 7c.

Bismuth—$2.40 per lb., 500-lb. lots, and $2.42 per lb., 100-lb. lots.

Cadmium—Nominal, $1.40 per lb.

Cobalt—Metal, $5 per lb.; black oxide, $3.40 per lb.; sulphate, $1.35.

Iridium—Nominal, $325 per oz.

Magnesium — Crude, 99 per cent, $1.35 per lb. f.o.b. Philadelphia.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Ingot, 43c.; shot, 43c.; electrolytic, 45c., f.o.b. Bayonne, N. J.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $70@$80 per troy oz.

Palladium—$75 per oz.

Platinum—Firm at $75 per oz.

Quicksilver—Nominally $45 per 75-lb. flask. San Francisco wires $45@$50. Steady.

[1]**Rhodium**—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 55@60c. per unit, New York. Practically no change on California chrome ore since August; 40@50 per cent can be bought at 50@60c. per unit, f.o.b. cars, California. One party has offered 800 tons of 40@45 per cent at 55c., and has been able to dispose of only 150 tons.

[1]**Manganese Ore**—40@45c. per unit, seaport; chemical ore (MnO_2) $60@$65 per gross ton, lump; $75@$80 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

[1]**Tantalum Ore**—Guaranteed minimum 60 per cent tantalic acid, 40c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¼@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

[1]**Tungsten Ore**—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3.25@$3.50, New York.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Jan. 8—Zinc blende, per ton, high $36.85; basis 60 per cent zinc, premium, $29; Prime Western $27.50@$29; average selling price, all blende ores, $33.88. No sales of calamine.

Lead, high, $57.20; basis 80 per cent lead, $55@$47.50; average settling price, all grades of lead, $49.64 per ton. A few settlements are being made on ore sold on $50@$55 basis, but the buying basis is $47.50 this week.

Shipments for the week: Blende, 6,186; lead, 491 tons. Value, all ores the week, $234,040.

Efforts to buy ore on $25 basis at the close of 1920 proved futile; the closing price for Prime Western was $27.50. Blende opened this week stronger on $27.50 basis, and a few bins were bid $28.50 and one $29, the same price as premium grade. Sellers consider this a hopeful and helpful indication. There is more ore for sale, but it is being held for a $30 basis. The purchase this week was 8,300 tons, 4,500 tons larger than last week, and was approximately 2,000 tons in excess of the production, another very encouraging feature.

Platteville, Wis., Jan. 8—No market demand for lead or zinc. Shipments for the week: Zinc ore, 396; lead, 110 tons. Shipped during the week to separating plants, 1,680 tons blende.

Non-Metallic Minerals

Asbestos—Crude, No. 1 $2,000@$3,500; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, $23; ground (white), $45; ground (off color) $30@$32 per net ton, less than carload lots, f.o.b. New York. Crude, first grade, $10 per ton, f.o.b. cars, Missouri; floated, $28 per ton in bbls.; $26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis.

Chalk—English, extra light, 5@5½c.; light, 5@6c.; dense, 4½@5c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$12; washed, $12@$15; powdered, $18@$22; bags extra, per net ton, f.o.b. mines, Georgia; crude, $8@$12; ground, $15@$40, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $25@$35; powdered, $30@$35, f.o.b. New York.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $25 per ton, f.o.b. Illinois mines, and $25.50, f.o.b. Kentucky; ground, suitable for acid, chem-

ical or enameling purposes, $60; lump, $17.50, f.o.b. Tonuco, N. M. In Canada 85 per cent calcium fluoride sells for $20 per ton, f.o.b. Madoc; output limited. Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines.

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Fuller's Earth—$16 per ton, carload lots, f.o.b. New York.

Graphite—The 90 per cent crucible grade is held in Alabama for 9c. per lb. and 85 per cent grade, 7@9c. Lubricating grade commanding the best price is a fine flake, passing a 100@120 mesh, and running higher than 96 per cent carbon. Linotype machines use a flake passing 90 mesh and standing on a 120 screen, with 90 per cent carbon, retailing at 75c. to $1 per lb. and selling to jobbers at 11@40c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Dolomite, 1@2 man size, $1.60@$1.65; 2@8 in., $1.55@$1.65 per net ton, f.o.b. Plymouth Meeting, Pa.; fluxing, $1.65@$1.75 per net ton, f.o.b. Howellville, Pa.

Magnesite, Calcined — High-grade caustic calcined, lump form, $35@$40 per ton, carload lots, f.o.b. California points. In Chicago district, $57.70; Atlantic seaboard, $61@$63.

Dead-Burned — $38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 50c.; No. 5, $1.20 @$1.40; No. 4, $2@$3; No. 3, $4.25@ $5; No. 2, $5.50@$7; No. 1, $8. Clear block: No. 6, 55c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $10; extra large, $25; all f.o.b. New York; ground, $150 per ton, Philadelphia. Domestic, uncut, f.o.b. Franklin, N. C., as follows: Scrap, $45 @$50 per ton; punch, 10c. per lb.; circle, 15@25c.; 1½ x 2 in., 75c.; 2 x 2 in., $1.15; 2 x 3 in., $1.65; 3 x 3 in., $2.10; 3 x 4 in., $2.50; 3 x 5 in., $2.75; 3 x 6 in., $3.75; ground 165 mesh, $150 @$170 per ton; ground roofing mica, $60; mica washers, 75c.@$2 per lb.; 1½-in. disks, No. 1, $1.40 per lb.; No. 2, $1.25. The foregoing domestic prices obtain also in the Chicago district.

[1]**Monazite**—Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $13; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $8.35; 68 per cent, $7.85; 68@66 per cent, $7.60. Finely ground Tennessee rock sells for $8.50 per net ton for 13 per cent phosphorus content, agricultural application; for acid-making, 14 per cent, $9; both prices f.o.b. Centerville, Tenn.

Pumice Stone—Imported, lump, 4@ 60c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 16½c.; Spanish lump, 14@16c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Sand (Glass)—Dry glass sand, $4 per net ton, f.o.b. cars Mapleton, Pa. Sand, f.o.b. Ottawa, Ill., is $3 per ton; $2.50 on annual contracts. Sand at Klondike, Gray Summit and Pacific, all in Missouri, is $2.50 on contract; some outside sales have been made at $4. St. Louis, open market, at $3.50; contract price on large quantities, $2.50; on small quantities, $3.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $12@$22 per ton; roofing grades, $9.50@$15; rubber grades, $12@$18; all f.o.b. Vermont. California talc, $20@$45, talcum powder grade. Southern talc, powdered, carload lots, $12@$15 per ton; less than carload, $25, f.o.b. cars; freight to New York $5.25 per ton, carload lots; less than carload lots, $9.25. Imported, $50 @$60; Canadian, $20@$40 per ton.

Mineral Products

Arsenic — White arsenic, 11½@12c. per lb.; sulphide, powdered, 15@15½c. per lb. in carload lots.

Sodium Nitrate—$3 per cwt. ex vessel, Atlantic ports. Market quiet.

Sodium Sulphate—For 95 per cent material, $22 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract.

Potassium Sulphate—Domestic, $225 @$250 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrocarbontitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 16@17c. per lb. of chromium contained; 4 to 6 per cent carbon, 17@18c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $110, f.o.b. seaboard bases; resale, $115; English, $110, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $50.50, f.o.b. furnace.

[1]**Ferromolybdenum**—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $55@$60; 50 per cent, $78@$80; 75 per cent, [illegible]

[1]**Ferrotungsten**—Domestic, 70 to 80 per cent W, 55@60c. per lb. of contained tungsten, f.o.b. works. Foreign, 60c.

Ferro-uranium—35 to 50 per cent U, $7 per lb. of U contained, f.o.b. works.

[1]**Ferrovanadium**—Basis 30 to 40 per cent, $6@$6.50 per lb. of V contained, according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York list price, 21¼c. per lb.; wire, 15¾.

Lead Sheets—Full lead sheets, 8½c.; cut lead sheets, 8¾c. in quantity, mill lots.

Nickel Silver—34¼c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets, 19¾c.; sheathing, 19¾c.; rods, ⅝ to 3 in., 16¾c.

Zinc Sheets—$11.50 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr_2O_3, $50@$55 per net ton, and $60 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $80 per net ton, shipping point; arches, keys, wedges, $85; splits, soaps, $100.

Fire Brick—First quality, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $45@ $50.

Magnesite Brick — 9-in. straights, $100 per net ton; 9-in. arches, wedges and keys, $105; soaps and splits, $120.

Silica Brick—9-in., per 1,000: Chicago district, $65@$70; Birmingham, Ala., $56@$61; Mount Union, Pa., $50 @$60.

Iron Trade Review

Pittsburgh, Jan. 11, 1921

On the whole, there seems to be a slight improvement in demand for steel products, but it is inconsequential, the market remaining extremely dull. Predictions are confidently made that there will be a distinct improvement in March, and that is in line with precedents, as the market frequently broadens in March.

The Steel Corporation's unfilled obligations decreased during December by 873,359 tons, against a November decrease of 815,371 tons. Shipments were about 94 per cent of capacity.

Pig Iron—The market remains absolutely stagnant, with more than half the merchant furnaces idle and many of those operating expecting to blow out soon. The market remains quotable at $32 for bessemer and malleable, $30 for basic, and $33 for foundry, f.o.b. Valley furnaces.

Semi-finished Steel—Mills quote sheet bars at $47, but buyers seem to expect to do $42 or $40. Billets are nominal at $43.50.

Charcoal and Coke

Charcoal—Willow, [illegible] bbls.; hardwood, 5½c. per lb., in 250-lb. bbls. Barrel charge is [illegible] additional.

Connellsville—Furnace, $6.25@$7; foundry, $5@$5.50.

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Copper Prices, Production, and Exports

Rapid Decline in the Metal Comparable to the Drop That Occurred in 1907—December Production Figures Indicate Sharp Curtailment Has Begun—Export Trade, Although in Good Volume Early in 1920, Has Tapered Off

ON THE last day of 1920 copper dropped to the lowest price not only for the year, 12.125c. per lb., f.o.b. refinery, but also to a figure comparable only to extraordinary conditions in the industry. Thus, back in 1914 at the beginning of hostilities copper reached an unusually low limit—11.739c. per lb. was the average for November,—but the rapid rise from that low point is still fresh in the minds of most people interested in the copper market. The average price of New York electrolytic copper for ten years prior to 1911 is 14.759c. per lb. If 14¾c. be judged a fair price for copper during that period, 12.75c. copper is certainly ridiculously cheap.

The most recent comparable decline in the price of copper is afforded by the record of the year 1907—a panic year and a year of depression. At that time the price dropped from an average monthly high of 25.065c. in May to 13.163c. in December. For the following four years the price held at relatively low levels, as the accompanying table indicates.

AVERAGE ANNUAL PRICE NEW YORK ELECTROLYTIC COPPER

In Cents per Pound

1907	20.004	1912	16.341	1917	27.180
1908	13.208	1913	15.269	1918	24.628
1909	12.982	1914	13.602	1919	18.691
1910	12.738	1915	17.275	1920	17.456
1911	12.376	1916	27.202		

In meeting the situation confronting them, it appears that copper producers have earnestly begun to drop their rate of production to a pre-war level or lower. December production reports bear this out. Thus, the largest producers have announced sharper decreases in production than any time during the year. The "porphyries" have taken a lead in the reduction, and together their output for December is lower than for November by more than 26 per cent. But they have not been alone in this movement. Inspiration, Miami, Anaconda, North Butte, and practically all producers have joined in the movement.

MID-YEAR AND YEAR-END COPPER PRODUCTION RATES, In Pounds

	June, 1920	December, 1920
Anaconda	12,700,000	10,500,000
Utah	10,000,000	7,500,000
Phelps Dodge	6,125,000	5,850,000
Inspiration	7,300,000	5,000,000
Miami	4,400,000	4,373,123
Ray Consolidated	4,520,000	2,975,000
Chino	4,010,069	2,999,000
Nevada Consolidated	4,650,000	3,000,000
Calumet and Arizona	4,764,000	3,300,000

Although curtailment of production is a desirable condition, its effect does not extend alone to the decrease in copper output. Miners, millmen and others are thrown out of employment, with attendant discomfort and even hardship; railroads lose in revenue, and the mining companies cannot run at their most efficient rate. All of which is the cost of the depression in the industry. Nevertheless, the sooner there is complete readjustment to existing conditions the quicker will be the return to normal.

Despite the optimistic feeling in the copper trade at this time last year, due to phenomenally heavy buying of copper both in the United States and abroad, which was expected to make heavy inroads upon the copper surplus, the large unconsumed stocks of copper are still to be eliminated as a market depressant. Foreign trade in copper has been confidently expected to do its share in reducing the copper surplus, but the record for the year 1920 has been disappointing in that respect. A particularly promising start was made during the first six months of the year, when copper exports consistently overbalanced imports by about 145,000,000 lb. This record was not sustained by the second half of the year, for from July to November, inclusive, the export balance was only 14,200,000 lb.

The table presented below gives a detailed record of foreign trade in copper for the first eleven months of 1920, from which several important developments during the year are noted. First, there is shown the heavy exports of copper during the first few months of the year, greatly outweighing imports; then the transition to a smaller export balance, and finally the change to a preponderance of imports over exports—a highly unsatisfactory state of affairs. The November details of movements record a virtual balance of exports and imports, and although they indicate a marked improvement over the October trend, present an unsatisfactory comparison with copper movements of last spring.

The mainstays of foreign trade for copper during 1920 were France, the United Kingdom, Germany, and Japan. Asiatic purchases were heavy during the early months of the year, and contributed largely to a concurrent speculative rise in price, but are now no longer a factor in export trade. Sweden, an important copper-importing country earlier in the year, also dropped out of the market during the last half of 1920. Germany was a fairly consistent consumer of American copper, but imports were far below the pre-war rate of over 17,000,000 lb. monthly. There is little doubt that Germany is taking the smallest quantity of copper with which it is possible for her to get along, but as a potential consumer her abilities have not been touched.

Export trade as a whole has been unsatisfactory and not in the volume desirable to help remove the excess copper stocks, but, considering that copper is now much cheaper than it was when most of these export sales were made, it will be interesting to watch the foreign trade response that low copper prices should bring.

MOVEMENTS OF COPPER FROM AND TO THE UNITED STATES DURING PART OF 1920

In Pounds

EXPORTS

Refined copper in ingots, bars, etc., to	January	February	March	April	May	June	July	August	September	October	November(a)
Belgium					.....	..	536,638	2,978,454	2,803,913	1,040,990	1 861,441
France	6,077,254	4,031,308	7,203,950	10,889,955	17,803,625	11,315,461	17,797,752	14,633,149	4,659,360	5,531,926	12,987,092
Germany			10,661,454	14,003,294	7,055,336	11,415,403	5,634,824	4,808,472	1,536,105	3,263,094	6 347,098
Italy		....	43,655	56,018	81,364	289,213	56,002	112,285	....	56 060	....
Sweden	1,175,235	3,137,606	4,772,500	4,145,331	6,458,806	1,467,850	3,465,284	2,889,617	2,964,343	561,415	. . . .
Netherlands							191,463	2,327,411	840,505	1,063,357	3 350 232
Switzerland				336,092	336,087	336,000			223,884	. . .	. . .
United Kingdom	8,524,942	5,294,208	12,439,106	8,798,829	14,810,044	11,018,402	9,200,750	6,828,152	3,326,631	4,423,793	4 738 717
Canada	2,355,664	3,983,327	4,861,385	2,210,644	3,877,894	2,140,139	1,523,997	2,961,718	2,264,481	1,084,171	1 424 510
Japan	10,428,250	15,580,964	32,037,044	9,024,552	9,184,000	4,417,980	940				. . .
Other	14,485,349	20,771,324	10,247,865	8,647,766	12,500,421	9,037,875	1,643,973	1,510,977	508,921	2 245 975	3 786 940
Wire, sheets, etc.	6,637,464	4,796,323	5,767,849	6,282,408	10,684,238	6,547,666	6,817,565	6,808,931	5,327,308	4,031,083	4 064 993
Total	49,684,158	57,595,060	88,034,808	64,394,889	82,791,815	57,985,989	46,869,188	45,859,166	24,455,451	23,301,864	38,561 023
Monthly average export price (c)	20.6c.	20.4c.	19.7c.	19.7c.	19.6c.	19.8c.	19.8c.	20.0c.	19.7c.	19.5c.	....

IMPORTS

	January	February	March	April	May	June	July	August	September	October	November(a)
Ore, concentrates, matte, unrefined and refined copper wire, etc. (b)											
Total	37,962,874	45,227,401	39,144,137	27,811,572	53,860,911	51,530,407	30,491,424	31,360,881	30,561,643	34,187,265	38 291,788

(a) Preliminary [illegible].

(b) Total copper [illegible] only material shipped to the United States for refining by Canada, Mexico, Chile, and Peru.

(c) Based on the [illegible] the value of the [illegible] at the time of exportation at the ports from which shipped.

COMPANY REPORTS

Yukon Gold Reports Tin Activities

Tin; Federated Malay States

The Yukon Gold Co. in a special report calls attention to its fine mining activities in the Federated Malay States. The government has control of all mining lands. Titles in perpetuity are not granted, but all lands are taken up on mining lease for twenty-one-year periods. If the requirements are met, the lease may be renewed when it expires. The mining regulations are fair and just. The government encourages large mining operations. There is a duty on all tin ore based on the gross value of 72 per cent concentrate. This varies from 12 per cent to 14 per cent, according to the price of the metal. Labor consists chiefly of Chinese coolies and Tamils. Wages paid range from 50c. to $1.75 per day, the latter being for mechanics and other skilled labor.

Local coal is available for steam plants, and there are mountain streams suitable for hydro-electric developments, which engineers are now investigating.

The use of tin has increased enormously in the arts and the manufacture of preservative containers. Viewing the situation from the possible tin that will be produced, and the increasing demand, it is reasonable to expect that the average price of tin at Singapore will exceed 45c. and will probably average 50c. per lb. for many years to come, says the report.

It has been estimated by drilling that the property, consisting of 2,182 acres, contains 126,127,000 cu.yd. with a metallic tin content of 75,115,000 lb. Returns are estimated as follows:

	With Tin at 40c. per Lb. at Singapore	With Tin at 45c. per Lb. at Singapore	Lb. Metallic Tin 75,115,000 With Tin at 50c. per Lb. at Singapore
Gross value of tin	$30,046,000	$33,801,750	$37,557,500
Cost of producing and marketing, including mining, freight, smelting, and export duty (a)	15,023,000	15,706,750	16,337,500
Operating profit	$15,023,000	$18,095,000	$21,220,000
Less royalties and outside interests	768,000	915,000	1,100,000
Net returns	$14,255,000	$17,180,000	$20,120,000
Total investment, property and equipment	3,670,000	3,670,000	3,670,000
Net over return of investment, in fifteen years	$10,585,000	$13,510,000	$16,450,000

(a) The cost per pound of tin produced increases from 20c. with tin selling at 40c. per lb. Singapore, to 21.75c. with tin selling at 50c. per lb., on account of duty increasing with price of tin.

It is proposed to equip the properties with power plants and seven dredges, or their equivalent in capacity, and it will require fifteen years to work out the properties with this equipment. The average capacity per dredge per year will be 1,200,000 cu.yd.

If the remaining unprospected areas under option in the above projects continue to develop at the present rate, an additional area equivalent to about 50 per cent of the present selected area should be added. It is expected that this additional area will warrant increasing the equipment to eleven dredges, which will return an operating profit, with tin at 45c. per lb., of $27,500,000 in fifteen years, or a net, after deducting cost of property and equipment, royalties, and other charges, of $22,000,000. With the full equipment the output should be about 450,000 lb. of tin per month.

Dredges are successfully working the Malayan tin deposits. Dredging costs vary in different parts of the field, but, without depreciation, range around 7c. per cu.yd. Dredging has shown that areas worked over by hand methods, besides virgin lands, can be dredged with good returns. The records of some of the dredging companies show that dividends of 25 per cent per year were paid from the dredging of ground averaging 0.50 lb. of tin ore per cu.yd. and with tin selling at 40c. per lb. at Singapore.

Extensive areas remain which cannot be worked by present methods, but should prove profitable for dredging. It is believed that dredging will soon be the controlling factor in the tin production of Malaya.

The company has both dredge and power-plant equipments immediately available, which, with certain alterations, are suitable for equipping the Malayan properties. It has also built up in the last fifteen years a staff and dredge organization with experienced men in every department, which can be transferred to the Malayan operations.

The projects so far developed show a large profit to be gained by dredging. Additional acreage is being developed each month, and the possibilities for extensive expansion are excellent.

McIntyre Porcupine Mines Increase Operating Profit

Gold; Ontario

The eighth annual report of the McIntyre Porcupine Mines, Ltd., indicates that an operating profit of $1,051,404.13, and a non-operating profit of $228,828.24, making a total of $1,280,232.37, was earned during the fiscal year ended June 30, 1920, as compared with $839,588.62 for the previous year. During the year, 188,835 tons of ore was treated, having an average value of $11.52. Bullion containing 99,461.39 oz. gold and 21,140.3 silver was recovered. Three dividends of 5 per cent each, aggregating $546,042.45, were paid to shareholders.

The result of the limited amount of development work accomplished, owing to the scarcity of labor, has been satisfactory. After producing $2,080,178.44, the ore reserves have been increased approximately one million dollars over the previous year's estimate.

Recent drilling has indicated the existence of a new vein system paralleling No. 5 vein, 480 ft. to the south, below the 1,000-ft. level. The intersections show good widths of better than the average grade ore, and, being on the north contact of the quartz porphyry, considerable importance is attached to this discovery. Profit and loss statement follows:

Earnings:		
Bullion recovery		$2,080,178.44
Bullion recovery custom ore	$53,689.09	
Payments for custom ore	53,689.09	
Treatment charges custom ore		6,887.00
Gross operating earnings		$2,087,065.44
Operating costs:		
Mining, development, and exploration	$582,676.27	
Transportation of ore	42,926.88	
Milling	197,317.14	
Heating and maintenance of building and camps	44,071.69	
Employees' insurance and welfare	33,503.36	
Administrative and general expenses:	$900,495.34	
Management and general expense, mine office	52,454.05	
Administrative and general expense head office	63,619.70	
Insurance, general	19,092.22	
	$135,165.97	
Total operating costs		1,035,661.31
Net operating earnings		$1,051,404.13
Non-operating revenues:		
Interest and exchange earned	$221,8[illegible]	
Miscellaneous earnings	[illegible]	
		228,828.24
Net earnings		$1,280,232.37
Appropriations:		
Reserve for municipal, provincial and dominion taxes for current year	[illegible]	
Reserve for plant depreciation	[illegible]	
Depreciation on Victory Bonds, 1934, cost $500,000, present market value $475,000	25,000.00	
Holdings in adjoining mining properties written down to $1—written off	[illegible]	
Total appropriations		462,211.54
Net profit for the year, transferred to surplus		$818,020.83

MINING STOCKS

Week Ended January 8, 1921

COPPER

Stock	Exch.	High	Low	Last	Last Div.	
Adventure	Boston	....	....	*60		
Ahmeek	Boston	52	46	52	Sept.'20, Q	.50
Alaska-B.C.	N. Y. Curb.	¾	⅝	11/16		
Allouez	Boston	21	17½	21	Mar.'19,	1.00
Anaconda	N. Y.	38⅝	33⅞	38	Nov. '20, Q	1.00
Ariz. Com'l	Boston	9	6¾	8¼	Oct. '18,	.50
Big Ledge	N. Y. Curb.	⅜	5/16	⅜		
Bingham Mines	Boston	....	....	9½	Sept. '19, Q	.25
Calumet & Ariz	Boston	50¼	40½	50	Dec.'20, Q	1.00
Calumet & Hecla	Boston	259	240	250	June '20, Q	5.00
Canada Copper	N. Y. Curb.	....	..	*13		
Centennial	Boston	7	7	7	Dec. '18, SA	1.00
Cerro de Pasco	N. Y.	31½	27	30⅜	Dec. '20, Q	1.00
Chief Consol	Boston Curb	3	2½	2¾	Nov. '20, Q	.10
Chile Copper	N. Y.	12⅜	9¾	11⅜		
Chino	N. Y.	23	19⅝	21¾	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*35½	*34	*35		
Con. Ariz.	N. Y. Curb.	....	....	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb.	2¼	1¼	2¼		
Copper Range	Boston	32	27	31¾	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*38	*34	*35		
Davis-Daly	Boston	7½	5½	7¼	Mar. '20, Q	.25
East Butte	Boston	10	7⅝	10	Dec. '19, A	.50
First Nat'l	Boston Curb	*85	*65	*80	Feb. '19, SA	.15
Franklin	Boston	3¼	2¼	3		
Gadsden Copper	N. Y. Curb.	....	....	*25		
Granby Consol	N. Y.	23	20	23	May '19, Q	1.25
Greene-Cananea	N. Y.	23⅝	20	22⅞	Nov. '20, Q	.50
Hancock	Boston	3½	2	3½		
Houghton	Boston Curb	*50	*50	*50		
Howe Sound	N. Y. Curb.	....	....	2⅝	Oct. '20, Q	.05
Inspiration Con	N. Y.	36⅜	31	36⅜	Oct. '20, Q	1.00
Iron Cap	Boston Curb	9½	6⅛	9½	Sept. '20, K	.25
Isle Royale	Boston	22¼	16¼	22¼	Sept. '19, SA	.50
Kennecott	N. Y.	21	17⅞	20⅝	Dec. '20, Q	.50
Keweenaw	Boston	1½	1½	1½		
Lake Copper	Boston	2¾	2	2¾		
La Salle	Boston	....	....	1¼		
Magma Chief	N. Y. Curb.	....	....	*21		
Magma Copper	N. Y. Curb.	20½	18	20¼	Jan. '19, Q	.50
Majestic	Boston Curb	*11	*8	*8		
Mason Valley	Boston	1½	1⅜	1⅜		
Mass Consol	Boston	3½	2½	3½	Nov. '17, Q	1.00
Mayflower-O.C.	Boston	5¼	4	5		
Miami	N. Y.	19½	15¼	18⅝	Nov. '20, Q	.50
Michigan	Boston	3	2½	3		
Mohawk	Boston	48	43½	46	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb.	5½	5	5½		
Nevada Con	N. Y.	11½	9⅞	10⅞	Sept. '20, Q	.25
New Arcadian	Boston	....	....	2½		
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	16	14½	16	Aug. '20,	.25
Nixon Nev.	N. Y. Curb.	....	....	*5		
North Butte	Boston	12	8⅞	11⅞	Oct. '18, Q	.25
North Lake	Boston	*50	*35	*50		
Ohio Copper	N. Y. Curb.	....	....	3/16		
Ojibway	Boston	1⅞	1¾	1⅞		
Old Dominion	Boston	21	15⅝	20½	Dec. '18, Q	1.00
Osceola	Boston	30	24	29	June '20, Q	.50
Phelps Dodge	Open Mar.	†175	†150	....	Jan. '21, Q	2.50
Quincy	Boston	41	35½	40	Mar. '20, Q	1.00
Ray Con	N. Y.	14⅜	11⅝	13½	Dec. '20, Q	.25
Ray Hercules	Boston Curb			*50		
St. Mary's M. L.	Boston	34	28	33½	June '20, K	2.00
Seneca Copper	Boston	20	17½	20		
Shannon	Boston	1⅜	¾	1⅜	Nov. '17, Q	.25
Shattuck Ariz	N. Y.	6⅞	4⅞	6½	Jan. '20, Q	.25
South Lake	Boston	....	....	1		
South Utah	Boston	*15	*5	*12		
Superior Copper	Boston	4	3½	4	Apr. '17,	1.00
Superior & Boston	Boston	2	1½	2		
Tenn. C. & C.	N. Y.	9	7½	8⅞	May '18, I	1.00
Tuolumne	Boston	*55	*40	*50	May '13,	.10
United Verde Ex.	Boston Curb	28	23	27	Nov. '20, Q	.50
Utah Consol	Boston	4	3½	4	Sept. '18,	.25
Utah Copper	N. Y.	55½	48½	54	Dec. '20, Q	1.50
Utah M. & T.	Boston	*150	*95	*150	Dec. '17,	.30
Victoria	Boston	1½	1½	1½		
Winona	Boston	*50	*35	*35		
Wolverine	Boston	12½	9½	11	Jan. '20, Q	.50

LEAD

Stock	Exch.	High	Low	Last	Last Div.	
Hecla Mining	N. Y. Curb.	4½	3 15/16	4½	Dec. '20,QX	.15
St. Joseph Lead	N. Y.	12¼	12	12¼	Dec. '20,QX	.50
Stewart	Boston Curb			*6	[illegible] '15,	.05
Utah Apex	Boston	3	2½	2½	[illegible] '20, K	.25

ZINC

Stock	Exch.	High	Low	Last	Last Div.	
Am. Z. L. & S.	N. Y.	9¾	8½	9¾	Mar. '17,	1.00
Am. Z. L. & S. pf.	N. Y.	31½	31½	31½	Nov. '20, Q	1.50
Butte C. & Z.	N. Y.	6	4⅞	5½	June '18, I	.50
Butte & Superior	N. Y.	14½	10⅞	12	Sept. '17,	1.25
Callahan Z. L.	N. Y.	7½	5½	7	[illegible] '20, Q	.50
New Jersey Z.	N. Y. Curb.	135	130	135	Nov. '20, Q	4.00
Success	N. Y. Curb.	*3	*2	*2½	July '16,	.03
Yellow Pine	Los Angeles	‡....	....	*45	June '20, Q	.03

*Cents per share. †Bid or asked. ‡Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, includes extra.

GOLD

Stock	Exch	High	Low	Last	Last Div.	
Alaska Gold	N. Y.	1¼	⅞	1⅛		
Alaska Juneau	N. Y.	1⅝	1	1⅝		
Carson Hill	N. Y. Curb.	....	....	22¾		
Cresson Consol. G.	N. Y. Curb.	....	....	1¼	June '20, Q	.10
Dome Ex.	Toronto		†*38	*41		
Dome Mines	N. Y.	12	10⅛	11⅞	Oct. '20, Q	.25
Golden Cycle	Colo. Sprgs.	‡....	....	*73	Dec. '20, Q	.02
Goldfield Con	N. Y. Curb.	3/32	1/16	1/16	Dec. '19,	.05
Hedley	Boston	....	....	4¼	June '19,	.10
Hollinger Con	Toronto	5.75	5.55	5.75	Dec. '20, BM	.05
Homestake	N. Y.	50	50	50	Sept. '19,	.50
Kirkland Lake	Toronto	*40	*40	*40		
Lake Shore	Toronto	1.05	1.03	1.03	Oct. '20, K	.02
McIntyre-Porcupine	Toronto	1.83	1.80	1.83	Jan. '21, K	.05
Porcupine Crown	Toronto	*18	*17½	*18	July '17,	.03
Portland	Colo. Sprgs.	‡....	....	*60	Oct. '20, Q	.01½
Reorgan. Booth	N. Y. Curb.	*4½	*3	*3	May, '19,	.05
Silver Pick	N. Y. Curb.	*5	*4	*5		
Teck Hughes	Toronto		....	*10		
Tom Reed	Los Angeles.	‡....	....	1.22	Dec. '19,	.02
United Eastern	N. Y. Curb.	2½	2 5/16	2⅜	Oct. '20, Q	.15
Vindicator Consol	Colo. Sprgs.	‡....	....	*18	Jan. '20, Q	.01
West Dome Consol	Toronto	*9½	*7	*7		
White Caps Min	N. Y. Curb.	*5	*4	*4½		
Yukon Gold	Boston Curb	....	....	*50	June '18,	.02½

SILVER

Stock	Exch	High	Low	Last	Last Div.	
Arizona Silver	Boston Curb	*19	*18	*18	Apr. '20, M	.03
Beaver Con	Toronto	*27	*26	*26	May '20, K	.03
Coniagas	Toronto	1.85	1.85	1.85	Nov. '20, Q	.12½
Crown Reserve	Toronto	....	....	*16	Jan. '17,	.05
Kerr Lake	Boston	....	....	2⅛	Oct. '20, K	.12½
La Rose	Toronto	*24	*24	*24	Apr. '18,	.02
McKinley-Dar	Toronto	*25	*25	*25	Oct. '20, Q	.03
Mining Corp	Toronto	1.00	1.00	0.98	Sept. '20, Q	.12½
Nipissing	N. Y. Curb.	7¾	7⅛	7¾	Oct. '20, QX	.50
Ontario Silver	N. Y.	5¼	4¼	5⅛	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb.	¾	½	9/16	Jan. '12,	.10
Peterson Lake	Toronto	...	....	*9	Jan. '17,	.01¾
Temiskaming	Toronto	....	....	*25	Jan. '20, K	.04
Trethewey	Toronto	*15½	*15½	*15½	Jan. '19,	.05

GOLD AND SILVER

Stock	Exch	High	Low	Last	Last Div.	
Atlanta	N. Y. Curb.	*1½	*1	*1½		
Barnes-King	Butte	‡....	....	1.11	Aug. '20, Q	.05
Bost. & Mont.	Boston	....	....	*63		
Cashboy	N. Y. Curb.	*5	*3½	*4½		
El Salvador	N. Y. Curb.	½	7/16	[illegible]		
Jim Butler	N. Y. Curb.	*17½	*16	*17	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb.	*5½	*4	*5	June '16,	.05
Louisiana Con	N. Y. Curb.	¼	¼	¼		
MacNamara M.	N. Y. Curb.	3/16	3/16	3/16	May '10,	.02½
N.Y.-Hond. Rosar	Open Mar.	†10½	†9	....	Oct. '20, QX	.50
Tonopah-Belmont	N. Y. Curb.	1½	1	1 7/16	Jan. '21, Q	.05
Tonopah-Divide	N. Y. Curb.	1 3/16	1 3/32	1 3/16		
Tonopah Ex.	N. Y. Curb.	1½	1 5/16	1 7/16	Jan. '21, Q	.05
Tonopah Mining	N. Y. Curb.	1 9/16	1 5/16	1 7/16	Oct. '20, SA	.05
West End Con	N. Y. Curb.	1⅛	15/16	1¼	Dec.'19, SA	.05

SILVER-LEAD

Stock	Exch	High	Low	Last	Last Div.	
Caledonia	N. Y. Curb.	*17	*15	*15	July '20, M	.01
Consol. M. & S.	Montreal	18	17½	18	Oct. '20, Q	.62½
Daly Mining	Salt Lake	1.95	1.95	1.95	July '20, Q	.10
Daly-West	Boston	3¾	3¾	3¾	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	2⅛	1¾	2⅛	Dec. '20, K	.25
Electric Point	Spokane	‡...	....	*5	May '20, SA	.03
Fed. M. & S.	N. Y.	....	....	7½	Jan. '09	1.50
Fed. M. & S. pf.	N. Y.	28⅜	23	28⅜	Dec. '20, Q	1.75
Florence Silver	Spokane	‡...	....	*14	Apr. '19,	.01½
Grand Central	Salt Lake	....	....	*37½	June '20, K	.03
Iron Blossom	N. Y. Curb.	3/16	*15½	*16	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	3.00	3.00	3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb.	*9	*7½	*8		
Prince Consol	N. Y. Curb.	5/16	¼	5/16	Nov. '17,	.02½
Rambler-Cariboo	Spokane	‡...	....	*7½	Feb. '19,	.01
Rex Con	N. Y. Curb.	*4	*4	*4		
South Hecla	Salt Lake	*65	*65	*65	Sept. '19, K	.15
Stand. S. L.	N. Y. Curb.	3/16	3/16	3/16	Oct. '17,	.05
Tamarack-Custer	Spokane	‡...	....	1.80	Dec. '19, K	.03
Tintic Standard	Salt Lake	3.42½	3.35	3.35	June '20, Q	.10
Wilbert Mining	N. Y. Curb.	*3	*2	*2½	Nov. '17,	.01

NICKEL-COPPER

Stock	Exch	High	Low	Last	Last Div.	
Internat'l Nickel	N. Y.	16¼	13½	15¾	Mar. '19,	.50
Internat'l Nickel, pf.	N. Y.	75	75	75	Nov. '20, Q	1.50

QUICKSILVER

Stock	Exch	High	Low	Last	Last Div.	
New Idria	Boston	*95	*95	*95	Jan. '19,	.25

TUNGSTEN

Stock	Exch	High	Low	Last	Last Div.	
Mojave Tungsten	Boston Curb	....	....	*5		

VANADIUM

Stock	Exch	High	Low	Last	Last Div.	
Vanadium Corp	N. Y.	37⅛	32⅛	35¾	Oct. '20, Q	1.50

ASBESTOS

Stock	Exch	High	Low	Last	Last Div.	
Asbestos Corp	Montreal	79½	77	79½	Oct. '20, Q	1.50
Asbestos Corp. pf.	Montreal	90	88½	90	Oct. '20, Q	1.75

MINING, SMELTING AND REFINING

Stock	Exch	High	Low	Last	Last Div.	
Am. S. & R.	N. Y.	39¼	35	38	Dec. '20, Q	1.00
Am. S. & R. pf.	N. Y.	80¼	75¼	80¼	Dec. '20, Q	1.75
Am. Sm. pf. A	N. Y.	64	64	64	Jan. '21, Q	1.50
U. S. Sm. R. & M.	N. Y.	35	33	34	Oct. '20, Q	1.50
U. S. S. R. & M. pf.	Boston	45	43½	44	Oct. '20, Q	.87½

CURRENT PRICES OF MATERIALS AND SUPPLIES

IRON AND STEEL

SHEETS—Quotations are in cents per pound in various cities from warehouse also the base quotations from mill

Blue Annealed	Large Mill Lots Pittsburgh	St. Louis	Chicago	San Francisco	New York Current	New York One Yr Ago
No. 10	3 55	6 22	4 68	7.95	$4 90	4 57
No. 12	3.60	6 27½	4 83	8.00	4 95	4 62
No. 14	3.65	6 32½	5 03	8.05	5 00	4 67
No. 16	3.75	6.42½	5 13	8.15	5.10	4 77
Black:						
*Nos. 18 and 20	4.20	8.00	5.80	9 05	5 80	5 30
*Nos. 22 and 24	4.25	8 05	5 85	9 10	5 85	5.35
*No. 26	4.30	8 10	5.90	9 15	5.90	5 40
*No. 28	4.35	8.20	6.00	9.25	6.00	5.50
Galvanized:						
No. 10	4.70	8.70	5.30	.....	6.40	5 75
No. 12	4.80	8 80	5 40	9.85	6.50	5 85
No. 14	4.80	8 80	5 40	9.85	6.50	5 85
Nos. 18 and 20	5.10	9.10	5.70	10 15	6.75	6 15
Nos. 22 and 24	5.25	9.25	5.85	10 30	6 90	6 30
*No. 26	5.40	9.40	5.90	10 45	7 05	6.45
*No. 28	5.70	9.70	6.00	10.70	7.35	6 75

* For painted corrugated sheets, add 30c per 1,000 lb. for 5 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets, add 15c., all gages

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco
Standard railroad spikes, 9/16 in. and larger	$3 65	$3 35	$3 40	$5 47½	$7 75
Track bolts	5 50	4 35	4 60	6 45	8 75
Standard section angle bars	2.75	3.00	2.75	4.50	5.00

STRUCTURAL MATERIAL—The following are the base prices f.o.b. mill Pittsburgh, together with the quotations per 100 lb. from warehouses at the places named:

	Mill Pittsburgh	New York Current	New York 1 Year Ago	St. Louis	Chicago
Beams, 3 to 15 in.	$2 45	$3 80	$3 47	$3 67½	$3 97
Channels, 3 to 15 in.	2 45	3 80	3.47	3 67½	3 97
Angles, 3 to 6 in., ¼ in. thick	2.45	3 80	3.47	3.67½	3 97
Tees, 3 in. and larger	2.45	3 85	3.52	3 72½	4 02
Plates	2.65	4.00	3.67	3.87½	4 17

STEEL SHEET PILING—The following price is base per 100 lb. f.o.b. Pittsburgh, with a comparison of a month and a year ago.

Current	One Month Ago	One Year Ago
$3 00	$4 00@$5.00	$2.55

RIVETS—The following quotations are per 100 lb:

STRUCTURAL

	Mill Pittsburgh	Warehouse New York Current	Warehouse New York One Yr. Ago	Chicago	St. Louis	San Francisco
in. and larger	$4.50	$5.73	$5.00	$5.08	$5.82½	$7 05

CONE HEAD BOILER

	Mill Pittsburgh	New York Current	New York One Yr. Ago	Chicago	St. Louis	San Francisco
¾ in. and larger	$4 60	$6 00	$5 10	$5 18	$5 92½	$7 15
⅝ and 11/16	4 75	6 15	5 25	5 33	6 83	7 40
½ and 9/16	5 00	6 40	5 60	5 68	6 92½	7 [illegible]

Lengths shorter than 1 in. take an extra of 50c. Lengths between 1 [illegible] and 2 [illegible] take an extra of 25c.

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	New York and St. Louis
Hercules red strand, all constructions	20
Patent flattened strand special and cast steel	20
Patent flattened strand iron rope	5
Plow steel round strand rope	30
Special steel round strand rope	30
Cast steel round strand rope	22½
Iron strand and iron tiller	5
Galvanized iron rigging and guy rope	+12½

Chicago, +17½ [illegible] on galvanized and on bright steel

Western and California Territory

25 , plow steel, 22½ galv. iron rigging and guy rope.

Montana, Idaho and Arizona

20 plow steel 27½ , galv. iron rigging and guy rope.

HORSE AND MULE SHOES—Warehouse prices per 100 lb. in cities named:

	Mill Pittsburgh	Denver	Chicago	St. Louis	Birmingham	Cincinnati
Straight	$5 75	$8 65	$7 00	$7 00	$7 [illegible]	$7 [illegible]
Assorted	5 85	8 90	7 15	7 15		

BAR IRON AND STEEL—Per 100 lb. to large [illegible]

Iron bar	$3 63	Steel bar	$[illegible] 35

DRILL STEEL—Warehouse price per pound:

	New York	St. Louis	Birmingham	[illegible]	[illegible]
Solid	12@14c	13c	20	14	18c
Hollow	17@20c	...		21	

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

BUTT WELD

Steel Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
¾ to 3	54 to 57½	41½ to 44	⅜	15½ to 5½ +	1½ to 11½
			½	19½ to 9½	1½ to 11½
			¾ to 1½	24½ to 34½	8 to 18½

LAP WELD

Steel Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
2	47 to 50½	34½ to 38	2	20½ to 28½	6½ to 14½
2½ to 6	50 to 53½	37½ to 41	2½ to 6	22½ to 30½	9½ to 17½

BUTT WELD, EXTRA STRONG, PLAIN ENDS

Steel Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
2 to 3	53 to 56½	40½ to 44	¾ to 1½	24½ to 34½	9½ to 19½

LAP WELD, EXTRA STRONG, PLAIN ENDS

Steel Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
2	45 to 48½	33½ to 37	2	21½ to 29½	8½ to 16½
2½ to 4	48 to 51½	33½ to 40	2½ to 4	23½ to 31½	11½ to 31½
4½ to 6	47 to 50½	35½ to 39	4½ to 6	22½ to 30½	10½ to 18½
7 to 8	43 to 46½	29½ to 33	7 to 8	14½ to 22½	2½ to 10½
9 to 12	38 to 41½	24½ to 28	9 to 12	9½ to 17½	5½ to+2½

STEEL—From warehouses at the places named the following discounts hold for steel pipe:

	Black New York	Black Cleveland	Black Chicago
¾ to 3 in. butt welded	38%	42%	57½%
3½ to 6 in. lap welded	33%	44%	53½%

	Galvanized New York	Galvanized Cleveland	Galvanized Chicago
¾ to 3 in. butt welded	22%	39%	44%
3½ to 6 in. lap welded	18%	29%	41%

Malleable fittings, Class B and C, from New York stock sell at list plus 23% Cast iron, standard sizes, net.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York Current	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Hot pressed square	+$1.25	$1.50	List	$2.25	+$1.15	$1 00
Hot pressed hexagon	+ 1.25	1.50	List	2.25	+ 1.15	0.85
Cold punched square	+ 1 25	1 50	List	2 25	+ 1 15	1 00
Cold punched hexagon	+ 1.25	1.50	List	2.25	+ 1.15	1.00

Semi-finished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	30%	50 10%
Chicago	40%	50%
Cleveland	50%	60-10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
¾ in. by 4 in. and smaller	35%	5	40
Larger and longer up to 1 in. by 30 in.	25%	4	30

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For Wrought-iron washers:

New York	$2 00	Cleveland	$2 [illegible]	Chicago	$2.50

For cast-iron washers the base price per 100 lb [illegible] follows:

New York	$7 00	Cleveland	$4 [illegible]	Chicago	$5 50

CONSTRUCTION MATERIALS

PREPARED ROOFING—Standard grade rubbered surface, complete with nails and cement, costs per square as follows at manufacturing points:

	New York 1-Ply c.l.	New York 2-Ply l.c.l.	New York 3-Ply c.l.	Philadelphia 1-Ply c.l.	Philadelphia 2-Ply [illegible]	Philadelphia 3-Ply [illegible]
No. 1 grade	$2 05	$2 40	$2 80	$1 95	$2 30	$2 75
No. 2 grade	1 85	2 15	2 50	1 75	2 05	2 40

Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. cost $3 [illegible] per roll [illegible] lots and $3 7[illegible] for smaller quantities.

[illegible] red and green slate finish, cost $8 00 per square [illegible] $8 25 in [illegible] quantities, in Philadelphia.

ROOFING MATERIALS—Prices per ton f.o.b. New York

[illegible]	$3 05
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	1[illegible] 00
Asphalt [illegible]	[illegible] 00

HOLLOW TILE—

	4 x 12 x 1[illegible]	[illegible]	[illegible] x 12 x 12
Minneapolis	$0 [illegible]	$0 [illegible]	$0 3314
Seattle	.13		.30
Los Angeles	[illegible]		
Cincinnati	.2[illegible]		

LUMBER—Price per M in carload lots

	8 x 8-In. x 20-Ft. and Under P.	Fir	Hemlock	Spruce	12 x 12-in 20-Ft. and Under P.	Fir
Boston	$60.00	$65.00	$52.00	$58.00	$76.00	$68.00
Kansas City	51.00	51.25	51.25	51.25	60.00	51.25
Seattle		35.00				35.00
New Orleans	38.00	....			42.00	.....
Baltimore	70.00				80.00	.....
Cincinnati	37.50	38.00	50.00	50.00	55.00	40.00
Montreal	80.00	80.00	70.00	80.00	79.00*	100.00
Los Angeles	.....	57.00			.....	59.00
Detroit	57.00	77.50			67.25	67.25
Denver	....	42.75			.....	42.75

	1-In. Rough, 10-In. x 16-Ft and under P.	Fir	Hemlock	2-In. T. and Gr. 10-In. x 16 Ft P.	Fir
Boston	$62.00	$74.00	$45.00	$63.00	$78.00
Kansas City	102.00	106.50	106.50	113.00	112.75
Seattle	....	27.50		...	25.00
New Orleans	65.00			38.00	
Baltimore (box)	50@52.50	..		50@55	
Cincinnati	34.00	47.50	43.00	35.00	64.00
Montreal	77.00	78.00	70.00	85.00	85.00
Los Angeles	......	58.00			
Detroit	43.00	47.50	43.00		44.00
Denver	.....	37.75			33.25

*Montreal—Up to 22 ft.; over which, $3.00 per M. increase up to 30 ft.

NAILS—The following quotations are per keg from warehouse:

	Mill Pittsburgh	Denver	Chicago	San Francisco
Wire	$3.25	$5.50	$4.15	$6.00

PORTLAND CEMENT—These prices are for barrels in carload lots, *without bags.*

	Current	One Month Ago	One Year Ago
New York (delivered)	$3.50	$3.80	$2.80
Jersey City (delivered)	3.20	3.20	2.47
Chicago	2.37	2.35	2.00
Pittsburgh	2.42	2.42	2.05
Cleveland	2.73	2.73	2.32
Denver	3.25	3.25	3.12
Los Angeles	3.10	3.10	2.78
San Francisco	3.09	3.09	2.43

NOTE—Charge for bags is generally 25c. each, $1 per bbl.

LIME—Warehouse prices:

	Hydrated per Ton Finished	Common	Lump per 200-lb. Barrel Finished	Common
New York	$21.00	$20.00	3.80* at plant	$3.60*
Kansas City	27.20	26.20	2.50	2.40
Chicago		......	....	1.65
St. Louis	27.00	21.00	....	2.50
San Francisco	25.40	22.00	....	2.25
Minneapolis	29.50	23.00	2.00†	1.85†
Denver	32.00	.....	1.05 (bu.)	....

NOTE—Refund of 10c. per barrel, with 25c. per ton off on hydrated.
*300-lb. barrels. †180-lb. barrels.

LINSEED OIL—These prices are per gallon:

	New York Current	New York Year Ago	Chicago Current	Chicago Year Ago
Raw per barrel (5 bbl. lots)	$0.83	$2.15	$0.97	$2.37
5-gal. cans	0.90	2.30	1.22	2.57
1-gal. cans	1.05	.....	....	...

WHITE AND RED LEADS—500-lb. lots sell as follows in cents per pound:

	Red Current Dry	Red Current In Oil	Red One Year Ago Dry	Red One Year Ago In Oil	White Current Dry and In Oil	White 1 Year Ago Dry and In Oil
100-lb kegs	14.25	15.75	13.00	14.50	14.25	13.00
25-and 50-lb. kegs	14.50	16.00	13.25	14.75	14.50	13.25
12½-lb. kegs	14.75	16.25	13.50	15.00	14.75	13.50
5-lb cans	17.25	18.75	15.00	16.50	17.25	15.00
1-lb cans	19.25	20.75	16.00	17.50	19.25	16.00

MINING AND MILLING SUPPLIES

HOSE—

FIRE

	50-Ft. Lengths
Underwriters' 2½ in.	$0.75 per ft.
Common, 2½-in.	40%

AIR

	First Grade	Second Grade	Third Grade
¾-in. per ft.	$0.50	$0.35	$0.25

STEAM—DISCOUNTS FROM LIST

First grade.....30%; Second grade 45%; Third grade 50-10%

LEATHER BELTING—Present discounts from [illegible] doz. rolls.

Light Grade	Medium Grade	Heavy Grade
30-10%	30%	25%

RAWHIDE LACING—For cut, best grade, 35%, 2d grade, 40%. For laces in sides, 6[illegible] per sq ft; 2d, 62 [illegible] tanned, cut 25 [illegible] sides, 65c per sq ft

MANILA ROPE—For rope smaller than ⅝-in. the price is ¼ to $0.02 extra while for quantities amounting to less than 600 ft. there is an extra charge of $0.01. The number of feet per pound for the various sizes is as follows: ½-in. 8 ft., ¾ in., 6; ⅞-in., 4⅓; 1-in., 1⅛-in., 2 ft. 10 in.; 1¼-in., 2 ft. 4 in. Following is price per pound for ⅝ in. and larger, in 1200-ft. coils:

New York	$0.25	Kansas City	$0.29
Cincinnati	0.32	Seattle	0.28
Chicago	0.27½	St. Louis	0.26½
Minneapolis	0.27¾	Denver	0.28½
San Francisco	0.25	Los Angeles	0.28

PACKING—Prices per pound:

Rubber and duck for low-pressure steam	$1.00
Asbestos for high-pressure steam	2.00
Duck and rubber for piston packing	1.20
Flax, regular	1.20
Flax, waterproofed	1.70
Compressed asbestos sheet	1.00
Wire insertion asbestos sheet	1.50
Rubber sheet	.50
Rubber sheet, wire insertion	.70
Rubber sheet, duck insertion	.60
Rubber sheet, cloth insertion	.30
Asbestos packing, twisted or braided and graphited, for valve stems and stuffing boxes	1.50
Asbestos wick, ½- and 1-lb. balls	1.10

RAILWAY TIES—For fair size orders the following prices per tie hold:

Material	7 In. x 9 In. by 8 Ft. 6 In.	6 In. x 8 In. by 8 Ft
Chicago—Plain	$1.85	$2.00
Chicago—Creosoted	2.20	2.25
San Francisco—Douglas fir, green	1.35	96
San Francisco—Douglas fir, creosoted	2.50	1.92

Prices per tie at Missouri mills; St. Louis prices about 25c. higher:

Untreated A Grade White Oak 6x8x8		Untreated A Grade Red Oak 6x8x8	
No. 1	$0.80	No. 1	$0.60
No. 2	.90	No. 2	70
No. 3	1.00	No. 3	.80
No. 4	1.25		

FLOTATION OILS—Prices of oils for flotation, in cents per gal. in bbls.

	New York	Chicago In. Bbl.	Chicago Carloads
Pure steam-distilled pine oil, sp.gr. 0.93-0.94	$1.75	$1.90	$1.85
Pure destructively distilled pine oil	1.65	1.90	1.85
Pine tar oil, sp.gr. 1.025-1.035	48	34	32
Crude turpentine, sp.gr. 0.900-0.970	.70	1.30	1.17
Hardwood creosote, sp.gr. 0.96-0.99*	.35	....	..

*F.o.b. Cadillac, Mich.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	New York One Year Ago	Cleveland	Chicago
White	11.00-15.50	13.00	15.00	11.00-14.00
Colored mixed	7.00-10.50	9.00-12.00	11.00	9.50-12.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13¼x13¼	13½x13½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

EXPLOSIVES—Price per pound of dynamite in small lots and price per 25 lb. keg for black powder:

	Low Freezing 20%	Gelatin 40%	Gelatin 60%	Gelatin 80%	Black Powder
New York	....	$0.3325	$0.3625	......	$2.80
Kansas City	$0.2475	.27	30	.34	2.40
Seattle	.18	.205	.225	.29½	2.60
Chicago	.2225	.2425	2675	.335	2.50
Minneapolis	.2222	.2426	.2682	......	2.80
St. Louis	.245	.28	315	.3575	2.50
Denver	.2250	.2550	.29	.3325	2.70
Los Angeles	.22	.27	.31	......	2.95
Atlanta	.2575	.2925	.3225	.3650	2.55
Cincinnati	.2275	.2625	.2925	.3575	2.30
Montreal	.30	.32	.37	.38	4.10

CHEMICALS

SODIUM CYANIDE—New York price is 22@30c. per lb.; Chicago, 30c.; St. Louis, 34c.; Birmingham, 45c.; Denver, 36c.

SODIUM SULPHIDE—New York price per pound is 6½c.@7c. for concentrated. Chicago, 5c. for concentrated, 3½c. for crystals. Denver price is 6c. for crystals. St. Louis, concentrated, 10½c., crystals, 11c. Concentrated comes in 500-lb. drums, crystals in 440-lb. bbl.

ZINC DUST—For 350 mesh the New York price is 12@13c. per lb.; Chicago, 12½c.

ALUMINUM DUST—Chicago price is $1.10 per lb.; Birmingham, $1.52.

MINERS' LAMP CARBIDE—Prices net f.o.b. cars at warehouse points:

	Union 100-Lb. Drums	Cameo 100-Lb. Drums	Union Single 25 Lb. Drums
East of the Mississippi, north of Chattanooga	$6.25	$6.00	$1.56

In the other zones the increase is proportionate to the increase in freights

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The Mining Industry in 1920

NINETEEN TWENTY, the second year following the Great War, was naturally one of continuous readjustment. Looking back to the period of our annual review a year ago, general conditions in the world appear to have improved. The ominous rumblings that threaten a world revolution have become fainter. Especially in America, all classes, including the labor element, have given proof of a single Americanism and a determination for orderly methods of progress. In Russia, bolshevistic theories have changed and collapsed; and although the power of Russia's arms is great, and she is still ambitious to loot the world, no country seems anxious to follow her example, and suffer the corresponding demoralization and disaster.

The turning of products to legitimate uses, instead of wasting them in war, brought about during the year a surplus and a corresponding rapid reduction of the enormously inflated war prices, most marked in the United States, where the currency is soundest, because backed by most metallic reserve.

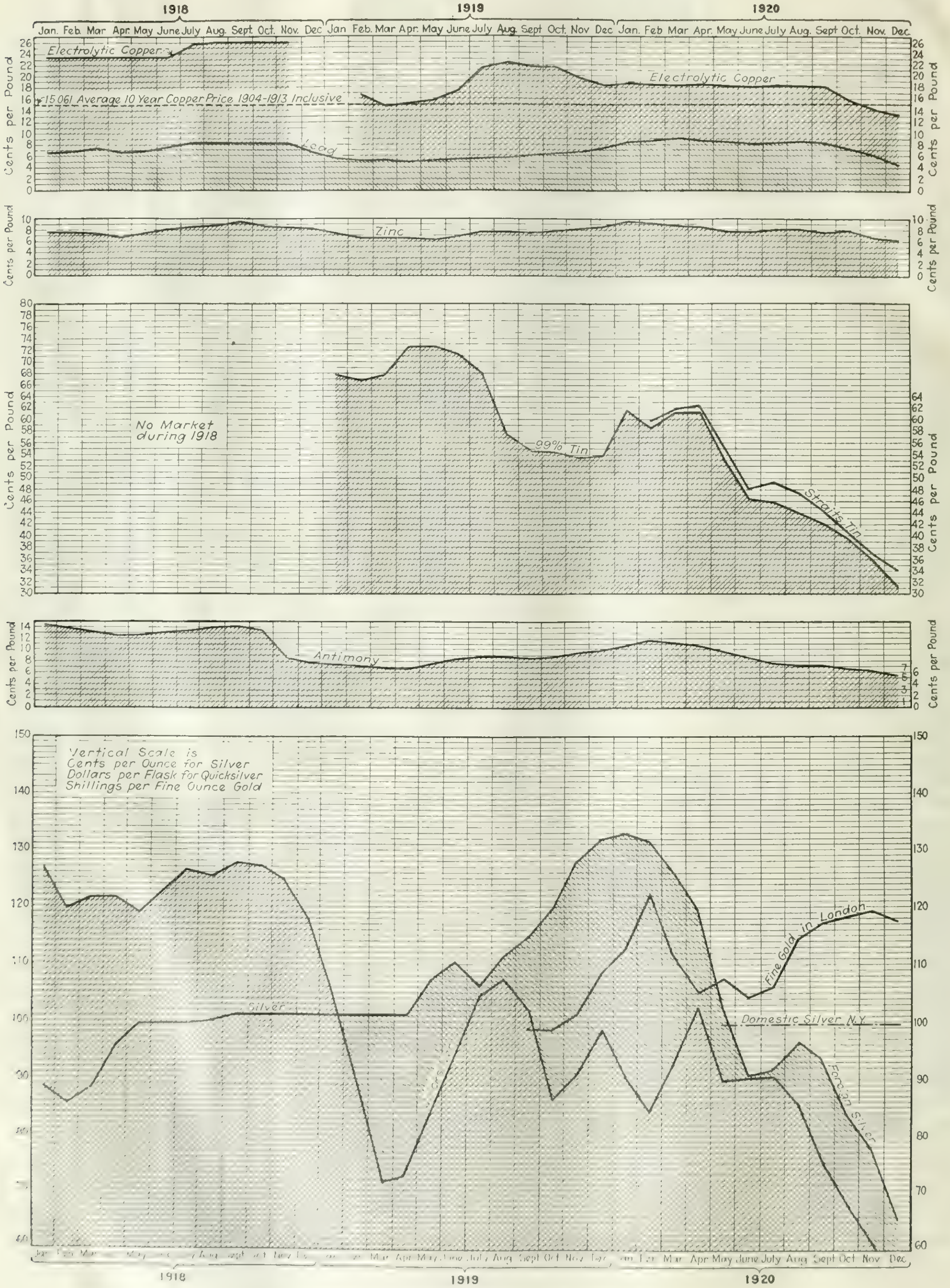
While the rapid deflation in the United States was the most gratifying sign of recovery from the fever of war, the immediate symptoms, such as the dropping of prices for commodities, and the closing down of plants, have been unpleasant. The mining industry has suffered with the rest. The lack of normal ability on the part of Europe to buy American copper, due to the low exchange (which results in part from Europe's depreciated currency) was one of the factors which resulted in the steady decline of metal prices during the year, in which copper fell from 19 to 12½c., and silver in the world market slumped from \$1.37 to 60c. Curtailment of metal production and reduction of wages, with the closing down of mines, have been the result. The "war-mineral" industries, of course, are sleeping—the same sleep that they were experiencing a year ago; and this is likely to be permanent unless they are heavily supported by special-interest legislation. The general deflation has been so rapid, and the resulting business depression so acute, that it is generally believed that only the Federal Reserve system has averted an unprecedented panic. The symptoms, altogether, are of the sub-normal temperature following the war fever; and, pursuing the figure further, this condition, with careful treatment, presages recovery. Conditions are bad: therefore, the general outlook for the future is very bright. Now is the time to prepare for the recurrence of business activity, and for the demand for metals which should normally follow. Never were metallic reserves of so great intrinsic value in the world's catalog of necessities as at the present time; and owners of metal mines may confidently look forward to far better times eventually.

One of the factors of the world disorder which affected mining industries differently in various countries was the unprecedentedly low rates of exchange between the United States and other countries. The dollar became the standard, instead of the pound sterling, and the exchange rates of most nations, including the main ones involved in the Great War, became greatly depreciated in relation to the dollar. This influenced the gold-mining industry very deeply, allowing the gold from South Africa and Australia to be marketed on a basis of the United States standard price, which, translated back through exchange rates, resulted in a substantial premium in pounds. This supported the Rand and made money for the Australian fields. Even Canadian mining industries, including not only gold but, early in the year, (and before the operation of the Pittman Act) silver, have profited in this way, Canadian exchange having been at a discount of from 8 to 18 per cent in the United States. The gold-mining industry of the United States was, therefore, taxed more severely than in other countries, although, under the conditions, the production has been surprisingly large.

The spectacular fall of silver in the world's markets brought into operation the Pittman Act, according to which the Government of the United States purchases silver produced within the country at a fixed rate of \$1 an ounce; and from the time that this law became operative, in May, with the fall of the world price below \$1 per ounce, the silver mines of the United States have had a great advantage over those of other countries. It has been remarkable and instructive, to students of economics, to see how this fixing of price has failed to stabilize the world price of silver, or even to arrest its collapse.

Mining enterprise in foreign fields has somewhat progressed. The campaign for new petroleum fields the world over has been pushed by various countries, chiefly England, the United States, and France, the enormous immediate economic significance of the possession of petroleum having come to be universally recognized. England, through her clearsightedness in perceiving, also, immense strategic importance, through governmental assistance has obtained a start of the rest; and some discontent has arisen on the part of the French government, and also on the part of that of the United States, against England on this account. The new administration in the United States should include this among the items of the now long-deferred post-war agreements which it will negotiate.

One of the permanent valuable results of the mining depression has been a study of the reduction of costs through greater efficiency in organization and through the introduction of mechanical improvements of various kinds. Mechanical loaders of the small type adapted to mining have been one of the devices largely experimented upon. In the United States the tendency toward a closer union and understanding of employer and employee, as a result of reaction from the world social turmoil, seems a distinct one, and this promises much toward raising efficiency and decreasing costs, thus promoting a higher living standard.



MONTHLY AVERAGE PRICES OF METALS

Chronology of Mining in 1920

JANUARY

Jan. 1—Primos Chemical Co. taken over by Vanadium Corporation of America.

Jan. 5—Mexico increased oil export tax 10 per cent; removed import duties from gasoline and other petroleum products.

Jan. 8—Bunker Hill & Sullivan's experimental mill burned down.

Jan. 17—British America Nickel Corp., Ltd., blew in new nickel-copper smelter at Nickelton, Ont.—President Carranza authorized temporary permits for oil-drilling in Mexico.

Jan. 29—Hearing of arguments in Utah Apex-Utah Consolidated suit began at Salt Lake City.

FEBRUARY

Feb. 1—Lake Superior mining companies advanced wages 10 per cent.

Feb. 2—Trial opened at Tombstone, Ariz., of 210 men indicted in Bisbee deportation cases.

Feb. 10—Bingham, Utah, underground miners struck.

Feb. 13—Tonopah-Divide mine operators' offer of 50c. more per shift and other concessions accepted by unions.

Feb. 16-19—A. I. M. E. held annual meeting at New York.

Feb. 17—Coeur d'Alene operators granted 50c. increase in wages effective March 1.

MARCH

March 1—Franklin K. Lane, Secretary of the Interior, retired.—Homestake Mining Co., Lead, S. D., put increased wage scale into effect.—U. S. Supreme Court decided U. S. Steel Corporation and subsidiaries are not an illegal combination.—Trojan Mining Co., in South Dakota, increased wages.—All Coeur dAlene mining companies increased wages 50c. per day.

March 9—Ontario Mining Association organized at Toronto.

March 8-10—Annual meeting of the Canadian Mining Institute at Toronto.

March 12—President of Mexico issued decree authorizing ten-year concessions for developing oil lands on Mexican national territory.

March 15—John Barton Payne became Secretary of Interior.

March 18-20—American Association of Petroleum Geologists held fifth annual meeting at Dallas, Tex.

March 22 — Representative L. T. McFadden introduced gold bonus bill.

APRIL

April 1—Bingham Canyon mine, mill, and smelter men given wage increase of 25c. per shift.—British Columbia opened Indian reservations to gold and silver prospecting and mining.

April 5—Overton vs. Presidio Mining Co. granted petition for rehearing by U. S. District Court of Appeals, San Francisco; the sixth rehearing in twenty years.

April 7—International Mining Convention at Seattle, Wash., opened.—Federal Trade Commission proceedings against Minerals Separation, Ltd., and other respondents began.

April 9—Leadville, Col., companies announced wage increase as of April 1.

April 16—Plymouth Consolidated Gold Mines, Ltd., Plymouth, Cal., granted wage increase of 50c. per day.

April 18—I. W. W. miners at Butte struck.

April 21—Fifteen I. W. W. members shot, one fatally, at Butte, Mont.

April 22—Walkout at Tonopah and Divide called by I. W. W.

April 26—Navigation on Great Lakes opened at Sault Sainte Marie.

April 28—U. S. Supreme Court refused Government a rehearing of anti-trust law case brought against U. S. Steel Corporation.

MAY

May 3—Severe windstorms caused damage in Joplin-Miami district.

May 5—Frederick G. Cottrell, assistant director, U. S. Bureau of Mines, nominated director, succeeding Van. H. Manning, resigned.

May 10—American Zinc Institute held second annual session at Chicago. Sudbury nickel district operators granted wage increase.

May 11—Governor of New York signed bill [illegible]

May 15—Winona mine at Houghton, Mich., [illegible]

May 16—Spindletop oilfield, Texas, damaged by [illegible]

May 17—U. S. Circuit Court of Appeals, San [illegible], Cal., reversed decision in Federal M. & S. Co. vs. Star Mining Co. lawsuit.—Director of Mint announced standing [illegible] of Treasury to buy silver at $1 per ounce under Pittman Act.

May 18—First permit under general [illegible] by Secretary of Treasury.

May 2[illegible]—Secretary of Interior Payne approved [illegible] land leasing rules and regulations.

May 26—Miami Copper Co. petitioned [illegible] bill which would reopen Minerals Separation [illegible] infringement suit to admit newly discovered [illegible]

May [illegible]—A. I. M. E. received endowment for [illegible] W. Hunt medal [illegible] conferred first medal on Mr. [illegible]

JUNE

June 1—Calumet & Arizona Mining Co. [illegible] five miles [illegible] Lordsburg, N. M.—Judge [illegible] Minerals Separation, Ltd., proceedings against [illegible] for contempt.

June 7—Miami Copper Co. [illegible] before U. S. [illegible] Court at Wilmington, Del., to answer contempt charges brought by Minerals Separation, Ltd.

June 10—Secretary of Interior promulgated regulations for operating in oil lands under "Land Leasing Law."

June 12—Secretary of Interior declared void first leases of Welch Mining Co., on Indian-owned lands near Douthat, Okla.—Metals Extraction Corporation started new-process zinc oxide plant near Joplin, Mo.

June 15—Hearing of Minerals Separation, Ltd., contempt proceedings against Miami Copper Co. at Philadelphia, Pa.

June 18—U. S. Circuit Court of Appeals, Philadelphia, Pa., denied petition by Miami Copper Co. to reopen case with Minerals Separation, Ltd., to admit new evidence.

June 23—Lake Superior Prevention of Accidents Conference opened at Duluth, Minn.

June 24—Smuggler-Union Mining Co.'s new flotation mill at Pandora, Col., burned.

June 26—Kansas-Missouri-Oklahoma zinc mines shut down until July 10.

JULY

July 1—Golden experiment station of Bureau of Mines, relocated at Reno, Nev.—British Columbia's Placer Mining Act amendments went into effect.

July 6—Minerals Separation, Ltd., hearings before Federal Trade Commission resumed in San Francisco, Cal., continued to July 10.

July 13—Minerals Separation, Ltd.'s, petition to hold Miami Copper Co. in contempt dismissed by Judge Morris, U. S. District Court, Wilmington, Del.—Minerals Separation, Ltd., hearings, adjourned from San Francisco, resumed at Salt Lake City.

July 19—Suit brought by R. S. Talbot, Spokane, Wash., against William H. Crocker, San Francisco, Cal., involving dividends of Northwest Magnesite Co.

July 20—International Mining Convention held for third time at Nelson, B. C.

July 27—Striking mine and oil workers of Mexico return to work at request of President Huerta.—American Smelting & Refining Co.'s sampling mill No. 4 at Murray, Utah, burned.

AUGUST

Aug. 2—Phelps Dodge's Burro Mountain branch started first unit of new mill.

Aug. 17—Ontario Mining Association held first general meeting, at Sudbury, Ont.

Aug. 23—Lake Superior Meeting of A. I. M. E. opened at Houghton, Mich.—Pedro Zamora, Mexican bandit, released Charles Hoyle and five other American and English engineers.

Aug. 24—Case of Northport Mining & Smelting Co. vs. Lone Pine-Surprise Consolidated Mining Co., opened at Spokane, Wash., before Judge Rudkin.—Public Utilities Commission of Utah refused increase in freight charges on coal and ore shipments.—Manganese ore from Brazil reached Mobile, Ala.

Aug. 26—Freight rates on lead bullion and blister copper from Salt Lake smelters to Atlantic seaboard raised 33⅓ per cent.

SEPTEMBER

Sept. 5—Miners at Virginia City and Gold Hill, Nev., struck.—Gold Canyon Dredging Co., Silver City, Nev., started dredging near Dayton, Nev.

Sept. 6—National Tax Association opened annual convention at Salt Lake City, Utah.

Sept. 9—International First Aid and Mine Rescue meeting opened at Denver, Col.

Sept. 13—Oklahoma State School of Mines, Miami, Okla., opened.

Sept. 16—U. S. Assay Office, New York, damaged by bomb explosion.

Sept. 20—Alexander McDougal vs. Oliver Iron Mining Co. suit for patent infringement came before Federal Court, Duluth, Minn.

Sept. 27—Ninth annual safety congress of National Safety Council opened in Milwaukee, Wis.

Sept. 28—Annual convention of Independent Oil Men's Association opened in Denver.

OCTOBER

Oct. 4—New Mexico chapter of American Mining Congress organized at Silver City, N. M.

Oct. 11—Lowell, suburb of Bisbee, Ariz., partly destroyed by fire.—Miners of Asbestos Corporation in Quebec strike.

Oct. 1[illegible]—Colorado Metal Mining Association asked old freight rates restored within state.

Oct. 15—Joplin, Mo., zinc ore producers voted shut-down for two weeks.—St. Louis Section of A. I. M. E. met in southeast Missouri "Lead Belt."

Oct. 18—Canada Copper Corporation's new [illegible]-ton concentrator at Allenby, B. C., started.—Canadian [illegible] producers ask bounty of Canadian Tariff Commission.—[illegible] of petroleum specifications [illegible] at Washington, D. C.

Oct. 20—Utah Apex-Utah Consolidated suit [illegible] in favor of former by Judge T. H. [illegible] question of ownership of [illegible] Atlin district, B. C., brought before courts.

Oct. [illegible]—[illegible] Mining & Smelting Co. [illegible] plant [illegible] Utah by order of Utah [illegible]

NOVEMBER

Nov. 1—Interstate Commerce Commission [illegible] in Salt Lake City, Utah, concerning [illegible] freight rates on coal and ore.—[illegible] laid off [illegible] Mine [illegible] United Verde Copper Co. [illegible]

Nov. 2—Walker Copper Co., Portola, Cal., laid off most of its miners.

Nov. 4—New Idria Quicksilver mine, California, closed larger plant.—Judge S. L. Pattee dismissed Bisbee deportation cases due for trial Nov. 8.

Nov. 8—Tom Reed Gold vs. United Eastern apex suit came to trial before Mohave County, Ariz., superior court.

Nov. 10—U. S. Court of Claims dismissed claim by A. S. & R. Co. against United States for additional payment of $512,515 on 33,069 tons copper taken at 23½c. per lb. during war.—Quincy Mining Co., Hancock, Mich., started up new 6,000-hp. Nordberg hoist.

Nov. 12—Apex suit between Federal Mining & Smelting Co. and Hecla Mining Co. officially announced to have been settled.

Nov. 13—A circuit of mines in Grass Valley, Cal., district served by airplane carrying supplies.

Nov. 15—American Mining Congress' 23d annual session opened at Denver, Col.

Nov. 16—Calumet & Hecla reduced wages, closed down Osceola branch, and reduced forces at other mines.

Nov. 18—American Metal Co.'s coal mines in Monclova district, Coahuila, Mexico, seized by striking Mexican coal miners.

Nov. 19—American Engineering Council of Federated American Engineering Societies organized at Washington, D. C.; Herbert Hoover elected president of F. A. E. S.

Nov. 27—Tacoma smelter announced wage reduction.

Nov. 30—Last ore carrier cleared from Missabe docks at Duluth and Superior.

DECEMBER

Dec. 1—Quincy Mining Co. in northern Michigan reduced wages—Cleveland-Cliffs Iron Co. reduced operation at Ishpeming.

Dec. 9—Court of Appeals at Philadelphia affirmed ruling dismissing Minerals Separation's applications for supplemental bills against Miami Copper Co.

Dec. 10—Copper companies of Globe, Ariz., announce wage reduction effective Jan. 1.

Dec. 11—Canada Copper Corporation's mill shut down.

Dec. 13—Supreme Court sustained decree quashing indictments in Bisbee deportation cases.

Dec. 14—Bacon vs. Neill lawsuit over Premier mine opened in Spokane.

Dec. 15—I. C. C. examiner recommended freight rate on ores reduced between Plumas County points in California and Mason Valley smelter.—Arizona Commercial shut down.

Dec. 16—Butte companies announced wage reduction effective in thirty days.—Old Dominion cut wages.

Dec. 17—Utah Copper Co. posted notice of wage reduction effective Jan. 1. (Other Utah companies took similar action at or about this time).

Dec. 22—Karl Eilers denied writ of mandamus ordering American Smelting & Refining Co.'s books opened.

Dec. 23—National Lead and Eagle Picher companies accused of price fixing.

Dec. 28—G. M. Colvocoresses appointed receiver for Consolidated Arizona Smelting Co.

Dec. 31—President signed mine assessment work bill giving six months' grace to claim holders.

Base and Precious Metal Production By States in 1920

PRELIMINARY ESTIMATES

Compiled From U. S. Geological Survey Reports

State	Gold	Silver, Ounces	Copper, Pounds	Lead, Pounds	Zinc, Pounds
Arizona	$4,943,000	6,098,251	559,235,000	14,000,000	1,457,000
1919	4,506,415	5,266,605	538,100,844	10,203,078	1,717,000
Montana	$1,839,200	[illegible],583,164	176,600,000	32,144,000	203,953,000
1919	2,229,588	[illegible],41,181	169,981,288	34,437,764	168,763,823
[illegible]	$7,856,000	[illegible] 751	71,000,000	1,760,000	
1919	9,036,000	[illegible] 034	56,534,992	1,128,000	..
California	$14,305,300	[illegible] 495	12,934,900	5,071,600	1,572,500
1919	16,695,955	[illegible] 189	21,732,507	3,568,267	472,990
Colorado	$7,613,400	5,572,407	3,600,000	44,600,000	42,000,000
1919	9,867,927	5,639,516	3,310,675	35,859,090	51,445,429
Idaho	$465,300	7,531,253	2,203,000	254,662,000	28,309,000
1919	713,238	5,579,056	3,122,763	182,341,898	15,994,229
[illegible]	$2,076,400	11,564,155	117,000,000	134,000,000	6,000,000
1919	2,159,471	11,649,961	124,06[illegible]	123,829,051	4,431,024
[illegible]	$3,554,900	7,392,687	55,790,[illegible]	19,[illegible]10,000	9,100,000
1919	4,541,502	6,863,580	52,331,175	15,349,370	9,004,698
New Mexico	$463,400	764,586	54,000,000	2,600,000	11,840,000
1919	[illegible]95,700	712,791	60,377,320	2,836,000	8,000,000
South Dakota	[illegible]	84,351			
1919	[illegible]	115,522			
Oregon	[illegible]	182,558	2,300,000		
1919	[illegible]	111,121	2,215,000		
Washington	$148,800	183,437	2,394,000	5,079,000	
1919	257,[illegible]	259,384	1,676,576	2,146,1[illegible]7	

[illegible] month

Imports and Exports of Metals And Ores

IMPORTS and exports of metals and ores for the first eleven months of 1920 and the corresponding period in 1919, according to the Department of Commerce, are as follows:

IMPORTS, TOTAL FOR ELEVEN MONTHS, 1919, 1920

(In Pounds, Unless Otherwise Stated)

	Eleven Months 1919	Eleven Months 1920
Antimony ore, contents	727,462	1,250,504
Antimony matte, regulus or metal	13,180,753	23,164,796
Copper		
Ore, contents	47,004,525	49,822,251
Concentrates, contents	33,582,354	43,056,650
Matte, Regulus, etc., contents	38,932,453	17,236,685
Imported from (in part)		
Canada	26,264,861	28,049,600
Mexico	53,769,203	31,831,992
Cuba	15,851,905	17,257,896
Chile	14,402,182	17,432,942
Peru	1,098,487	2,053,444
Unrefined, black, blister, etc	241,767,442	212,121,652
Refined, in bars, plates, etc	34,102,257	108,326,211
Old, etc., for remanufacture	4,119,803	11,299,360
Composition metal, copper chief value	355,982	2,866,494
Brass, fit only for remanufacture	14,767,923	42,875,004
Lead		
Ore, contents	18,403,822	28,223,586
Bullion, contents	102,165,220	88,553,013
Imported from (in part):		
Canada	9,763,131	7,072,372
Mexico	105,072,199	97,152,620
Chile	4,635,514	1,894,502
Pigs, bars and old	8,849,348	62,428,494
Manganese ore, long tons	296,968	542,189
Imported from (in part)		
Cuba, long tons	33,820	8,218
Brazil, long tons	219,852	374,873
British India, long tons	3,800	63,988
Tungsten ore, long tons	7,858	1,668
Pyrites, long tons	359,387	311,634
Imported from:		
Spain, long tons	257,826	188,234
Canada, long tons	84,224	95,272
Tin ore and oxide, long tons	15,376	28,895
Tin bars, blocks, pigs, etc	76,758,266	120,144,762
Imported from (in part)		
United Kingdom	18,119,019	23,818,760
Straits Settlements	50,214,145	72,231,742
Dutch East Indies	3,988,950	3,374,540
Hongkong	68,558	12,594,868
Zinc		
Ore, contents	31,160,293	44,037,978
Imported from:		
Canada	6,971,821	3,513,782
Mexico	20,375,864	29,101,835
Blocks or pigs and old	138,333	29,055

EXPORTS OF COPPER, LEAD AND ZINC

(In Pounds)

	1919	1920
Copper		
Ore, contents	507,846	248,712
Concentrates, contents	134,321	191,381
Unrefined, black, blister, etc	1,450,411	1,730,994
Refined, in ingots, bars, etc	402,998,239	514,231,583
Exported to (in part)		
Belgium		24,698,082
France	78,038,396	112,930,832
Germany	1,478,200	78,457,805
Netherlands		31,740,047
United Kingdom	101,803,324	89,403,574
Canada	18,063,427	28,687,930
Composition metal, copper chief value	350,842	438,362
Old and scrap	438,470	480,237
Pipes and tubes	5,576,062	4,288,254
Plates and sheets	12,957,177	21,748,310
Wire, except insulated	52,550,908	38,974,369
Lead		
Pigs, bars, etc		
Produced from domestic ore	20,869,543	5,270,759
Produced from foreign ore	79,805,532	31,140,396
Exported to (in part)		
United Kingdom	45,956,068	3,813,748
Canada	4,083,200	3,464,078
Argentina	6,237,203	2,600,658
Japan	23,127,710	7,056,080
Zinc		
Dross	10,245,093	5,621,963
Zinc		
Produced from domestic ore	199,786,487	148,085,823
Produced from foreign ore	23,952,174	56,262,876
Exported to (in part)		
United Kingdom	98,752,407	135,017,175
Canada	4,161,315	391,375
Mexico	125,590	469,026
Japan	34,554,778	4,737,785
In sheets, strips, etc	37,075,091	22,881,016

Copper*

By H. A. C. Jenison
Geologist, U. S. Geological Survey, Washington, D. C.

THE salient features of the domestic copper industry in 1920 were a subnormal and hesitant market; a decreased production; labor troubles, and the failure of exports to improve conditions.

Early in October producers realized that they would have to reduce prices. Throughout the month repeated slight reductions of prices were made. In November the price was reduced from 15 to 13.5c., a decline that aroused considerable interest among buyers but did not result in the expected business, because, under the existing conditions, consumers could not utilize the normal amount of copper. The only large buyers were probably those who could afford to buy at the low prices quoted and hold their purchases in stock until consumption should become normal. Probably a small part only of the copper bought from the producers will be consumed immediately. Owing to the cautious progress of industrial reconstruction, and the consequent poor trade conditions, the consumption of copper is considerably below normal.

MONTHLY AVERAGE PRICE OF COPPER

Month	New York Electrolytic 1919	New York Electrolytic 1920	London Standard 1919	London Standard 1920	London Electrolytic 1919	London Electrolytic 1920
January	(a)	18 918	92 238	118.095	106 619	123 238
February	16 763	18 569	78 700	120.188	95 700	126.950
March	14 856	18 331	76 821	109.533	82 071	118.348
April	15.246	18.660	77.300	103 025	82 200	111.500
May	15 864	18 484	77 767	96 750	81 227	109 200
June	17.610	18.065	83.062	87.864	85 900	101 909
July	21.604	18.576	99.576	90.148	103 046	106.455
August	22.319	18.346	97.300	93.935	106 429	111 143
September	21 755	18 144	100 767	96 381	.	111.905
October	21.534	15.934	103.418	93.327	....	104.905
November	19.758	14.257	98.894	84 807	....	94.614
December	18.295	13.188	103 708	75.702	....	85.905
Year	18 691	17 456	90 796	97 480		108 839

(a) No market. New York, cents per pound. London, pounds sterling per long ton of standard copper.

Early in 1920 the conditions of trade in general, and of the copper market in particular, forced producers to realize that they must curtail production. All the larger producers reduced their output, and many of the smaller discontinued operations. By July some large producers had reduced operations to about half of the rate maintained in 1918, and many were confining their activities to the least expensive workings and to essential development work. The marked decline in the copper market in November and December, however, forced a still further curtailment of production, and secondary copper and copper alloys, which were offered in large quantities, particularly by the Government, at low prices, unfavorably affected prices and output.

The first half of 1920 was marked by large exports, which reacted favorably on the industry, but in July the exports fell off materially, and it soon became evident that Europe could do little more to improve the market for American copper. The rate of exchange remained so low that European buyers could not easily take over large quantities of American copper without an extension of credit. An extension of credit was handicapped by the facts that European buyers had no export market for manufactured copper and that only a fraction of the quantity normally consumed in Europe could at present be utilized in its domestic industries. Consequently the European countries that have usually consumed large quantities of American copper bought little more than was needed for essential replacements.

Furthermore, besides the unfavorable conditions of exchange, exportation, and consumption in Europe, European consumers of copper have had on hand great stocks of old copper, as well as of brass and other copper alloys. It is reported that in England alone one firm salvaged at least 300,000,000 lb. of copper from brass, copper shell bands, and other articles, and this copper is now available at low prices. The present low price of copper may, however, make it profitable for European buyers to absorb and hold in stock considerable amounts of American copper until industrial conditions become normal.

TABLE I. PRODUCTION, STOCKS, IMPORTS, EXPORTS, AND CONSUMPTION OF COPPER, 1918-1920.

(In Pounds)

	1918	1919	1920
Smelter output from domestic ores	1,908,500.000	1,286,000,000	1,235,000,000
Refinery production of new copper from domestic and foreign ores	2,432,000,000	1,768,000,000	1,573,000,000
Stocks at the end of the year, at smelters and refineries	742,600,000	904,000,000	(a) 873,000,000
Imports	575,805,115	429,387,594	(b) 407,437,515
Exports	747,689,580	516,627,775	(b) 543,695,851
Apparent domestic consumption	1,662,000,000	877,000,000	(c) 911,000,000

(a) Amount contains 683,000,000 lb. of refined copper and 190,000,000 lb. of blister copper. (b) Total for ten months ending Oct. 31, 1920. from records of the Bureau of Foreign and Domestic Commerce. (c) Estimated

TABLE II. EXPORTS OF COPPER DURING THE FIRST HALF AND FOLLOWING FOUR MONTHS ENDING OCT. 31, 1920. (a)

(In Pounds)

Country	January to July, 1920	July to November, 1920
United Kingdom	67,740,054	26,904,251
Belgium	15,713,683	7,359,995
Denmark	7,885,976	1,289,500
France	57,445,271	42,641,354
Germany	58,773,179	15,243,495
Italy	1,944,405	241,770
Netherlands	29,047,830	7,005,686
Norway	4,897,619	[illegible]
Switzerland	1,058,208	223,954
Other Europe	[illegible]	[illegible]
Canada	[illegible]	[illegible]
Japan	[illegible]	[illegible]
Other countries	38,509,374	4,781,169
Totals	[illegible]	[illegible]

(a) According to the Bureau of Foreign and Domestic Commerce.

Until the last quarter of 1920 the copper industry undoubtedly received a considerable amount of artificial support. Prices were held up despite diminished sales and a relatively small reduction in stocks. It was hoped that a general decline in copper prices and in the shares of the companies could be averted until a reaction set in and copper returned to its normal place. However, the great stocks on hand became too much of a burden, and the producers were forced to make considerable reduction in prices to dispose of the stocks. These reductions in prices undoubtedly eliminated the artificial support, so that the industry is now assuming its proper relations to trade and industry in general.

The present status means, of course, temporary curtailment of production, closing down of mines, and considerable losses, but it undoubtedly puts the industry in a healthier position than it has enjoyed at any time since the war. It is unlikely that there will be further accumulation of stocks; unprofitable mining will be discontinued; and when the present stocks of new and secondary copper and copper alloys are actually absorbed by industry (not held in stock by the consumers), copper producers will be in a sound position.

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Undoubtedly, in the near future, great hydro-electric developments, electrification of railways, and other large copper-consuming enterprises will be undertaken, but little such work can now be attempted, on account of the high cost of labor and materials other than copper. There is, however, no question that the industrial demand for copper will soon be greater than it has ever been before. Until that time there must be a little patient waiting and readjustment, and it must be remembered that the European situation is the greatest factor in the present condition of the country in general and the domestic copper industry in particular.

Pig Lead

By A Specialist in Lead

TO OBTAIN a comprehensive view of the 1920 price movement in pig lead it is necessary to go back to Nov. 11 and 12, 1919, when the peak of the upward trend for 1919 apparently had been reached. The *Engineering and Mining Journal* quoted on these two days $6.85 per 100 lb., New York. By the first of December the New York price had declined $2 per ton, and the St. Louis price $4.50, and the domestic demand had greatly slackened. It was just at this period, however, that the position of the lead market changed completely. Although on Oct. 1 the London price was £25 12s. 6d., by Dec. 5 it had advanced to £40 per ton, and the market for lead had become a world market.

As the London price advanced, the Mexican production was sold in London instead of in New York, and the price in the latter city rose to a peak of 9.37½c. per lb. in March, and in August to a lower peak of 9c.

MONTHLY AVERAGE PRICE OF LEAD

	New York			St. Louis			London		
Month	1918	1919	1920	1918	1919	1920	1918	1919	1920
January...	6.782	5.432	8.561	6.684	5.316	8.300	29.00	37.227	47.095
February...	6.973	5.057	8.814	6.899	4.784	8.601	29.00	28.675	50.256
March....	7.201	5.226	9.145	7.091	4.992	8.894	29.00	27.952	46.054
April......	6.772	4.982	8.902	6.701	4.722	8.618	29.00	24.888	39.225
May.....	6.818	5.018	8.576	6.704	4.773	8.352	29.00	23.852	38.488
June.......	7.611	5.340	8.323	7.511	5.070	8.169	29.00	22.544	34.330
July........	8.033	5.626	8.338	7.750	5.408	8.283	29.00	23.457	34.960
August.....	8.050	5.798	8.687	7.750	5.583	8.725	29.00	24.750	36.304
September..	8.050	6.108	8.177	7.750	5.853	8.160	29.00	25.330	35.452
October....	8.050	6.487	7.070	7.750	6.249	7.018	29.00	28.473	35.238
November..	8.050	6.808	6.159	7.750	6.649	6.127	31.20	34.731	32.489
December..	6.564	7.231	4.727	6.324	6.955	4.717	40.00	41.202	24.089
Year.....	7.413	5.759	7.957	7.222	5.530	7.830	30.10	28.590	37.832

New York and St. Louis, cents per pound. London, pounds sterling per long ton

On March 11, the London price, translated into United States currency at the current rate of exchange, amounted to 8.35c. per lb. It was on this date that the long downward trend in London started, and the price steadily fell until in December, 1920, it reached 3.35c. per lb., a drop of 5c. per lb. during the nine months.

The price in the United States, after reaching its peak early in March, gradually followed the London price down, until July 10, when the active domestic demand not only advanced the price in New York, but also caused a marked strengthening of quotations in London. At this time, in a short period of two or three weeks, probably 20,000 tons of pig lead was bought for shipment to American consumers and distributors, and for the first time in years large lots of lead could be and were purchased for shipment to the United States from Mexico, England, Australia, France, Germany, and other countries at a price which, with duty and freight added, was less than the market ruling in New York.

During the second half of August, transportation in the United States improved markedly. Though at least 45,000 tons of pig lead was on the rails on Aug. 15, by Sept. 15 there was probably less than half this amount. It was just at this time that the great activity in the automotive industry stopped abruptly, and the storage-battery companies were obliged to reduce their orders for the immediate future by more than 50 per cent, and in some cases to cancel all shipments for a period of from thirty to ninety days.

The arrivals of pig lead in the United States during the first eight months of 1920 averaged less than 5,600 long tons per month. In September, the reported arrivals were 17,195 long tons, and in October 10,760 long tons, an average monthly increase of over 8,000 long tons.

In the face of adverse conditions in almost every lead-consuming industry, the New York price rapidly fell from 8.90c. per lb. on Sept. 8 to 4.50c. per lb. on Dec. 15, so that the close of the year ended the important post-war price movement which had lasted from May, 1919, to the end of 1920.

Although it may be true that the world price in the early months of 1920 was materially increased by speculation, many other important factors influenced the market. England imported from Spain, during the first ten months of 1920, about 36,000 gross tons, almost exactly the same amount as in 1919, but, during the first four months of 1920, imports from Spain aggregated 6,700 long tons, as against 16,000 for the same period in 1919. The Australian production was greatly curtailed by strike conditions. During the first ten months of 1920, England received slightly less than 50,000 long tons from Australia, as against 85,500 for the same period in 1919. The United States production was below normal, due largely to labor shortages in the mining districts. These conditions, combined with the congestion of transportation in the United States, were mainly responsible for the high prices during the first three quarters of 1920.

PRODUCTION OF LEAD (REFINERY STATISTICS) (a)

(In Tons of 2000 Lb.)

Domestic	1916	1917	1918	1919	1920
Desilverized....	330,189	319,015	284,733	226,085	236,912
Antimonial....	22,819	16,265	18,658	14,864	8,992
S. E. Missouri....	206,105	205,861	189,207	158,182	206,836
S. W. Missouri....	33,128	40,575	63,635	55,790	29,004
Totals....	592,241	581,716	556,233	454,921	471,744
Foreign					
Desilverized....	17,832	50,962	98,596	61,380	51,700
Antimonial....	3,304	2,991	2,083	1,547	2,197
Totals....	21,136	53,953	100,679	62,927	53,897
Grand Totals....	613,377	635,669	656,912	517,848	525,641

(a) These figures include the lead derived from scrap and junk by primary smelters.

One of the interesting results of the heavy importations of pig lead was the change in the relationship between the New York and the St. Louis markets. The competition of foreign lead forced the New York price down to a level with the St. Louis price, so that the market for pig lead in cities in the Central Freight Association territory was higher than in New York City.

Production—The production of pig lead in the United States has declined since 1916, when the peak of 592,241 tons was reached.

The decline in 1919 was by far the most important. There was a slight increase in production in 1920, but it would seem that unless large new lead deposits are discovered in this country the production will never equal that of the years 1916 and 1917.

Consumption—The peace-time demand for lead products has increased greatly since January, 1919. As heretofore, the paint industry has been the greatest outlet for pig lead, and most of the corroders enlarged their plants during 1920, in some cases by 100 per cent. The storage-battery industry was second in importance. The third largest demand came from the manufacturers of lead-incased cable. During the first half of the year, there was a fair-sized demand from manufacturers of sheet lead and lead pipe, and a large demand for sporting ammunition, bearing metals, solder, caulking lead, type metals, lead foil, and other commercial applications.

The three most important industries undoubtedly consumed a tonnage of lead in 1920 equal to the entire domestic production in the United States. That a greater shortage of lead did not occur was due to the heavy importation of lead and to the extraordinary tonnage of reclaimed lead made available.

In 1919, it is estimated by the U. S. Geological Survey that over 122,000 tons of secondary lead was produced. In 1920, it is probable that over 150,000 tons of secondary lead was made available for consumption, the increase being attributable in a large measure to the heavy tonnage of shrapnel balls, small-arms ammunition, and sheet lead which was reclaimed by the United States and other countries and shipped to the market in New York, where it could be paid for in dollar exchange.

Zinc—Market and Metallurgy

By W. R. Ingalls
Consulting Engineer, New York

The zinc industry suffered from the general economic conditions of 1920. Early in the year production was maintained at a high rate, although much below the maximum during the war. In view of the bad situation as to zinc production in Europe it was anticipated that the United States would be called upon to export at least 100,000 tons of spelter during 1920. In fact, buying for export began as was expected, and for several months continued on a large scale, but at about the midyear this ceased, and Europe began presently to resell to us our own spelter. Following this the price, which had risen to about 8c., as the maximum for the year, declined, about 5¾c. being quoted at the end of November. The contraction in domestic demand was such that in spite of greatly curtailed production unsold stocks accumulated.

MONTHLY AVERAGE PRICE OF ZINC

Month	St. Louis 1917	1918	1919	1920	London 1917	1918	1919	1920
January	9.449	7.661	6 922	9.133	48 329	54 000	56.045	58 643
February	9.875	7 639	6.273	8 708	47 000	54 000	46 150	61 338
March	10.130	7.286	6 150	8 531	47 000	54 000	38 500	53 467
April	9.289	6.715	6 114	8 184	54 632	54 000	36 188	47 388
May	9 192	7 114	6 079	7.588	54 000	54 000	35 477	45 088
June	9.201	7.791	6 551	7 465	54 000	54 000	36 763	41 193
July	8.473	8 338	7.523	7 720	54 000	54 000	41 815	41 886
August	8 190	8 635	7.439	7 835	54 000	54 000	39 338	41 220
September	7 966	9 092	7.160	7.661	54 000	54 000	40 955	39 690
October	7.813	8 451	7 473	7 150	54 000	54 000	43 630	39 750
November	7.672	8 141	7 827	6 247	54 000	54 100	46 588	35 028
December	7.510	7.813	8 350	5 824	54 000	56 050	53 101	27 762
Year	8 730	7 890	6 988	7 671	52 413	54 180	42 879	44 372

St. Louis, cents per pound. London, pounds sterling per long ton

The production of zinc in Europe in 1920 was small in comparison with pre-war figures, but it became clear that the European ability to buy spelter was greatly inferior even to the sharply diminished supply. This situation, combined with the high cost of production and general inefficiency that were prevalent, produced deep gloom in the zinc industry.

The conditions in zinc smelting in the United States in 1920 are well reflected by the following figures from a well-managed works: As compared with 1915 the man-days of labor required to smelt a ton of ore had increased by 7½ per cent. The hourly rate of wages had increased 2¾ times. The metallurgical loss of zinc in the process had increased nearly 50 per cent. In other words, the smelting of a ton of ore in 1920 required more labor than in 1915, the labor was paid an immensely increased rate of wages, and, whereas it had previously obtained 88 per cent of the zinc in distillation, the extraction had fallen to about 82 per cent.

The increase in the cost of coal was of the same order as the increase in wages. As for the total cost of smelting, if the figures of $10 to $12 per ton of ore were representative of 1915, the corresponding figures of 1920 were $25 to $30. In spite of this, zinc was sold largely during the first half of 1920 at 7½c. per lb.; which is comparable with 5½c. as a pre-war normal price. This apparent paradox is explained by the ability of the relatively new mines of Oklahoma to produce concentrates from their comparatively rich ore at substantially pre-war prices, notwithstanding the immensely higher costs for mining.

ZINC PRODUCTION, 1918-1920, BY QUARTERS
(In Tons of 2,000 Lb.)
Reports of Ore Smelters Only

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
	1918			
Illinois	34,848	34,829	36,445	35,686
Arkansas	6,156	5,603	7,618	7,373
Kansas-Missouri	10,284	5,016	7,198	9,336
Oklahoma	37,751	35,261	35,036	35,323
Electrolytic	8,094	9,497	11,049	10,335
Others (a)	36,881	36,265	35,481	34,075
Totals	134,014	126,381	132,827	132,128
	1919			
Illinois	34,018	27,694	29,344	27,575
Arkansas	7,622	7,082	8,196	8,496
Kansas-Missouri	11,303	10,819	10,617	10,608
Oklahoma	36,142	27,484	25,829	29,999
Electrolytic	10,446	12,370	3,146	
Others (a)	37,024	36,050	30,467	29,353
Totals	136,555	121,499	107,599	106,031
	1920			
Illinois	31,551	31,406	24,949	21,577
Arkansas	7,900	7,500	9,000	5,566
Kansas-Missouri	7,389	6,432	6,749	[illegible]
Oklahoma	27,971	25,283	22,105	[illegible]
Electrolytic	11,659	15,208	17,098	13,476
Others (a)	46,014	44,233	36,945	32,869
Totals	132,484	130,062	116,846	100,380

(a) [illegible]

Through the courtesy of the American Zinc Institute, the 1920 [illegible] have been compared with the summary of the Institute.

The first half of 1920 saw the climax of evil conditions in the zinc industry. The demands of labor were then insatiable, and strikes among the smelters were common occurrences. With the unmistakable turn of the industrial tide about Oct. 1, however, a change in the attitude of labor became manifest, the first evidence of it being improvement in efficiency.

Without any doubt the most important thing in the metallurgy of zinc in 1920 was the thorough proving of the electrolytic process. When this process was first introduced in 1916 I prophesied its success and its enormous influence on zinc production, but I foresaw its limitations to especially favorable conditions. My forecast has been exactly verified by experience. In the meanwhile great improvements have been made in the process. For example, it has become possible so to roast the ore that no sulphuric acid is required for the lixiviation of the zinc. The removal of impurities interfering with the electrolysis has become much more easily manageable. And so on. In the light of these developments the limitations of the electrolytic process do not seem to me to be so severe as they did four years ago. In other words, I can now see the electrolytic process as a more powerful competitor of distillation. However, the factors remain that the electrolytic process must be conducted on a large scale and the cost of plant per unit of capacity is greater than that of the ordinary plant.

PRODUCTION OF ZINC 1915-1920
(In Tons of 2,000 Lb.)
By Ore Smelters Only

	1915	1916	1917	1918	1919	1920
Arkansas	....	7,637	25,701	26,750	31,396	29,966
Colorado	8,984	8,908	7,735	3,897	2,779	1,682
Illinois	161,665	181,495	176,071	141,808	118,631	109,483
Missouri-Kansas	111,052	154,396	86,505	31,834	43,347	25,131
Oklahoma	111,405	169,064	204,587	143,371	119,454	97,690
Electrolytic	....	10,963	27,245	38,885	25,962	57,441
East and others (a)	114,036	147,555	154,567	138 805	130,115	158,379
Totals	507,142	680,018	682,411	525,350	471,684	479,772

(a) Includes Anaconda and other electrolytic production in 1915.

The roasting of zinc ore for the electrolytic process is done generally in furnaces of the MacDougall type. These are built now for such conservation of heat and such transferal of heat by the circulation of air through the furnace as I showed should be the case in my U. S. patent No. 786,567 of April 4, 1905. Carrying out these ideas, with the addition of some others of ingenious nature, the Wedge Mechanical Furnace Co. is now building a furnace in which it expects to dead-roast zinc blende without the assistance of any extraneous heat. Theoretically this is possible.

In the distillation process the improvements have continued to be in details only. This is natural, for the process is one that comprises a multiplicity of details.

Electrothermic smelting has continued to be practiced successfully at one works in Norway and at another in Sweden. A third plant, at Glomfjord, Norway, was put into operation in the latter part of 1920. In all of these works the gangue of the ore is fused and drawn off as a slag, as in lead smelting. Prof. C. H. Fulton, in this country, has experimented on a large scale with electrothermic dry distillation, so to speak. His ideas seem to me to possess more merit than do the Scandinavian.

In the production of zinc oxide there have been noteworthy improvements. The New Jersey Zinc Co. is burning in its Wetherill furnaces a briquetted charge. This has been found to increase the extraction of zinc and reduce the requirements for coal and labor, at only a relatively small expense for briqueting.

Tin

BY J. H. LANG

Tin Specialist, the American Metal Company, Ltd., New York

COMMODITY markets usually display considerable uniformity of movement, regardless of special circumstances affecting them individually. This was more than ordinarily the case in 1920; so much so that it is hardly necessary to describe them separately or in detail. The story is the same in all cases. Like the populations of the countries at war, markets were gathered up by forces stronger than themselves, and swept like leaves before the wind to a common destination. Whether it was copper, tin, lead, or spelter, silver, rubber, sugar, silk or wool, wheat, corn, cotton or leather, the results were the same—the money market dominated all other markets. Divide goods into money and the result is the price. As credit contracted, prices inevitably declined.

MONTHLY AVERAGE PRICES OF TIN IN 1918, 1919 AND 1920

	New York				London		
			1920				
Month	1918	1919	99%	Straits	1918	1919	1920
January	85.500	67.702	61.596	....	293.227	248.557	376.512
February	92.000	[illegible]	58.466	59.932	311.525	223.963	395.750
March	(a)	67.[illegible]	61.037	61.926	318.875	236.843	369.489
April	(a)	72.[illegible]	61.120	62.115	329.905	225.275	345.450
May	(a)	72.[illegible]	53.230	55.100	364.217	234.398	294.813
June	(a)	71.[illegible]	46.125	48.327	331.925	238.263	250.614
July	(a)	68.[illegible]	45.798	49.154	360.347	253.272	261.886
August	(a)	57.226	43.856	47.620	380.900	273.625	274.048
September	(a)	54.482	41.940	44.[illegible]	343.905	280.102	270.120
October	(a)	54.377	39.310	40.[illegible]	335.543	279.239	258.190
November	(a)	53.307	35.667	36.[illegible]	323.550	283.556	241.080
December	(a)	53.870	31.135	33.[illegible]	267.736	314.113	212.440
Year	(a)	63.328	48.273	49.[illegible]	330.138	257.601	295.866

(a) No average computed.
New York in cents per pound; London in pounds sterling per long ton.

As may be imagined, tin was no exception to the rule. This erratic and exotic commodity, like Abou Ben Adhem, "led all the rest." There was no dizzy pinnacle of price that it could not climb nor any descent so steep that it hesitated to come down. Everything combined to give range and latitude to its gyrations. Always a favorite medium of speculation, it was in excellent position to start when the boom began in the summer of 1919. There was then the smallest visible supply on record—almost invisible in fact. There was plenty of tin, but the governments of the Federated Malay States and the Dutch East Indies were carrying it—15,000 tons, more or less. Even after they had transferred the load to the public, the market, like a certain beverage now absent but not forgotten, was still "going strong."

From a price of about £270 in September, 1919, tin had risen in February, 1920, less than five months later, to the record figure of £420 per ton. Then evidence of weariness and over-speculation began to appear. The financial strain began to tell, and first one market and then another began to crack. Whether America was the original "deflationist," and set or merely followed the fashion, is immaterial. It soon became universal. Even far-off China and Japan were not immune, and disgorged among other things large quantities of tin to add to the burdens of a market already overloaded.

With restricted business, consumers found themselves over-extended, and there was no support from "bears." Except for occasional flurries and reactions the decline was almost perpendicular, and in the short space of another five months, that is, in June, 1920, the market was below prices prevailing when the boom started. Standard tin in London on June 15 touched £235, and futures £239. From this low point the market advanced about £50, the reaction reaching its height on Aug. 5, at £284 and £289. Then the great recession in business, which had occurred by this time, and tight money put a period to the advance, and a fresh decline occurred, carrying the price down to new low levels for the year.

TABLE I. TIN MARKET IN 1920—CLOSING PRICE END OF MONTH

1920	Silver in London, Pence per Ounce	Demand Sterling Exchange, New York Dollars	Spot Standard Tin, London, £ per Ton	Spot Straits Tin London, £ per Ton	Currency Equivalen (New York, Straits Tin, Cents per Lb.	Spot Market New York, Straits Tin, Cents per Lb.
January......	83	3.5025	383. 5.0	388. 5.0	60.707	59.50
February.....	83.125	3.4025	400. 0.0	400. 0.0	60.759	60.25
March........	72.625	3.9025	348. 0.0	348. 5.0	60.672	63.00
April.........	64.50	3.82625	345. 0.0	345. 0.0	58.931	60.50
May..........	57.625	3.875	274.10.0	275. 0.0	47.573	51.50
June	52	3.94375	246. 0.0	258.10.0	45.512	47.75
July..........	56.625	3.725	268. 5.0	283. 0.0	47.061	48.25
August.......	58.75	3.5625	272. 0.0	280. 0.0	44.531	46.75
September....	59.375	3.4625	268. 0.0	270. 0.0	41.735	42.75
October......	52.50	3.4425	267. 5.0	270. 5.0	41.533	40.25
November....	43.875	3.48125	207.10.0	208. 0.0	32.326	33.25
December....	40.875	3.53	205.10.0	210.10.0	33.172	35.00

TABLE II. TIN—COMPARATIVE STATISTICS (RICARD & FREIWALD)

(In Tons of 2,240 Lb.)

	Year Ended, Nov. 30, 1920		Year Ended, Nov. 30, 1919		Year Ended, Nov. 30, 1918	
Visible supply beginning of period................	.....	20,495	.....	8,546	.....	16,408
Supplies:						
Straits................	49,826		48,693		54,752	
Australian.............	3,200		2,300		3,345	
Banca and Billiton	15,671		11,779		11,104	
Standard..............	13,843	82,540	7,971	70,743	9,364	78,565
Total..............		103,035		79,289		94,973
Deliveries:						
United Kingdom.......	21,589		18,306		16,905	
Continent............	5,751		10,965		12,127	
U. S. A...............	57,714	85,054	29,523	58,794	57,395	86,427
Visible supply end of period............	..	17,981	.. .	20,495	.	8,546

At this juncture the Straits Government came forward with a stabilization plan under which it offered to buy all ore not marketable elsewhere at a price equivalent to about £229 for refined tin f.o.b. Singapore. The price at which it pegged the market on Jan. 6, 1919, was about £235, f.o.b. Singapore (£242 c.i.f. London), in spite of which the price declined in London during February, 1919, to £200, and it was not until several months later that the pegged price became firmly established in the open market and the Straits Government was enabled to liquidate.

How far history will repeat itself in this respect remains to be seen. I rather expect a somewhat similar state of affairs in 1921; that is, that temporarily under present adverse conditions we shall see lower prices; but if, as is generally anticipated, and as occurred in 1919, business improves, then the market must rise to the level fixed in the Straits. At best there is small comfort for "bears" in this development, especially as a similar policy seems to have been adopted by the government of the Dutch East Indies in regard to Banca tin. Even assuming that the government of the Federated Malay States undertakes to buy only ore mined in the Straits or tin produced therefrom (as distinguished from tin smelted in the Straits from foreign ores), it will control something like 35,000 tons, and the Dutch about 15,000 tons, equal to about 45 per cent of the world's production, which is sufficient to control the market.

The drastic fall in silver has been a handicap to tin, because of its effect on the Chinese market, and locally the dollar price is affected by fluctuations in exchange. Details of these markets will be found in accompanying tables. Latest available statistics of production, deliveries, visible supply, and related data are also presented. These latter do not show the output of the various producing countries, but only the shipments therefrom, but doubtless reflect conditions with fair accuracy, and the situation so far as may be judged by these figures is entirely sound. The year 1920 closed with less visible supplies than were on hand at the beginning of the year, while prices were much lower—practically back to pre-war levels in fact. Invisible supplies, though not meager, are certainly no larger than a year ago. Given easier money and the improved business which is sure to follow, we have every reason to expect higher prices for tin in 1921.

Gold

BY H. N. LAWRIE

Chief, Precious Metals Division, the American Mining Congress

FROM a world's gold production in 1919 of $365,200,000, it is estimated that the production for 1920 will be $339,400,000, a decrease of $25,700,000, as compared to the decline from 1918 of $18,400,000. Of the total decline, $10,300,000 is estimated as the decrease in the production of the United States, which is more than twice the estimated decline of South Africa of $5,000,000.

The decline in the world's gold production has been continuous since 1915, when the production was $470,500,000. The total decrease in production during this five-year period has been $131,100,000, or 28 per cent. The decrease in the production of the United States amounted to $51,000,000, or nearly 40 per cent of the total world's decline, and the decline in Africa was $28,800,000, or nearly 22 per cent. The decrease of $27,400,000 in the production of Australasia nearly equals that of Africa, and yet Australasia produced but $49,400,000 in 1915, as compared to Africa's production of $217,600,000. The disintegration of Russia accounts for $18,600,000 of the total European decline of $19,400,000. The Transvaal contributed $19,400,000 and Rhodesia $7,400,000 to the total African decline of $28,800,000 since 1915. Other comparisons may be made from the table on p. 142.

GOLD AND SILVER PRODUCTION OF THE WORLD FOR TWENTY YEARS

	Gold	Ounces Silver (a)		Gold	Ounces Silver (a)
1901	$260,877,429	173,011,283	1911	[illegible]	226,192,923
1902	298,812,493	162,763,483	1912	[illegible]	224,310,654
1903	329,475,401	167,689,322	1913	[illegible]	223,907,845
1904	349,088,293	164,195,266	1914	[illegible]	168,452,942
1905	378,411,754	172,317,688	1915	[illegible]	184,204,745
1906 ...	405,551,022	165,054,497	1916 (a)	[illegible]	[illegible]
1907	411,294,458	184,206,984	1917 (a)	[illegible]	174,187,800
1908	443,434,527	203,131,404	1918	[illegible]	[illegible]
1909	459,927,482	212,149,023	1919	[illegible]	[illegible]
1910	454,213,649	221,715,763	1920	[illegible]	159,000,000

(a) As reported by the Director of the Mint (1920).

The South African production for the same period decreased 13.2 per cent. The rate of decrease was therefore four times as great in the United States as in South Africa. This results partly from the fact that the South

African fields were more remotely situated from the center of war and did not feel the effect of rising costs so soon, and partly from the fact that the American producer could not benefit by the exchange premium, the United States dollar retaining its par position with respect to all other currencies. Although gold from a monetary standpoint is an international problem, the production of gold in this country is a domestic problem, and demands a domestic solution.

GOLD PRODUCTION OF THE WORLD

Calendar Years

	1915	1918	1919	1920	Increase (+) or Decrease (—) 1919 1920	1915-1920
	Millions of Dollars					
United States....	101.0	68.6	60.3	50.0	—10.3	—51.0
Canada.........	18.9	14.5	15.9	17.1	+ 1.2	- 1.8
Mexico.........	6.6	16.8	15.2	13.2	- 2.0	+ 6.6
Total North America....	126.5	99.9	91.4	80.3	—11.1	- 46.2
Central America	3.0	3.4	3.3	3.0	0.3	0.0
South America....	14.3	14.1	14.1	14.0	— 0.1	— 0.3
Russia...........	28.6	12.0	12.0	10.0	— 2.0	— 18.6
Balance Europe..	1.6	0.7	0.8	0.8	— 0.0	— 0.8
Total Europe..	30.2	12.7	12.8	10.8	— 2.0	— 19.4
Australasia......	49.4	30.8	26.1	22.0	— 4.1	— 27.4
British India.....	11.5	10.0	10.5	9.4	- 1.1	— 2.1
Balance Asia.....	17.9	15.5	13.1	11.1	— 2.0	— 6.8
Total Asia.....	29.4	25.5	23.6	20.5	— 3.1	— 8.9
Transvaal.......	188.0	174.0	172.2	168.6	— 3.6	— 19.4
Rhodesia........	18.9	13.1	12.3	11.5	— 0.8	— 7.4
Balance Africa...	10.7	9.9	9.3	8.7	- 0.6	- 2.0
Total Africa...	217.6	197.0	193.8	188.8	— 5.0	— 28.8
Total for World	470.5	383.6	365.2	339.4	—25.7	—131.1

Years 1915-1918-1919 from Report of the Director of the United States Mint. The 1920 estimate is by H. N. Lawrie.

The decline in the gold production of the United States, as great as it has been during the last five years, does not reflect fully the present serious condition of the gold-mining industry.

The purchasing power of the gold ounce in the United States has averaged during this last five-years period $13.85, as compared to $20.67 in 1914. The McFadden Bill now before Congress restores the lost purchasing power of the ounce for the next five years, which will enable these properties to continue operation. Even with this constructive relief, it will be three years before the gold-mining industry may expect to recover a large part of its pre-war normal output. If no Congressional relief is provided, an extensive tonnage of proved gold ore resources will be a total loss and unreclaimable at a later date and the production of new gold will rapidly approach the vanishing point.

Since 1865, a large yardage of placer gravel and tonnage of siliceous gold ore have been removed. Active prospecting now, even if made most profitable, would probably not yield new deposits to replace those now lost and about to be abandoned for lack of governmental action. The process of price recession and credit deflation cannot take place rapidly enough to save the remnants of the gold-mining industry from extinction. The future of the industry in the United States therefore depends largely upon the timely action of Congress in applying a constructive remedy.

Silver

By Parker D. Handy

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AT THE CLOSE of 1920, general economic conditions throughout the world were unsettled. Silver mined in America and silk spun in China are common sufferers in the decline of prices. As silver is not only a commodity but a metallic measure of values among millions of people in the Orient, the keen interest taken in its fluctuations claims more than ordinary attention. The world is a spectator. Many vital interests are involved.

TABLE I MONTHLY AVERAGE PRICE OF SILVER

Month	New York 1918	1919	1920	London 1918	1919	1920
January	88.702	101.125	132.827	44.356	48.438	79.846
February	85.716	101.125	131.295	42.792	48.027	85.005
March	88.082	101.125	125.551	43.260	48.171	74.194
April	95.346	101.125	119.779	47.215	48.886	68.848
May	99.505	107.135	102.585	48.980	52.104	60.010
June	99.500	110.430	90.957	48.875	53.896	51.096
July	99.625	106.394	91.971	48.813	54.133	53.736
August	100.292	111.370	96.168	49.077	58.835	59.875
September	101.125	114.540	93.675	49.500	61.668	59.476
October	101.125	119.192	83.480	49.500	64.049	54.197
November	101.125	127.924	77.734	48.969	70.065	50.952
December	101.125	131.976	64.774	48.492	76.432	41.845
Year	96.772	111.122	100.900	47.516	57.059	61.590

New York quotations, cents per ounce troy, 999 fine silver. London, pence per ounce sterling silver, 925 fine.

At the beginning of 1920, the question of bimetallism was revived, although generally with a view toward demonstrating the unfitness of silver for remonetization. The peak price of silver in November, 1919, $1.37½, was above coinage parity, and the continued high prices in January and February, 1920, gave grounds for considering a possible silver emergency. The possibility of melting fractional silver attracted the attention of governments, and as early as December, 1919, the Treasury, in co-operation with the Federal Reserve Banks, made arrangements to release standard silver dollars, against other forms of currency, to be employed in regulating our exchange with countries having a silver monetary standard. A total of 13,000,000 dollars of silver went to the Orient up to May, 1920, under these arrangements. By the middle of April, however, silver prices started downward, and the emergency was over. From the year's high price in New York of $1.37 on Jan. 12, commercial bar silver of foreign origin dropped to 59¼c. on Dec. 10, despite the deterring effect of Government purchases under the Pittman Act. A similar violent reaction has taken place in the London market.

Market fluctuations have been more frequent than ever before, the rapid fall in 1920 having been of even greater extent and abruptness than that of the early 90's. The average monthly official price of commercial bar silver in New York and London is given in Table I.

Purchase of domestic silver under the Pittman Act began in May, at the rate of $1 per oz., 1,000 fine. A practical working arrangement was soon effected, and by Nov. 30 approximately 26,500,000 oz. had been purchased according to the terms of the act. Monthly purchases have averaged 4,000,000 oz., and if the silver market does not rise above $1 and domestic production proceeds at its present rate it will require about three and one-half years for the Government to replace the 208,900,000 oz. contained in the silver dollars broken up.

Although it was undoubtedly thought that the purchase of American silver at $1 per fine ounce would stabilize the market at considerably higher prices than have prevailed, it cannot be said with fairness that the current year's operation of the Pittman Act has had no influence whatever. The general economic conditions resulting in lower silver prices and the continued sales in London of large amounts of melted silver coin from Europe would without doubt have brought about a more severe reaction if the world's supply had not been reduced by the 30,000,000 oz. already absorbed by the United States Government.

The fundamental factors in the silver situation are the demands of India and China. The major portion of the annual silver output must be disposed of in the market centers of these two countries at the best prices obtainable. It is the court of last resort.

Although China for the last two or three years has been a large purchaser of silver to replace an estimated amount of 77,000,000 standard ounces sold to India in the years 1914 to 1917, it has apparently reached the point of saturation for the present.

Usually a favorable balance of trade makes India a creditor country. According to statistics, the export trade of India for the period from 1914 to 1919 was £744,000,000, and the imports were £492,000,000. Partial settlement of the indebtedness has been invariably made by importations of gold and silver, the latter playing a prominent part in cancelling the obligation. In this connection Council Bills, drafts drawn by the Secretary of State on the Indian government, have also been freely sold. Bills have been marketed ordinarily at 1s. 4½d. per rupee, a figure corresponding to the gold export point. If the rupee fell below this figure, or if the trade balance against the mother country was satisfied, then in order to correct the weakness of the financial position a resort was made to the sale of Reverse Council Bills (the sale in India of bills on London against the Gold Standard Reserve, an accumulation of funds from the profits of the rupee coinage). During 1920, the trade balance being unfavorable to India, the sales of Reverse Council Bills from Jan. 1, 1920, to Dec. 1, 1920, totaled £55,000,000. Notwithstanding the strenuous efforts of the government, reaction following the aftermath of peace brought about the wildest fluctuations in the price of silver of which there is any record.

A summary of the causes of the sudden rise and fall of silver prices follows:

AS TO THE RISE

Heavy demand for Indian currency since 1914.

Enormous bullion purchases by the English government on India account.

Large excess of merchandise exports from Bombay, Calcutta, and other Eastern ports.

Huge military expenditures in India, Egypt, Mesopotamia, and Palestine.

Embargo on silver imports on private account.

AS TO THE FALL

Cessation of bullion purchases on government account in 1919.

Unfavorable balance of trade against India for the last six months, as shown by the large amount of Reverse Council Bills sold.

Unfavorable monsoon or lack of rain during the last summer and autumn.

The substitution of paper money in place of the silver rupee.

Serious famine in five important provinces of China.

Dullness of export trade during 1920, owing to limited resources and low prices.

Statistics of Production—According to the Director of the Mint's report, the world production of silver for 1919 was 174,517,414 fine ounces, but from available statistics, the 1920 production will be but 159,000,000 fine ounces. The United States 1920 output will probably not exceed 50,000,000 ounces. Canadian production has also declined, owing to the gradual exhaustion of the richest veins in the Cobalt field, but the Mexican mines give no evidence of diminishing returns due to exhaustion of natural resources.

Our estimate of the world's production of silver during 1920 follows:

	Ounces
United States	50,000,000
Mexico	56,000,000
Canada	13,000,000
South America, Central America and West Indies	17,000,000
Europe	5,000,000
Australia	8,000,000
Asia and Africa	10,000,000
Total	159,000,000

Table II is an endeavor to show the distribution of the foregoing amount of new silver, but also includes the 27,000,000 oz. of melted coin silver received from the Continent in the London bullion market:

TABLE II. DISTRIBUTION OF SILVER PRODUCED IN 1920

	Ounces
Home consumption in the arts	23,000,000
United States Mint purchases under the Pittman Act	30,000,000
Mexican government purchases	9,500,000
English consumption in the arts	4,000,000
English mint — for medals	2,000,000
Shipments to India from England	14,000,000
Shipments to India from United States	200,000
Shipments to China and the Far East from United States	70,000,000
Shipments to China and Far East from England	18,000,000
United States Mint purchases for subsidiary coinage and other buyers, distribution unknown	15,300,000
Total	186,000,000

Exports of fine bullion from the principal shipping ports of North America during the past twelve months are approximately given in Table III.

TABLE III. SILVER EXPORTS DURING 1920

	Ounces
New York to England	5,000,000
New York to India	200,000
San Francisco to China, including Hongkong	62,900,000
San Francisco to Japan	4,600,000
San Francisco to French East Indies	2,100,000
Halifax to England	3,800,000
Vancouver to China and Far East	4,400,000
Total	83,000,000

Prediction for the immediate future trend of bullion prices is impossible, as the outlook for India and China is so full of uncertainty and no definite conclusions concerning their 1921 inquiries can be drawn. The situation, however, does present one possible feature of future strength. The disappearance of silver currency and reserves in Europe should only be a temporary condition. Eventually the millions of ounces obtained from melted coins and shipped from London to India and China are likely to be replaced, and it is inevitable that recourse must be made to silver as well as gold as international commerce is re-established with nations of the Eastern Hemisphere. But without considering the time or extent of this future demand for replacing coins melted abroad, a falling off in production, due to lower prices for silver, and an improvement in trade conditions and value of exchanges would undoubtedly advance bullion values above present levels. According to the British *Board of Trade Journal*, a return to a more normal balance of trade in India is admitted, and the general Indian situation gives cause for some optimism in viewing the future.

North American Smelting Works

IN VIEW of the fact that practically no enlargements or additions have been made in the list of smelters during the last year, we are omitting publication of the customary tables showing names and capacities.

Several copper smelters included in the list published in the *Engineering and Mining Journal*, Jan. 17, 1920, did not operate during 1920 or are now closed down. These include the Clifton smelter, formerly owned by the Shannon Copper Co.; the plant of the Calaveras Copper Co. at Copperopolis, Cal.; the Benson works of the Arizona Smelting & Power Co.; the smelter of the Canada Copper Corporation at Greenwood; the Granby plant at Grand Forks; the Ladysmith smelter; the Mason Valley smelter at Thompson, Nev.; the Ouray furnaces in Colorado; the plant of the Penn Mining Co., at Campo Seco, Cal.; the Phelps Dodge smelter at Morenci; the Mammoth Works at Kennett, Cal.; the Mountain Copper Co.'s smelter at Martinez; and the blast furnace plant at Cooke, Mont. The Mexican smelters in general operated intermittently in 1920. The British American Nickel Co.'s smelter and refinery was blown in and operated at fractional capacity.

Among the silver-lead smelters, the Globe plant of the A. S. & R. at Denver is now closed down, as is also the Ohio and Colorado Smelting & Refining Co.'s Works at Salida.

Many of the zinc smelters are either closed down or working at greatly reduced capacities.

Iron Mining in the United States

By D. E. A. Charlton

Managing Editor *Engineering and Mining Journal*

A REVIEW of iron mining in the United States naturally should begin with a summary of operations and conditions in the Lake Superior district, but inasmuch as the data concerning the various Michigan and Minnesota ranges are incorporated in separate articles dealing with mining in those states, (on pp. 163 and 179, respectively), as is also a résumé of conditions in the Alabama field (p. 180), the following paper considers the remaining states from which it was possible to secure information on iron mining.

According to figures prepared by the *Iron Trade Review*, the total shipments of iron ore from Lake Superior districts during 1920 were 60,227,226 tons, so that a rough estimate would place the total iron ore mined during the year in the United States at 72,000,000 tons. Total production of coke and anthracite pig iron for the year, according to *Iron Age*, was 36,414,114 tons.

In New York, Witherbee, Sherman & Co. operated at their Old Bed, Harmony and New Bed deposits at Mineville, producing about 950,000 tons. There was little or no change in methods of mining or concentration, and little equipment was added. Labor conditions were good, and the semi-contracting system, introduced last year, brought about the best labor efficiency ever produced in the district, enabling the company to retain the older and better men. The Port Henry Iron Ore Co. conducted operations at its mines in the same district. The Chateaugay Iron & Ore Co., at Lyon Mountain, completed a new hoisting shaft and also a new separator. Much development work has been done in the last two years, and considerable effort has been made to concentrate operations on the surface and avoid surface transportation from a number of pits by connecting by drifts on the lower levels. The Fort Montgomery Iron Co. operated its Forest O'Dean mine, eight miles west of West Point, and made considerable improvement in the local housing conditions. At this property the ore is sorted and is taken by rail and ropeway from the mine to Fort Montgomery, on the Hudson, where it is placed on barges for shipment. Considerable development work was done at the Sterling mines of the Ramapo Ore Co., at Sterlington. A new vertical shaft was sunk to the 400-ft. level of the Scott mine, a separator has recently been completed, and modern equipment has replaced that formerly used. Although there was little demand for hematite ore in the state, the Clinton Hematite mines continued operations in Oneida County, but most of the work done was development.

In New Jersey, the North Jersey Steel Co. took over the mining properties known as the Beach Glen, Misel, and Cobb tracts, and after a considerable examination, consisting of diamond drilling, unwatering the old Beach Glen mine, and taking samples of the ore shoots as exposed in the old workings, began actual development at the Beach Glen mine on May 1. An air compressor plant, blacksmith and machine shops, supply house, and offices have been erected, and a concentration mill with a capacity of seventy-five tons of crude ore per hour was about half completed. It is expected that this mill will go into operation on Feb. 1. The combined properties have estimated ore reserves of 5,000,000 tons of assured ore and 10,000,000 tons of probable ore. Other producing mines in the district are: The Mount Hope mine, at Mount Hope, and the Oxford mine, at Oxford Furnace. Both these belong to the Empire Steel & Iron Co. of Catasauqua, Pa., and were in full operation during 1920. The Richard mine, near Wharton, N. J., belonging to the Thomas Iron Co. at Hokendauqua, Pa., was operated during the first six months of 1920, and in June the property was shut down. The reason for the shut-down was that the mine was operated under the same union as the Mount Hope and Oxford mines, but it was found at the Richard mine that closed-shop conditions made the operation unprofitable, so the mine was closed down indefinitely or until open-shop conditions will obtain. The Replogle mine, near Wharton, N. J., belonging to the Wharton Steel Co., operated all through 1920. This mine produces a bessemer iron ore, which is concentrated. The mine is operated under open-shop conditions, the labor situation being very good. The Ringwood mine, at Ringwood, N. J., is owned by the Ringwood Co. of Ringwood. This mine produced about 100,000 tons of iron ore this year. There was a small operation at the Pequest furnace, near Oxford.

During 1920 iron ore (magnetite) was mined, in Pennsylvania at Cornwall, Lebanon County, French Creek, Chester County, and at Rittenhouse Gap, Berks County. Operations at Cornwall were on a somewhat large scale than for some years, the output of the Cornwall "Ore Banks" exceeding 700,000 tons for the year. The greater part of this ore was shipped to the concentrator at Lebanon, the remainder being sent to the Robesonia Iron Co.'s furnace at Robesonia, Pa. The concentrator capacity at Lebanon is now being enlarged by the addition of six Greenawalt sintering pans, three of which should be ready early in 1921. This will call for a monthly tonnage for 1921 of probably 85,000 to 90,000 tons of ore. Operations at Cornwall are all in open cut with steam shovels. Preparations for sinking an inclined shaft to increase output are now under way. An enlarged stripping program has been mapped out, and a Model 300, Marion electric revolving shovel has been purchased, together with additional locomotives and 20-yd. air dump cars. At French Creek mines, an underground operation, development work continued during the year. Shipments, however, were slowed down, owing to the destruction of the sintering plant at Birdsboro by fire. This plant has been rebuilt on improved lines, and, business conditions permitting, the mine should make record shipments in 1921. The Rittenhouse Gap mines opened up several years ago, and continued to produce in a small way during 1920. The ore, principally from development work, is concentrated in a small mill at the mines.

The Low Moor Iron Co. at Low Moor, Va., carried on development at its Dolly Ann mine in 1920. At this mine the shaft is at an angle of 60 deg., the vertical depth being 60 ft. A feature, which is unique for the district, is the installation of a washing plant that is set up on the headframe of the skipway. The plant consists of two double-paddle 18-ft. steel logs, electrically operated. The skips dump into a chute, and the material discharges directly into the logs. The capacity of the plant is 200 tons in ten hours.

According to Joseph Hyde Pratt, director of the North Carolina Geological and Economic Survey, several of the iron mines of North Carolina were producers during 1920. The Cranberry iron mine, at Cranberry, Avery County, was operated by the Cranberry Furnace Co., whose headquarters and furnace are at Johnson City, Tenn. The company is the largest producer of iron ore in North Carolina, and is working a deposit of magnetic iron ore. The mine has been worked, by underground methods, continuously since 1876, the ore consisting of immense lenses of magnetite. Limonite ores of Cherokee County were also worked rather extensively during 1920. The mining is largely open cut and pit work. These iron-ore deposits have been worked spasmodically since 1840, but during the war and with the increased price for pig iron, many of the mines were reopened and have been steady producers since the summer of 1917. The mines are in the vicinity of Andrews, Marble, and Murphy. These limonite ores run from 44.75 to 56 per cent iron. The ore is shipped to furnaces at Middlesboro, Ky., and Lafollette, Tenn. In Ashe County, there are lenses of magnetic iron ore similar to those at the Cranberry deposit in Avery County. These ores, which for many years have been inaccessible, are now available to railroad transportation by reason of the construction of the railway by the Norfolk & Western to West Jefferson, Ashe County. The production of iron ore in North Carolina during 1920 approximated 40,000 tons.

The Sunrise mines of the Colorado Fuel & Iron Co. at Sunrise, Wyo., were closed down from Sept. 22, 1919, until March 1, 1920, owing to the steel strike at Pueblo. On March 1 operations were resumed with full force. Practically all the old force of men returned. The employees operated under the Rockefeller Industrial Plan, which has proved very satisfactory with respect to industrial and social relations. The fourth level is being opened, and an elaborate system of concrete loading pockets at the hoisting shaft is being installed. The shaft was also concreted to this level. All ore production was shipped to the Minnequa works at Pueblo.

The only iron property which has been operated in Colorado for many years is the Orient mine, near Villa Grove, in Saguache County. This mine belongs to the Colorado Fuel & Iron Co., although it has not been operated on company account for many years. It was closed down early in 1919, and remained idle until May 1, 1920, when it was operated by lessees and produced about 400 tons per month.

With one exception there are no iron mines operating in Washington. Several good-sized deposits of iron ore are, however, known to exist in the state, and during the last several years there has been considerable talk of building a modern steel plant on Puget Sound. The Neutral mine, situated near the town of Chesaw, in northern Okanogan County, has been supplying the Northwest Magnesite Co. with 1,500 to 2,500 tons of magnetite yearly, which is used in the manufacture of ferromagnesite. The Northwest Magnesite Co. has now arranged to secure a byproduct iron from the Dupont Powder Works in California, and the Neutral mine recently closed down.

No iron mining operations were carried on in California during 1920, although for the last two years a syndicate of California bankers and business men has been engaged in studying the possibilities of developing an iron and steel industry on the Pacific Coast.

In Utah, a small amount of low-grade iron ore was mined and shipped from the Tintic district in 1920, for use as a flux at the smelters in the Salt Lake valley. This came principally from the Dragon Iron mine, at Silver City, although some was produced by the Milford Copper Co. and by the Iron King Consolidated Mining Co.

The Bessemer Consolidated Mining Co., in Ormsby County, Nev., made a small shipment during 1920. This is the only property operated solely for iron ore in the state.

Manganese*

By W. R. Crane
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A MARKED reaction in 1920 followed a year of stagnation in the domestic manganese industry. The price of ore made a near approach to that of war times. Simultaneously, the imports of foreign manganese ore rose steadily, except during January and July. Though figures for domestic production are not available, the relatively small amount would undoubtedly show an increase similar to that of the imports.

Domestic production of manganese ore of 35 per cent and above, for 1918 and 1919, was 305,869 and 58,085 long tons.[1] The 1919 figures represent shipments of stocked ore as well as that mined during the year, and do not, therefore, give the actual production. Though it is not possible to estimate the production for 1920, it is probable that 50,000 tons would be a fair estimate.

Imports of manganese ore for 1919 were 333,844 long tons, and those for 1920, up to and including September, totaled 423,012. With the increase in imports came an increased demand for domestic ores, a rather unusual situation, but it was the direct result of depleted reserves and increased demand at a time when conditions were far from normal.

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[1] U. S. Geological Survey

The high cost of producing manganese ore during the war still continues. Marked decline in the cost of certain supplies was noticeable in 1920, but the cost of rail transportation increased, particularly in the United States and Brazil, though ocean freights declined somewhat. The cost of transportation of ores is therefore more favorable to foreign than to the domestic supply.

The average pre-war cost of delivering manganese ore in American ports was 17.3c. per unit for Brazilian, Indian, and Russian ores, being 17.2c., 17.1c. and 17.6c. per unit, respectively. Some time will probably elapse before such cost of delivery will again obtain, and meanwhile the present high cost of transportation on American railroads will seriously curtail domestic production.

The interest in domestic manganese deposits following the sudden rise in price was both prompt and extensive, and although not of material importance except in a few favored localities, it demonstrated that despite the loss sustained during the war period, many are still disposed to try their fortunes in the business of producing manganese under reasonably favorable conditions. The mining of manganese from domestic deposits will without doubt be continued indefinitely in such old producing localities as Batesville, Ark., and Butte and Philipsburg, Mont., and the manganiferous iron producing districts of Colorado, Minnesota, and Nevada.

Tungsten Market

BY CHARLES HARDY

Charles Hardy & Ruperti, Inc., New York

THE year 1920 was a most unsatisfactory one for the tungsten miner, tungsten converter, tungsten user, and even for the importer, and I do not believe that the prospects for 1921 will be any better unless all concerned work harmoniously together for the protection of the whole industry. The year started with an accumulation of tungsten ore in the warehouses in New York, Pittsburgh, and on the West Coast variously estimated at between 10,000 and 12,000 tons. The withdrawals from warehouse and the shipments abroad were far below normal. It was estimated toward the latter part of 1919 that the maximum consumption of tungsten in 1920 would amount to about 4,500 tons.

Assuming importations during the year from all quarters, up to and including the month of October, amounted to 1,636 tons, the visible ore supply in warehouses (not taking into consideration the material on hand at buyers' works) was estimated to be approximately 10,000 tons at the close of 1920. This is a formidable tonnage, and it would require, even under normal conditions, at least two years to dispose of this amount, provided no new importations come in. The imports, however, of ferrotungsten and tungsten metal powder have been heavy, and of course every ton of this material prevents the American consumer from using the local accumulation of ore. The foreign exchange situation has helped considerably to encourage these imports at prices which are far below those at which domestic converters could possibly produce the metal or the powder. Steel containing tungsten has also been brought in, and I do not think I am too pessimistic in stating that the whole tungsten mining and using industry is disorganized.

The price situation on tungsten varied during 1920 with the hopes or disappointments of the people interested in tungsten on the question of the tungsten tariff bill. Early in the year the tungsten bill before Congress was strongly recommended by the committee, and the price of $7 per unit for Chinese ore, with which quotation the year started, was fully maintained with slight alterations from this figure. However, when Congress adjourned early in June, the Senate had not acted upon the tungsten bill, and as no action on the tariff could possibly be looked forward to during 1920, prices took a considerable slump. At the end of July a price of $5 per unit was reached for Chinese ore. For a little while the market remained at $5 per unit, but when general slackness in business became apparent, when steel plants began shutting down, and when the number of possible buyers of tungsten ore became less and less, the market settled down to a purely nominal figure, and at this writing I doubt whether sales could be effected at even $4 per unit. The price quoted, in view of the present low rate of exchange, makes the New York equivalent only $3.25 per unit and short ton.

Though conditions do not look hopeful, I believe that the revival of business in general, which cannot be much longer delayed, together with the buying orders for railroad equipment and construction, will in its turn have a helping influence on the tungsten situation in the United States.

Tungsten Mining

BY F. W. HORTON

Mining Engineer, New York

DURING 1920 practically no tungsten was mined in the United States. Forced sales of ore in a heavily overstocked market and continued imports reduced prices far below the cost of production of even the most fortunately situated tungsten mines in this country. In consequence, tungsten mining virtually ceased, and only a nominal production from development work was made by three or four companies. Notwithstanding the low prices, there was little demand for ore.

At no time in the entire decade preceding 1914 have the present low prices been equaled. In fact, they have never been attained in the entire history of the tungsten industry except during the period from 1900 to 1903 inclusive, when tungsten mining was beginning and the value of the element in steel was not generally recognized. Even during this period, the lowest price was $1.75 per unit, f.o.b. mines, and the average price was above present quotations. The average price of tungsten ore from 1898, when it was first sold in this country, to 1914 inclusive, was slightly over $6 per unit. Present prices are far below the cost of production, not only of all domestic mines but also of most foreign tungsten properties. In fact, it is doubtful if there are more than a half dozen mines in Burma or China, the countries where tungsten ore is produced most cheaply, that could deliver ore in New York at a profit at prevailing prices.

Tungsten mining as an industry in this country has ceased to exist, and the few domestic makers of tungsten powder and ferrotungsten still in business are operating only sporadically. Our tungsten mines cannot compete with the production of ore by the cheap labor of the Orient, and they must remain closed until such time as the United States Government sees fit to grant them a protective tariff on ore. Such a tariff must, of course, also apply in proper proportion to tungsten in any of its forms.

Chromite

By Samuel H. Dolbear
Consulting Mining Engineer, San Francisco, Cal.

THE rapidity with which pre-war trade channels are being reopened is fairly indicated by the chromite situation during 1920. Domestic production, which rose to 82,430 tons in 1918, decreased to 3,900 tons in 1919, and in 1920 had almost ceased, only scattering carloads being shipped. Final statistics are not yet available, but it is believed that the deposits in San Luis Obispo County, Cal., were the only ones operated in that state in 1920, and the total shipments from California, Oregon, and Wyoming will not exceed a few hundred tons.

Markets of the world were supplied largely in 1920 by the deposits of New Caledonia, Rhodesia ranking second. There was little activity in Asia Minor, owing chiefly to labor and transportation difficulties. The United States continues to import chrome ore from Cuba, but in less amounts than in the last two years. The ores of this country are reported to present some difficult metallurgical problems. The deposits are controlled by American capital. Deposits in Costa Rica have been mined during the last year, yielding high-grade ore, and regular shipments are made to the United States. The operations are controlled by interests allied to the United Fruit Co., whose steamers touch the ports of this country. The deposits are said to be large, and plans have been made for increasing production.

Prices during 1920 ranged from 50c. to 70c. per unit (1 per cent CR_2O_3) f.o.b. Atlantic seaboard for ore or concentrates containing 50 per cent chromic oxide. Some domestic ore of lower grade changed hands at concessions to these figures. The outlook for domestic production in 1921 is not bright. Deposits in Western States will likely be able to compete locally only in supplying the small requirements of steel plants situated chiefly in California and Colorado. The falling in price of ferrochrome will prevent much Western production of that product.

Nickel

By Thomas W. Gibson
Deputy Minister, Ontario Department of Mines, Toronto, Canada

THE year 1920 was not a prosperous one for the nickel industry. The deposits at Sudbury, Ontario, Canada, which supply 85 per cent of the world's requirements, were drawn upon to maximum capacity during the war period. The ore raised in 1918, the peak of production, was 1,643,040 tons, and about the same quantity was smelted. The nickel contents of the matte product were estimated at 45,886 tons, and the copper contents at 23,843 tons. When the war closed, the demand fell off sharply, and subsequently almost entirely ceased. Large stocks of matte and refined nickel had been accumulated by the Allies, and the year 1919 by no means saw this entirely absorbed. As a result, operations were greatly curtailed, and, in 1919, the quantity of ore raised fell to 614,955 tons. The pre-war scale of production was resumed for a considerable part of 1920, but subsequently fell off considerably. Ore raised for the first nine months of 1920 amounted to 925,378 tons, and for the full year to about 1,100,000 tons. Of this, approximately 1,000,000 tons was smelted into matte, representing about 28,000 tons of nickel and 14,500 tons of copper.

Two companies, the International Nickel Co. of Canada, Ltd., and the Mond Nickel Co., Ltd., have long been the sole occupants of the field, but during the year a third, the British American Nickel Corporation, Ltd., came into production. This company has opened up the old Murray mine, which was found to contain large reserves of ore; has put up smelting works at the mine, and erected a refinery at Deschenes, Quebec, where a sufficient supply of electric power is available. This makes two nickel-refining works in Canada.

An unusual feature in the metallurgy of nickel is that there are three methods of refining. The British American company uses the electrolytic process invented by Hybinette. The International company employs the Orford salt-cake process, both at Port Colborne, Ontario, and Bayonne, N. J. The Mond works, in Wales, are operated on a process invented by and called after Dr. Mond, the original founder of the company.

The Sudbury ores carry appreciable quantities of gold, silver, and metals of the platinum group. In 1919, a total of 1,770 oz. of the platinum group metals was recovered, which included 642 oz. of platinum, 842 oz. of palladium, 227 oz. of rhodium and 76 oz. of osmium, iridium, and ruthenium. These were obtained from the International Nickel Co.'s mattes. From the Mond Nickel Co.'s mattes, about 3,078 oz. of platinum was obtained in 1915, 5,474 oz. of palladium, and 917 oz. of iridium and rhodium. In 1916, 1917, and 1918 the recovery of platinum amounted to 3,372 oz., 4,719 oz. and 4,958 oz. respectively.

The nickel deposits of New Caledonia, idle during the war period, are again being worked, but on a reduced scale. Ore of the Sudbury type is said to have been found in the Province of Manitoba, at the Bear and Oiseau rivers, these points being ten or fifteen miles distant. It is considered possible that the occurrences indicate the existence of a belt of norite, but no developments have yet taken place.

Undoubtedly the stimulus of war has greatly expanded the capacity of existing companies for producing nickel. The companies for the moment feel, in the language of the lady in the old song, "all dressed up, but nowhere to go." It may be hoped that when normal conditions are once more firmly established, this useful metal will come into its own.

Molybdenum

By W. Norman Bratton
Climax Molybdenum Co., New York

THE future of molybdenum is in the steel industry, and producers can hope for no change until the merits of molybdenum steel are sufficiently recognized by users of alloy steel. As soon as the miners can convince the consumer of the merits of molybdenum, mines will resume operation.

During 1920 Professor Arnold, of Sheffield, experimented with a molybdenum high-speed tool steel containing about 5 per cent molybdenum, and presented a paper on the subject that created world-wide discussion.

This steel has not been favorably received in the United States, although reports from England seemed to indicate that it met approval there.

Steel metallurgists in the United States are working with fractional percentages of molybdenum in producing steels in which the average content of molybdenum is about ⅓ per cent, and results are surprising. The applications of this steel are now well established in the automotive industry and are continually branching out into other uses, notably for railway springs. In the mining industry, reports are noted that molybdenum has commercial advantages in steel balls for grinding mills and rock-drill steels, and further investigation in this field may provide an output.

Molybdenum Market

By Charles Hardy
Charles Hardy & Ruperti, Inc.

THE short space available is more than ample to report the happenings in molybdenum in 1920, which was a year of practically "no business at all." Nearly all mines producing molybdenite in the United States and in Canada were shut down; the stocks with which this country found itself at the beginning of the year are still in warehouse; no inroads have been made thereon to speak of; importations of molybdenum-bearing ores into the United States have stopped entirely; offers from abroad on ferromolybdenum and molybdenite were far below domestic quotations, due mainly to the exchange situation, yet these low figures did not bring about any business of consequence.

The market started in January with sellers quoting 75c. per lb. MoS_2 for 90 per cent concentrate, with buyers at approximately 60c., and this rate of price difference kept up all through the year. The little business done was generally at a compromise figure.

Platinum and Palladium[*]

By James M. Hill
Geologist, U. S. Geological Survey

STOCKS of platinum and palladium at the beginning of 1920[1] were 29,228 troy oz. and 10,235 troy oz. respectively, and were somewhat below normal, which resulted in a continuation of the high prices prevailing for the metals through the first two months of 1920. Increased imports from Europe and continuation of the receipts from Colombia, South America, had a tendency to lower prices, which was accentuated by the strike of jewelry workers in the East, so that by June the price of platinum had reached $82 and palladium $72 per ounce.

Imports of platinum for the first nine months of 1920 were approximately 58,700 oz., indicating a total for the year of nearly 78,300 oz., which is about 23,800 oz. more than the total imported in 1919. Palladium imported for consumption during the first six months of 1920 was 4,798 oz., predicating a total for the year of approximately 9,500 oz. or nearly three times the imports in 1919. Near the close of 1920, platinum-group metals were apparently being received from abroad in larger quantities than during the earlier months.

With the resumption of jewelry manufacture in August, the demand for platinum increased to such an extent that the price rose to $117 per oz. by the latter part of September. Since that time, apparently due to slackened demand caused by more difficulties with jewelry makers, the prices steadily declined to $75 per oz. for platinum and $75 per oz. for palladium at the end of the year.

There seems to be little question that small lots of Russian platinum will continue to come out through various channels, and it is even conceivable that there may be receipts of rather large lots, providing financing can be arranged. It is believed that with the increased output from Colombia, which can be reasonably expected from the larger and more efficient operations in that country, the market will be well supplied with platinum metals during 1921. Prices, however, can hardly be expected to be as low as the pre-war figures until the Russian fields are again on a producing basis. It is believed, however, that the prices of both platinum and palladium will be lower than those during 1920.

Quicksilver in California

By Fletcher Hamilton
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San Francisco, Cal.

THE quicksilver production of California for 1920 was approximately 9,770 flasks (75 lb. each). This is the lowest yield in the history of the state since 1850. The previous bottom level was in 1914, when the output declined to 11,373 flasks. The low-point price in 1914 was $37 per flask. Since the war, prices have again declined, so that during the last two months of 1920 the quotations ranged around $50 to $65 per flask. However, even at those figures, which were below cost of production, the sales of domestic metal were so limited for several months that on Nov. 1 all of the principal operators in California closed down their plants. This included the New Idria, Cloverdale, and Oceanic mines. On June 20, the New Idria plant was wrecked by fire; but the company proceeded to rehabilitate it, and had two of the five rotary furnaces again in operation, when compelled to close on account of market conditions. Importations in 1919 amounted to 10,635 flasks, and in 1920 to 16,131 flasks up to Dec. 1.

AVERAGE MONTHLY PRICE OF QUICKSILVER
(Per Flask of 75 Lb.)

Month	New York			
	1917	1918	1919	1920
January	$81.04	$126.77	$105.50	$90.192
February	120.90	119.89	89.84	84.432
March	113.30	121.63	71.56	92.611
April	115.64	121.87	72.94	102.192
May	105.98	118.97	83.12	89.560
June	84.34	122.66	93.25	90 154
July	107.80	126.63	104.68	90.333
August	115.00	125.56	107.08	83.806
September	112.21	127.81	102.52	75.000
October	100.94	127.18	86.35	67.200
November	102.50	124.91	90.74	58.417
December	115.90	117.70	98.27	49.577
Year	$106 30	$123.47	$92.15	$81.123

There is plenty of ground, even in California, in addition to what may be in Nevada and Texas, that will warrant development if only a fair price can be assured that will justify exploitation. The domestic quicksilver industry is in danger of complete extinction, if not soon given adequate protection against foreign importations. Manufactured mercurials should also be included in the dutiable tariff list, as a protection to American detonator and drug manufacturers, which would in turn further assist the domestic mines.

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[*] Published by permission of the Director of the U. S. Geological Survey.

[1] "Platinum and Allied Metals in 1919," p. 13, 1920; U. S. Geological Survey, "Mineral Resources of the United States."

Antimony

By K. C. Li

President, Wah Chang Trading Corporation

DURING 1920 the market for antimony in China was not a question of cost of production or consumptive demand. Price fluctuations were based chiefly on Chinese exchange. Chinese miners and smelters are paid for their product in gold, and have to pay for their labor and raw materials in silver, in the form of taels. Partly as a result of the business collapse in Japan early in the year, China has entered a period of depression, with great distress to her industries, especially affecting those whose products are not consumed at home, such as antimony.

During 1920, the exchange value of the tael fell almost 60 per cent. In February, bar silver reached a high of 90d. per ounce in London, and the Shanghai tael exchanged for about $1.67. By May, the tael had fallen to $1.11, and in December to 70c. The fall in the price of antimony during the year was not because the Chinese miners or smelters were able to reduce their prices in Chinese money, but chiefly due to exchange. An important point is also that the lowest price of antimony "regulus" c.i.f. London was £22 per ton in 1914. At the then rate of exchange £1 averaged 7.5 taels. Thus one ton of antimony would exchange for 165 taels c.i.f. London to the Chinese smelter, or 155 taels, c.i.f., Shanghai. Today the smelter receives below 100 taels, c.i.f., Shanghai. As conditions are today in China any improvement in demand should immediately create a stronger market.

AVERAGE MONTHLY PRICES OF ANTIMONY IN CENTS PER POUND

Ordinary Brands

Month	1916	1917	1918	1919	1920
January	42.45	17.29	14.28	7.43	10.58
February	44.31	29.80	13.82	7.17	11.59
March	44.75	32.89	13.09	6.80	11.06
April	42.06	34.04	12.54	6.79	10.50
May	31.60	25.20	12.85	7.66	9.66
June	20.05	19.51	13.06	8.44	8.29
July	14.70	15.83	13.20	8.99	7.50
August	11.53	15.06	14.00	8.96	7.18
September	11.81	14.94	14.15	8.63	7.11
October	12.70	14.75	13.32	8.71	6.72
November	13 84	13.91	8.77	9.11	6.11
December	14.59	15.06	7.92	9.62	5.53
Year	25.37	20.69	12.58	8.19	8 49

The strong tone with which the New York market closed the year 1919 continued into 1920, with supplies scarce and a strong demand. January opened with ordinary brands selling at 9.75c., the price advancing steadily through the month to 11¼c. and this advance continuing during February to 11⅝c., at which price March opened; but heavy arrivals from the East during this month depressed prices to 10½c. at the close. Although not evident at the time, this was the beginning of a decline which continued steadily throughout the year.

April closed at 10c., decline being aggravated by Japanese business troubles. During May the light demand and more abundant supplies brought prices down 1⅛c., and, these same conditions continuing into June, the closing price for the first six months was 7½c. During June the drop was rapid, due to a heavy fall in the price of silver from 99½ to 80c. Prices in the Orient were considerably above the New York market. During July and August the market declined to 7c. It continued steady into September, but heavy offerings of war scrap, shrapnel balls, and similar material, both from foreign governments and our own, were a depressing influence, and after a light month, with little interest in future deliveries, the market became decidedly weak in October, falling to 6⅜c. This decline continued during November to 5¾c. and at the end of December, partly owing to liquidation for inventory purposes, but chiefly because of the absence of consuming orders, spot metal could be bought for less than 5¼c. This is the lowest price recorded for antimony in over six years, and marks a decline from the beginning of the year of over 46 per cent in the price of the metal.

Imports of antimony ore for the first nine months of 1920 were 1,360 gross tons, containing 1,146,461 lb. of antimony. This compares with 754 tons and 709,378 lb. in the corresponding period of 1919. The antimony contents of matte, regulus, and metal imports during the same period of 1920 were 21,188,568 lb., compared with 10,200,608 during 1919 and 20,788,681 in 1918. On Dec. 31, 1919, the stock of antimony in bonded warehouses was returned by the U. S. Bureau of Statistics as 1,073 long tons. On Oct. 31, 1920, this stock was 1,561 tons, comparing with 1,489 tons the same date, 1919.

Arsenic

By A. E. Wells

Metallurgist, New York

THE demand for white arsenic in 1920 was even greater than in 1919, when 10,000 tons was consumed in this country. The increase has been due to increased requirement of the mineral for the making of insecticides. Production in this country was entirely inadequate to supply the demand, and consequently prices were very high, white arsenic being quoted up to 15 and 16c. per lb. during the spring of the year. With the general curtailment of industries and the seasonal slacking up in demand, the price fell, and during the last several months arsenic sold for 11 and 12c. per lb. One company supplied a large contract over the year at less than 10c. per lb. It is estimated that the domestic production was approximately 6,000 tons, and that between 3,000 and 4,000 tons was imported from Canada and Mexico.

The principal producers are the American Smelting & Refining Co., from the Globe plant, at Denver, and the plant at Tacoma, Wash.; the United States Smelting Co., at Midvale, Utah; and the Anaconda Copper Mining Co., at Anaconda, Mont. The arsenic from the above-named plants was produced primarily as a byproduct from lead- and copper-smelting operations. Because of the high prices and heavy demand, the first two companies made special efforts to obtain high arsenical ores and to smelt as large a percentage of these as possible with their regular furnace charges. The Globe plant of the American Smelting & Refining Co. treats the high arsenical dust and fume obtained in the baghouses and Cottrell apparatus at several of the other Western plants of that company. The United States Smelting Co. has begun to produce calcium arsenite at Midvale, Utah, and is experimenting with the production of other arsenical products. The production at Anaconda gradually increased during 1920, and in 1921 the Anaconda production should be an important factor in the market. When running at normal smelting rate, the Anaconda plant has a potentially large arsenic productive capacity, but the probabilities are that with the great increase in the demand for that material, there will be no serious overproduction.

Bismuth

By J. A. Samuel
Philipp Brothers, Inc., New York City

THE production of bismuth in the United States is confined to a few lead and tin refineries, chiefly of the American Smelting & Refining Co. and the U. S. Smelting, Mining & Refining Co., by which companies it is obtained as a byproduct. Production figures are not available. Refined bismuth is produced abroad principally in England, Australia, and Germany from ores mined in China, Australia, and Bolivia. The greater part of this production is controlled by an English syndicate, which naturally is in a position to control the market. Domestic production is probably sufficient to supply domestic requirements, but, nevertheless, some metal is imported from England and Australia.

The market abroad remained unchanged during 1920 at 12s. 6d. per lb., the market here fluctuating with sterling exchange. Early in 1920 quotations were around $2.65 per lb. in 500-lb. lots. At present bismuth may be obtained at from $2.10 to $2.25 per lb. The metal is difficult to refine, and to be readily salable must be at least 99.9 per cent pure and absolutely free from arsenic.

It is understood that there are large stocks of bismuth abroad, and it is not improbable that the price may recede. There are now undisposed stocks of Australian bismuth in the United States. The principal features of 1920 were the comparatively heavy shipments of bismuth ores produced in China as a byproduct in tungsten mining, and the Australian shipments.

[A careful investigation leads us to believe that domestic production in 1920 was smaller than that in 1919, the figures being approximately 320,000 and 250,000 lb. respectively.—EDITOR.]

Cobalt

By C. W. Drury
Professor of Metallurgical Research, Queen's University, Kingston, Ont.

THE rapidly increasing demand for cobalt metal and its products continued during 1920. The chief uses of cobalt are in the manufacture of stellite (cobalt-chromium-tungsten alloy) and in the ceramic and drying-oil industries. Cobalt oxide is used in the ceramic industry and cobalt salts in drying-oil industries.

The production of cobalt from the mines of Cobalt, Canada, continued during 1920, most of the shipments being made to the cobalt smelters in Ontario. A recently published report[1] describes briefly a cobalt deposit in Australia. The cobalt ore occurs associated with diorite and schistose rocks.

The smelting of cobalt ores by the Missouri Cobalt Co., Fredericktown, Mo., has proved a success, and the Missouri company has produced a considerable portion of the cobalt consumed in the United States. The price of cobalt rose toward the latter part of 1920, owing to the increased costs of raw materials, chemicals, and general supplies. In the process of recovering cobalt from its ore, many complicated chemical reactions appear to be necessary to remove the large quantities of impurities, especially sulphur, arsenic, iron, copper, and nickel, which are in the ores at Cobalt.

Cobalt until a few years ago was considered one of the rarer metals, but owing to the various properties which it imparts, the metal and its products are finding new applications. With certain metals it increases the resistance to corrosion, in steels it gives cutting hardness, and with iron it forms an alloy which possesses remarkable magnetic properties.

Uncommon Ores and Metals

By H. C. Meyer
Vice-President, Foote Mineral Co.

Cadmium

THERE are no distinct ores of cadmium, the metal being obtained as a byproduct in the refining of certain zinc ores. In such ores it occurs in a ratio of about one part to 200 parts of zinc. Nearly all commercial zinc carries a small percentage of cadmium, as this element resembles zinc closely in its metallurgical behavior. The demands for the metal are small, and if they could be stimulated, the total production could be brought up to as much as 400 to 500 tons annually. Its greatest use is in the manufacture of low-fusing alloys employed in automatic sprinkler systems for fire protection. During the war it was proposed as a substitute for tin in solder, but this use was never fully developed. A new commercial application of the metal is for testing storage batteries. Cadmium sulphide is used in the ceramic and glass industries. Mixed with selenium it produces beautiful orange and red enamels used in the manufacture of glass beads, and also, in conjunction with selenium in the glass industry, it is used in the manufacture of so-called ruby glass employed for railway signal lights.

During the first half of 1920 the price of the metal ranged from $1.45 to $1.50 per lb. In the last half of the year the price dropped to $1.40 per lb. During the early months of 1920 the sulphide sold for $1.50 per lb., but in the last quarter it dropped to $1.25 to $1.35 per lb., depending on quantity. No statistics are available as to the actual tonnage produced. During 1919, according to the U. S. Geological Survey, 99,939 lb. of metal and 31,197 lb. of sulphide were produced.

Cerium

IMMEDIATELY following the armistice the demand for ferrocerium began to decrease, and during 1920 the market for this alloy contracted still further, owing to foreign competition. Prior to 1915, Germany and Austria had a monopoly on ferrocerium as well as cerium mixed metal. When the United States entered the war, the Welsbach patents covering the manufacture of ferrocerium were seized by the Alien Property Custodian, and several American manufacturers were duly authorized to produce this alloy, under license.

France during 1920 became a large purchaser of cerium compounds, used for the production of cerium mixed metal. This was subsequently alloyed with iron to produce the ferro-alloy. Approximately 100 tons of cerium carbonate, rare-earth hydrates, and other miscellaneous cerium compounds were exported to foreign countries during 1920. The value of these compounds ranged from 18c. per lb. for the carbonate up to 75c. per lb. for such salts as the oxalate and the oxide.

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[1] *Can. Min. Jour.*, Vol. XLI, No. 47, p. 981, 1920.

No statistics are available as to the total production of ferrocerium in the United States during 1920, although it is estimated that it ran from 2,000 to 3,000 lb. per month during 1919. There were no important fluctuations in the price of ferrocerium during the year, which ranged from $10 to $14 per lb., depending on quantity. Cerium mixed metal carrying approximately 95 per cent cerium, lanthanum, and didymium metals and 5 per cent iron ranged in price from $6 to $8 per lb. in ingot form.

Selenium

PRIOR to the discovery of the use of selenium as a decolorizing agent in glass, the element was more or less of a chemical curiosity and the production of no significance.

There were no important price fluctuations throughout 1920, the value of the material ranging from $1.80 to $2.10 per lb., depending on quantity. Figures are not yet available on the 1920 production. The U. S. Geological Survey reports 60,025 lb. produced during 1919.

Tellurium

TELLURIUM still remains the black sheep among the elements. Although efforts to discover new uses have been made by the Government in co-operation with metal refineries which have accumulated large stocks of tellurium, no important commercial applications have yet been developed. It has been used in a small way in high-resistance alloys, for coloring porcelain and glass, staining silver, in medicine, and in the manufacture of certain special dyes. However, all of the above uses represent only a very few hundred pounds per year. No figures are available as to the production, but it is understood that it could be produced in very much larger quantities than selenium.

Titanium

ONLY two known deposits of rutile have been worked on a large commercial scale, one in Virginia and one in southern Norway. The Norwegian deposits produce an exceptionally high-grade product, carrying from 93 to as high as 98 per cent titanium dioxide.

A new use, as a paint pigment, has recently been developed for pure titanium dioxide. Prepared grades of titanium dioxide for ceramic purposes and for the coloring of porcelain and artificial teeth were in limited demand throughout 1920.

The price of ilmenite during the year ranged from $8 to $20 per ton. This was for concentrates carrying a minimum of 45 per cent TiO_2. Imported rutile was quoted during the first half of the year at 15 to 16c. per lb. in carload lots, and during the last half at 12 to 13c. per lb. in carload lots.

Zirconium

AN INCREASED demand for zirconium ore (zirkite) was noted during 1920. This product, which is the natural oxide of zirconium imported from Brazil, is now recognized as one of the so-called super-refractories for high-temperature work.

Ferrozirconium is still in an experimental stage. Alloys containing from 25 to 35 per cent zirconium metal were produced during the war, but carried an objectionably high percentage of silicon and aluminum. Recent improvements in the metallurgy of zirconium have resulted in a lowering of the price of zirconium metal powder, which closely resembles tungsten powder in appearance. It is expected that zirconium metal powder will be produced on a semi-commercial scale and sold at a price of about $12 per lb. for a product running over 95 per cent pure.

The price of zirkite during the first half of 1920 ranged from 4½ to 7c. per lb. in carload lots. Dead-burnt zirkite in grain or powdered form sold at 8 to 11c. per lb. Zirkite bricks in standard shapes sold at 65 to 90c. each in carload lots. The last half of 1920 witnessed a drop in prices, zirkite selling at 3½ to 4c. per lb., dead-burnt at 6 to 8½c. per lb., and bricks at 60 to 85c. each. The pure oxide sold during the first half at $1.10 to $1.20 per lb. During the last half, the price dropped to 75c. to $1 per lb., owing to cheaper methods of production.

Uranium and Radium*

By Richard B. Moore

Chief Chemist, U. S. Bureau of Mines

DURING 1919, especially toward the end of the year, the production of radium slowed up considerably. The war demand had ceased, and a considerable amount of radium was thrown back on the industry. It took practically the whole of the year 1919 to clean up this material, although some of it held over until the early part of 1920. During the latter part of 1919, a decided increase in interest in the use of radium for cancer treatment was shown by physicians.

No notable extension of the present known carnotite fields occurred during 1920. There was little development in connection with the new deposits in Grant County, N. M. However, some development is to be noted at Lusk, Wyo., where a moderate amount of ore has been mined and shipped, putting the deposit at this locality for the first time in the class of a regular producer. The average of the ore now mined is not more than 1.5 per cent U_3O_8.

Ore prices are considerably higher than they were two or three years ago. The rise is due largely to the fact that vanadium has been in great demand, and the price of ferrovanadium has been quite high. The following will give an idea of what ore of various grades is worth at the present time:

URANIUM AND VANADIUM PRICES IN 1920

Price per Pound U_3O_8		Price per Pound V_2O_5	
Grade Per Cent	Price	Grade Per Cent	Price
1.00–1.24	$1.00	4.0 to 4.99	$0.75
1.50–1.74	1.50	6.0 to 14.99	.90
2.00–2.50	2.25		
2.50–2.99	2.50		
3.00–3.49	2.75		

Price f.o.b. railroad

Another firm offers as a basic price $70 per ton for ore containing 1¼ per cent U_3O_8 and 3 per cent V_2O_5. For every additional 1/100th of 1 per cent U_3O_8 present, 80c. is added. For 1/100th of 1 per cent below 1 per cent U_3O_8 $1 penalty is assessed. For every 1 per cent V_2O_5 over the original 3 per cent, $15 is added. Not very much ore is sold on any basis, as the larger part obtained is mined by half a dozen operating companies, the small miner having been largely eliminated.

One new company, the Tungsten Products Co., of Boulder, Col., has gone into the radium business. One company, the Carnotite Reduction Co., of Chicago, during 1920 ceased the production of radium, and has been lately winding up its affairs.

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The production of radium during 1920 was the largest in the history of the industry, totaling approximately 35 gm. of radium element. This one year's output is probably greater than the total European production up to date from ores mined in Europe.

Prices of radium did not vary much during 1920. In the early spring one sale of over two grams of radium element was made at $89,000 per gram. Several bids received on this material were around $100,000 per gram. The average price on smaller lots, however, has been from $110 to $120 per milligram.

Test quotations obtained during December were as follows: One firm, $110 per milligram of radium element; two firms $120 per milligram of radium element. This shows a tendency toward the stiffening of prices, and it is even possible, if the present situation as regards vanadium which developed in November and December continues, that the prices may go up still further.

Vanadium*

By Richard B. Moore

Chief Chemist, U. S. Bureau of Mines

THE larger part of the vanadium made and sold as ferrovanadium in the United States is produced by the Vanadium Corporation of America. This company, after acquiring the interests of the American Vanadium Co., took over the holdings of the Primos Chemical Co. late in 1919, and with the exception of the vanadium produced as a byproduct in the manufacture of radium from carnotite ore, the company produces practically all of the vanadium used in the world at present. The Vanadium Corporation has pushed the production of vanadium on its properties much more vigorously than did the American Vanadium Co. It has gradually increased its production, until on Sept. 1, 1920, the monthly production was about six times the average during the last few years. The principal properties of this company are situated at Minasragra, Peru, at an altitude of over 15,000 ft. It is stated by the company that the orebody is holding up well, and that there is a large reserve of ore in sight. The average grade shipped is from 22 to 25 per cent V_2O_5. The ore is treated at the Ridgeville, Pa., plant, and converted directly in the electric furnace into ferrovanadium. The Vanadium Corporation operated a plant at Newmire, Col., originally owned by the Primos Chemical Co., all of 1920 until Nov. 1, at which time operations were closed, as it was thought best by the Vanadium Corporation to shut this plant down, as all demands can be met at present from the South American ores.

A considerable amount of vanadium concentrates, principally in the form of iron vanadate, has been put on the market as a byproduct in connection with the recovery of radium from carnotite. In a few cases a low-uranium high-vanadium carnotite ore has been treated mainly for the vanadium, the radium and uranium being byproducts. Prices allowed for the vanadium content of these ores are given under "Uranium and Radium."

There has been some small development in connection with vanadinite in Arizona. The ores are concentrated, and a small tonnage of concentrates has actually been treated for the recovery of the vanadium. There have been no commercial developments in connection with the descloizite mines of Nevada, although some experimental work has been carried on by the Bureau of Mines in connection with the treatment of this ore.

Prices for vanadium remained fairly constant during 1920: $6 per lb. was practically the average price for vanadium metal in ferro. On the other hand, the price at times rose as high as $6.50 and in the case of low-silicon and low-carbon ferro as high as $7. It has been stated that in a few cases small lots of specially high-grade ferro sold for even a higher figure.

The total production during 1920 was probably more than four million pounds, figured as vanadium pentoxide. The demand for ferrovanadium was extremely strong all year until October, when the market showed some weakness, and this developed during November and December, until at the end of the year it was extremely difficult for independent producers to sell vanadium either as concentrates or as ferro.

Petroleum

By Frederick G. Clapp

Consulting Geologist and Petroleum Engineer, New York

THE last year has been in some respects unlike any previous year in the history of oil production, as there was a critical interval of intense production, so far as the United States is concerned, and a culmination of a period of numerous incorporations and of the combination of numerous companies of large capitalization and holdings, with a subsequent severe decline in the market value of oil securities. In addition, there was the passing of the upward curve of oil production by a still faster rising consumption curve, the consequent serious diminution in the amount of oil in storage, and a rapid increase of American oil investments and holdings in foreign fields, tending to offset to some extent the bugaboo of British control. Together with these developments, there has been a continuation of the ascendancy of the so-called Royal Dutch Shell interests, aided to some extent by a knowledge of the acquirement of a substantial interest in that company by the British government, which became public news during 1920. To summarize, the year was one of semi-panic concerning the future of oil production, as well as one of limited safe and sane measures toward assuring a future supply.

TABLE I. APPROXIMATE RELATIVE RANK OF OIL-PRODUCING STATES AT CLOSE OF 1920

California
Oklahoma
Texas
Kansas
Louisiana
Wyoming
Illinois
Kentucky
West Virginia
Ohio
Pennsylvania
New York
Indiana
Montana
Colorado
Tennessee
Arkansas

At the end of 1920 the rank of the oil-producing states was as given in Table I. California took the place of Oklahoma late in the year and Colorado gave place to Montana.

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The total production for the year has been estimated by several authorities to be about 445,000,000 bbl., or about 12 per cent in excess of the 1919 production. In foreign countries little change is noted, as no new fields of importance were discovered. Hence, the order of importance of foreign nations apparently continues as I have represented in Table II.

TABLE II. APPROXIMATE RELATIVE RANK OF OIL-PRODUCING COUNTRIES AT CLOSE OF 1920

United States
Mexico
Russia
Dutch East Indies (together with British North Borneo)
Rumania
Persia
India
Poland
Peru
Japan (including Formosa)
Trinidad
Egypt
Argentina
Germany
Canada
Venezuela

It is seldom that two substantially non-producing states attain a position among the producers in any one year, but such was the condition in 1920. Both Montana and Arkansas, heretofore only infinitesimal producers, opened up one or more fields. Arkansas has produced natural gas for many years from fields of Carboniferous age in the vicinity of Fort Smith. Little drilling has been done elsewhere in the state. In April, 1920, a great gas well was completed at Eldorado, in western Union County, not far from the Louisiana line. The daily production of this well was reported all the way from 10,000,000 to 100,000,000 cu.ft., and it sprayed barrels of oil per day. The excitement caused by the well was increased in August by the announcement of an oil well opened up in southwestern Ouachita County, with a production variously estimated up to 100 bbl. per day.

Considerable testing is being done in the same general province of Arkansas, where the surface formations are of Tertiary age, underlain by Cretaceous sediments similar to those of northern Louisiana. Unofficial geological accounts emanating from southern Arkansas tell of fine structures, and more conservative geological advice emphasizes the great caution necessary in accepting without further confirmation conclusions as to structure in that region. The fundamental conditions are undoubtedly similar to those in northern Louisiana, and with more careful geological studies in the future by geologists familiar with such formations, a number of fields may be opened in Arkansas.

In Montana, gas has been produced in relatively small amounts for years, and oil in small quantity was known. The first real oil field seems, however, to have been discovered in Musselshell County in 1920. As the geological formations and types of structure are similar to those of Wyoming, Montana may be expected to become an important producing state, although careful geological explorations will be necessary, as in other oil regions.

No other states have entered the producing list, although tests are being made in New Mexico, Mississippi, Florida, and Washington, with some chances of success; wells are being sunk in search of oil in Georgia, Missouri, and elsewhere, and wildcatting continues in Tennessee and Arizona as well as in the producing states.

No year passes without new pools being opened in Oklahoma, and 1920 witnessed the usual number, including, among others, several small pools in Stephens County, the Weeleetka and Okemah pools, in Okfuskee County; a new deep-sand pool south of Muskogee, and another near the Garfield-Noble county line. Osage County has also had several important discoveries. In Kansas the new pool near Florence, in Marion County, is important.

Early in the Ranger excitement in central Texas, persons familiar with that region realized that in time the Bend limestone fields of lower Pennsylvanian or upper Mississippian age would be extended to some extent into the surrounding counties of Stephens, Callahan, Coleman, Brown, and Comanche. This extension has taken place, and during the year Callahan County at least has been added to the producing list from the Bend limestone. During the same period, Stephens County has replaced Eastland as of paramount interest and greater production. The peculiar conditions existing in the central Texas fields, involving the porosity of the limestone "sands," the water conditions, and in some localities the disastrous close-drilling of wells, have caused a rapid decline in production in nearly every pool not long after its discovery. Though this is by no mean distinctive of the Texas fields, it has had a noteworthy effect, because some of the largest operations in those fields are certain on that account to be unsuccessful. With a few exceptions the profits have been far less than those predicted by the promoters.

As an after-boom statement, one may call attention to the way in which every favorable factor in an oil field is magnified during the boom, and even the layman can now realize the part played by advertising, both legitimate and illegitimate, in the great oil booms. During the latter part of the year, the weekly statistics recorded fluctuations from loss to gain and back again to loss in production of the north-central Texas fields considered as a whole.

One result of the central Texas boom, extending over a series of years, has been the spread of leasing and wildcatting through the state, the potentialities of which had not properly been appreciated previous to the Ranger excitement. Some great gas wells have at last been drilled in the vicinity of Amarillo, in the Panhandle, and though few in number, they are so widely spaced and on such extensive geological structures that a general belief prevails that oil will be found somewhere in the same region. Unless the Permian and underlying Pennsylvanian sediments are too greatly altered by metamorphism, an oil field or fields are to be expected, as the conditions appear similar to those at Cement, Duncan, and Healdton, Okla., where oil is found in the base of the Permian or in the underlying Pennsylvanian series in many sands distributed through a great vertical thickness.

Another portion of Texas where wildcat activities have been carried on is the Edwards Plateau and Trans-Pecos region. Considered collectively, and regardless of the failures drilled during the year in Edwards, Pecos, Valverde, and Crockett counties, and of the unimportant shallow showing in Reeves County, some chance exists of discovering new and important fields in that great region.

Many of the Gulf Coast salt domes require many years to mature as producing fields, on account of small relative area and because of their having such sharp structures that a number of wells are necessary to prove them, whereas in many other oil fields a single well is sufficient. Thus it was only in October, 1920, that Fort Bend County became an important oil producer, with an initial production reported as 5,000 bbl per day from the first well. Attention must be called to the fact that the West Columbia pool, in Brazoria County, known for several years as an oil field, took a notable spurt in 1920, when the Texas Company drilled a well with authentic production of over 30,000 bbl. per day, being, with the possible exception of the Lake View gusher of California, the greatest well ever drilled in the United States.

In Kentucky and Wyoming some new pools have been discovered. The effect of the Public Land Leasing Bill, which was passed by Congress and signed by the President, seems to have been disappointing, both to companies that were expecting an immediate distribution of the impounded assets resulting from their drilling during the last few years and also to individuals who have gone to trouble and expense in finding favorable territory on the public lands, and were hoping to be awarded leases, some of which might have been tested during the year.

In the auction sales held by the Government for the Indians in Osage County, Okla., better success has been attained, and persons well informed in the oil business have been surprised at the high bonuses bid and paid for acreage. The policy of the Government in selecting the tracts for every sale in such a manner that maximum prices could be obtained has certainly been a success from the Indians' point of view, if not from that of the oil operators. Something of the demand for Osage leases can be judged by the fact that in the last sale in 1920 (on October 12) the average price paid was $100.36 per acre for 30,959 acres.

For a number of years American geologists have been calling attention to the opportunities in prospective foreign oil fields, but had received little encouragement from companies which were in the best position to enter these fields. The first signs of change in this situation took place in the interval from 1913 to 1916, when one of the largest oil companies in the United States made extensive explorations in Asia and South America, and subsequently several important expeditions entered foreign countries. Attention was called to Colombia in a practical way in 1918, when the Tropical Oil Co. (consolidated in 1920 with the International Petroleum Co.) drilled a 1,000-bbl. well on its concession 350 miles up Magdalena River in the interior of that country, and since that time various companies have acquired interests, culminating in 1920 in what might be termed an oil rush to Colombia.

Oil operators were temporarily discouraged by the passage of a law by the Colombian government modeled somewhat on the Mexican oil law. The new law has been generally objected to by American companies. Although not retroactive, like the Mexican law, it has some objectionable provisions. During the time when the Tropical and some other companies were exploring Colombia, the General Asphalt Co. and its subsidiaries were conducting similar explorations in Venezuela, with the assistance of several of our foremost geologists. As a result an average of 10,000 bbl. per day is said to be now shipped from one field alone in Venezuela. A large interest in General Asphalt has been acquired by the Royal Dutch Shell combine.

Much new exploration work has been done in Mexico since the downfall of the Carranza government; and there are indications that the difficulties between the Mexican government and American oil companies are near a satisfactory settlement. All is not yet harmony, but sincere efforts seem at last to be in progress on both sides, which cannot be said of efforts under the previous régime. The greatest disappointment in Mexico is the entrance of salt water in large quantities into the principal fields of the Vera Cruz Province and the consequent drowning of many of the greatest wells, so that several of the pools are now practically abandoned, and the end of production in that region appears to be in sight unless new pools are opened.

It is my belief that this country will not be in the background when future discoveries of petroliferous substances are made. American enterprise is as energetic as ever, and it is now realized—what many enthusiasts did not appreciate twenty-five or fifty years ago—that oil fields are rapidly exhaustible. The lesson of 1920 seems to be not to restrict the nation to any single plan for the future. The American petroleum industry should avail itself of every means at hand to protect present and to assure future petroleum supplies, including greater efficiency in production, recognition of oil-shale possibilities, discovery of vegetable substitutes for gasoline, and the prosecution of the most scientific and systematic campaign for foreign development in those countries where conditions are now known to be favorable, so that in coming generations the United States may control its equitable share of the world's petroleum.

Abrasives

BY J. VOLNEY LEWIS

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ABRASIVES were in great demand during the greater part of 1920, but the general slump in business in the last quarter brought the industry to its lowest ebb for many years. Prices changed little during the year, but there was a slight tendency toward higher quotations for natural abrasives and manufactured products than during 1919. There is a universal feeling that the present depression is only temporary. Prices will doubtless be reduced, but producers say this is possible to only a slight extent, as abrasive prices have never been advanced from pre-war levels in a degree commensurate with other commodities.

Emery and Corundum.—The total production of American emery for 1920 will be about the same as in 1919, possibly not over 1,000 tons. Imports for the year are much smaller than in 1919. Grecian and Turkish emery have been scarce, owing to the disturbed conditions in those countries and the continued inactivity of the mines. Prices are higher than in 1919, but the volume of business has been less.

The total production of garnet from the Adirondacks for the year 1919 is estimated at about 6,000 tons. The figures for 1920 will be lower. During the first half of 1920, the business in artificial abrasives exceeded all previous records. There was a severe decline, however, in the later months of the year, and by December the electric furnaces were producing only about 25 per cent of their capacity. There were no price changes of consequence in 1920. Manufacturing costs advanced sharply, owing chiefly to higher freight rates. The production of aluminous abrasives, adapted to a wide range of uses, has gradually monopolized the abrasive field, due to the attainment of a higher degree of uniformity than is possible with natural materials.

Imports for ten months of 1920: Crude artificial abrasives, 56,584,065 lb., valued at $1,429,182; emery ore, 4,590 tons, valued at $154,957; corundum ore and grains, 2,522 tons, valued at $270,905; rottenstone and tripoli, 791 tons, valued at $14,370; all others, $328,928. Exports for nine months of 1920 of grinding wheels and other abrasives totaled $4,895,560 as compared with $4,427,745 for the corresponding period of 1919.

Asbestos[*]

By Oliver Bowles
Mineral Technologist, U. S. Bureau of Mines

THE United States produces only a small proportion of its requirements of asbestos. With the exception of a small output by the John D. Hoff Co. in California, the entire domestic production of spinning fiber comes from Arizona. The Arizona Asbestos Association is the chief producer, but active operations were conducted also during 1920 by the Regal Mine, the American Ores & Asbestos Co., the Colorado Arizona Asbestos Mining Co., and the Alene Asbestos Association. According to U. S. Geological Survey statistics, the 1919 production for Arizona was only about 420 tons. The 1920 production probably exceeded 1,000 tons. A plant is now being equipped to resume long-suspended operations in the Vermont asbestos area.

In the Quebec field, which is America's chief source of supply, production was low during the severe winter months, but later increased greatly. Advancing costs, decreased production, poor transportation, and heavy demand for asbestos pipe coverings led to a remarkable price advance, Crude No. 1 rising from about $1,800 per ton in 1919, to $3,000 early in 1920, and the price holding at $2,000 to $2,400 toward the end of the year. Acute car shortage early in 1920 resulted in stocking of warehouses, and shipment largely of high-grade fiber, with an ensuing shortage of lower grades in the hands of American manufacturers. Twice during the year shipments were made by barge from Quebec via Lake Champlain. Total importations from Canada, for the first nine months, of 124,614 tons, as compared with a total of 135,861 tons for 1919, indicate that shipments were rapidly returning to normal during the last six months. Curtailment in automobile manufacture resulted in a decided falling off in orders for brake-band fiber, which, however, had little effect on prices.

South Africa is becoming an important factor in the asbestos situation. Imports for the first nine months amounted to about 3,450 tons, practically all of which was of spinning grade. Much of the African fiber requires special treatment, but this difficulty is being gradually overcome. Cape blue is now being fiberized and prepared for manufacturers in America by a New Jersey company using a process that is especially efficacious in the treatment of this type of asbestos.

Barytes

By J. B. Pierce, Jr.
Chief Chemist, Rollin Chemical Corp., Charleston, W. Va.

THE barium industry at the beginning of 1920 evinced every indication of a good year. Especially was this true of the crude ore, barytes, and, to a lesser extent, of the entire list of manufactured barium products. Good-grade washed barytes sold for approximately $10 per long ton, and some small tonnage is reported to have been sold as high as $12. Until the last quarter of the year, when the demand slackened off, good ore was almost unobtainable unless contracted for during the last of 1919 or the first of 1920.

A great deal of prospecting and new development in the Appalachian barytes field was carried out in 1920. Most of this work did not lead to the opening up of new mines of consequential output, but the trend of the prospecting seemed to be away from the Cartersville district, in Georgia, the heaviest producer in the Appalachian field since 1916, toward the Tennessee fields, particularly in and around Sweetwater; also, into the North Carolina fields, especially in the vicinity of Stackhouse and Hot Springs. At the former place the Rollin Chemical Corporation opened a new mine adjacent to the old Stackhouse mine, on the French Broad River.

It is impossible at the time of writing to give authentic figures for the production of barytes for 1920, but the total production for that year should be close to 200,000 short tons. The barium products business was active over the greater part of 1920, with a good volume of trade and good prices. The closing down of the rubber industry during the late summer had a depressing effect on the blanc fixe business. The production of lithopone, blanc fixe, and barium carbonate will be maintained at about recent past levels and may even increase slightly. Ground barytes, barium chloride, barium peroxide, and other barium chemicals will doubtlessly show a slight reduction.

During 1920 there were no technical changes or advances of note in the industry, which was seriously depressed during the last quarter of the year by small importations of foreign goods. The depression was rendered more acute by reports of larger importations to follow, which were supposedly going to be offered at large price concessions. Therefore the barium industry is watching with great interest the tariff situation, as it is vital for its survival that adequate protection be given it.

Bauxite and Aluminum[*]

By James M. Hill
Geologist, U. S. Geological Survey

THE output of bauxite during 1920 was considerably larger than in the previous year, being estimated at nearly as much as the record output of 1918, which was 605,721 long tons, and close to double the output of 1919. This increased production was largely from the Arkansas fields, as operations in the eastern fields slackened in 1920. In the Bauxite, Arkansas, field, the Republic Mining & Manufacturing Co. installed steam shovels working on heavy overburden and ore. Mining there resembles the open-pit work in iron and copper mines.

Imports of bauxite for the first six months of 1920 were 5,707 long tons, and it is believed that nearly 15,000 tons was received during the year from South America. It is rumored that the Sollers Point project of the Aluminum Company of America has been abandoned, and that South American bauxite will be sent to East St. Louis for its preliminary treatment.

There is little information concerning the domestic aluminum-making industry. Apparently, the Badin plant, in North Carolina, is nearly at full production, and it is believed that the total output of aluminum in 1920 will be considerably larger than in 1919, in which year production was curtailed, owing to large accumulations of metal that were not used during the war.

Imports of crude aluminum and scrap metal for the nine months ended Sept. 30, 1920, were 32,533,000 lb., valued at $9,796,600, and manufactured articles valued at $1,488,000. This is more than twice the quantity imported in 1919. Exports of aluminum for the first nine months of 1920 were 6,823,000 lb. of ingot metal and alloys; 1,579,000 lb. of plates and sheets; and manufactured articles valued at $1,699,000. The total value of all exports was $4,350,000, or nearly $1,000,000 more than for 1919.

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Apparently the aluminum industry is in a healthy condition, and should be in a position to make a considerable increase in output now that the domestic and South American sources of bauxite are in condition to supply almost unlimited quantities of ore and hydroelectric installations are nearing completion. In Europe the aluminum situation will in the future be controlled by the Compagnie d'Alais, as it recently absorbed the Société Electrometallurgique Français. The new organization controls 90 per cent of the aluminum-producing capacity in France, besides the works in Norway and an interest in the Italian works.

Borax

By George J. Young

Western Editor *Engineering and Mining Journal*

BORAX is produced by the mechanical and chemical treatment of colemanite, which is mined from comparatively extensive deposits in the Furnace Creek area in the Death Valley region of California and from minor deposits in southern California. The most important company of the industry is the Pacific Coast Borax Co., which controls the Furnace Creek deposits. The Sterling Chemical Co. also mines colemanite.

During 1920 the American Trona Corporation produced borax from fractional crystallization of concentrated brines obtained from Searles Lake. The borax is a byproduct obtained in the separation of potash from the brines. Fertilizer requirements necessitate the removal of borax from the potash. As a consequence, a considerable amount of the borax byproduct from this region must compete in a market which is already well supplied.

Both Chile and Asia Minor supply the borax market of Europe, and there is therefore little outlet for surplus production in this direction. At Searles Lake, the Solvay Process Co. made no borax production during 1920. The West End Chemical Co., which installed a plant for the production of potash, stated in its report of April, 1920, that facilities for the manufacture of borax would be constructed as soon as potash production begins.

Although the production of borax is closely controlled, prices did not greatly rise during the war period. The average wholesale price for 1920 was approximately 8c. per lb. for sodium tetraborate, powdered. During the period since 1916, wages have advanced 198 per cent and coal and cost of supplies 100 per cent at the borax mines. In 1919, a total of 28,518 tons of borax, valued at $4,351,891, was produced, as against 26,673 tons in 1918, valued at $3,909,565. The 1920 production will probably not exceed that of 1919.

Operations of the Pacific Coast Borax Co. at Ryan continued throughout 1920. Labor was inadequate in amount and quality, but the labor situation became more satisfactory toward the close of the year. Housing facilities and dormitories were erected by the company. A 500-hp. Diesel engine was put in and some additions were made to the calcination plant at Death Valley Junction.

Fluorspar[*]

By Raymond B. Ladoo

Mineral Technologist, U. S. Bureau of Mines

THE production of fluorspar, which showed a decided drop in 1919, from the peak reached in 1918, apparently recovered somewhat in 1920. The tonnage mined by a group of producers in the Illinois and Kentucky fields, which furnished 70 per cent of the output in 1919, showed an increase in 1920 of about 10 per cent over the production for the previous year. Other mines in this field which mined little or no ore in 1919 were again producers in 1920.

In Colorado, conditions were reported to have been much better than in 1919, and a considerable increase in tonnage probably resulted. In New Mexico, where production has never reached capacity, there has been much activity, and the output probably exceeded that of any previous year. The open-hearth steel industry, which normally consumes about 83.5 per cent of the fluorspar produced, in the form of gravel spar, was very active during 1920, and probably consumed 140,000 to 145,000 tons. From all the available data it would thus appear that the total production was in excess of 145,000 tons and possibly over 150,000 tons.

Imports of fluorspar were much larger in 1920 than in any year since 1913, and they were increasing during the latter part of the year, being over 4,000 tons in September and October. Total imports probably were over 20,000 tons, of which more than 75 per cent came from England and about 20 per cent from Canada. The average declared value of English spar for the first half of the year was about $10 per ton and of Canadian spar about $15 per ton.

Prices on gravel spar were somewhat lower in 1920 than in 1919, a reduction of $5 in the base price being noted. The price of 85 per cent gravel spar, f.o.b. Kentucky and Illinois mines, was $22.50 to $27 per ton, with an average of $25. New Mexico spar averaged $15 per ton, f.o.b. shipping point, a net increase of $1 per ton, due to lower freight rates to the East. Acid-lump spar was greatly in demand at prices from $50 to $60 per ton. At the end of the year, many smaller mines were closed, because of lack of orders, but larger companies were working to capacity on old contracts.

The market is now dull but prices are firm.

Fuller's Earth in Georgia

By S. W. McCallie

State Geologist, Atlanta, Ga.

UNUSUAL activity in the fuller's earth industry of Georgia is to be recorded for 1920. Considerable money was expended in prospecting in Stewart and Decatur counties. In the latter county the Atlantic Refining Co. was successful in locating a large deposit of high-grade fuller's earth suitable for the refining of mineral oils, and the company erected a refining plant which produced its first output in October, 1920. The maximum daily production of the plant is 200 tons. The thickness of the deposit of fuller's earth now being worked varies from 3 to 7 ft.

The plant of the Georgia Reduction Co., situated on the Dublin & Savannah R.R. fourteen miles south of Macon, was seriously handicapped by lack of labor and coal during the early part of the year. In the last two months, however, labor at reduced wages has been plentiful and the coal supply has been satisfactory. The output, used almost entirely for refining vegetable oils, is materially increasing from year to year. This is due to domestic fuller's earth replacing the English earth, which prior to the World War was used extensively in this country.

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[Production statistics for fuller's earth for 1920 are not available. In 1919 the U. S. Geological Survey estimates production in the United States as 106,000 short tons, valued at $2,000,000, or $18.87 per ton. Florida produced 90 per cent of the entire production in 1919. Imports in 1919 were 13,873 tons, valued at $189,711. According to our information both domestic production and imports in 1920 exceeded those of 1919. Florida still occupies the position of leading producer, and there have been no new developments of importance in states other than Florida and Georgia. Prices remained steady at the close of 1920. Continued prosperity is closely related to the prosperity of the lubricating oil industry. —EDITOR.]

Graphite Industry

BY BENJAMIN L. MILLER

Professor of Geology, Lehigh University, Bethlehem, Pa.

AGAIN the graphite producers of the world report a disastrous year. Indeed, there was greater depression during 1920 than in 1919. Although graphite is used in a large number of articles, the greater portion of the production has gone into the manufacture of graphite crucibles, for which only the best grades are suitable. Graphite from Ceylon has long held the field.

When the armistice was signed, the principal manufacturers of graphite crucibles had on hand large quantities of high-priced graphite, and the producers likewise had large supplies ready for shipment. The demand for crucibles diminished, and there still remain available large amounts of graphite produced under war conditions. The inevitable result was a fall in the market prices to a point below the cost of production. At present there remain unsold thousands of tons of Ceylon, Madagascar, and domestic graphite, and until this accumulated surplus has been absorbed there is little chance of general revival of the industry.

The Alabama graphite industry is practically stagnant. Several companies operated for short periods during the early part of 1920, but at the close of the year only the Superior Flake Graphite Co., of Clay County, and the Ceylon Co., of Coosa County, were in operation. In addition, the mill of the Flaketown Graphite Co., of Chilton County, was rebuilt and will soon begin operations. Similar conditions prevailed during the year in the graphite districts of New York, Pennsylvania, Texas, and Montana. Some graphite for paint was mined at L'Anse, Mich. Rhode Island continues to produce an impure variety for foundry facings.

In the opinion of persons familiar with the situation, the domestic flake-graphite industry cannot prosper unless Congress levies an import tax on the graphite of foreign countries.

Foreign Countries—The Black Donald Graphite Co., at Calabogie, Ontario; the Quebec Graphite Co., and the Consolidated Graphite Mining & Milling Co. of Buckingham, Quebec, operated during 1920. These mills have installed the Callow flotation system, with excellent results. They are producing graphite for other than crucible purposes, and the Quebec Graphite Co. is entering the field as a manufacturer of greases, stove polish, paints and other articles. The amorphous graphite deposits of Sonora, Mexico, were worked during 1920. This material is used for pencils, foundry facings, and like applications. There was practically no mining of graphite in either Madagascar or Ceylon in 1920, on account of the large supplies on hand and the prevailing low prices.

Prices—There was no market of consequence for graphite during 1920. Lump Ceylon graphite sold in Colombo for 7c. per lb. and in New York for 8½c. Madagascar flake of 85 per cent C sold in New York for 4c. per lb., and there are reported to be from 35,000 to 40,000 tons still stored in Madagascar, in Marseilles, and in New York. There has been no regular market for domestic flake, but sales have been made for 6c. per lb. and less, probably in almost every case at a price less than the cost of production.

Gypsum

BY FRANK A. WILDER

Southern Gypsum Co., North Holston, Va.

THE gypsum industry made more progress in 1920 than in any previous year in its history. When tonnage figures are compiled, they will undoubtedly show the largest output that has yet been attained. The steadily rising production before the war was disturbed by the war-time drastic regulation of building operations. Most of the gypsum mined is made into plaster, and, as plaster is one of the last of the materials used in a building, the gypsum industry does not respond to initial building operations, and, conversely, it does not feel the effect of a building depression as soon as most other building materials. It was midsummer of 1919 when the gypsum industry responded to the building revival, and it did not experience the depression that came in the fall of 1920.

Considerable additional capital came into the industry through the combination of the American Cement Plaster, the Best Wall Board, and the Beaver Board companies. This group of interests is well fitted to push the use of gypsum plaster board and gypsum wall board, and the way for such development was prepared by the remarkably satisfactory showing made by gypsum boards when tested by the Government during the war.

The outstanding feature of 1920 in relation to the gypsum industry was the publication by Reimer, in Oregon, of the results of careful experimentation with gypsum, or calcium sulphate, and sulphur, as fertilizer for alfalfa and other legumes. Reimer's work was, during the year, supported by other agricultural chemists, and the importance of gypsum as a fertilizer again seems to be winning recognition. When used with finely ground raw phosphate, a fertilizer is formed which has more available plant food at less cost than is obtained in acid phosphate.

In 1919, according to the U. S. Geological Survey, 2,430,000 tons of crude gypsum was mined in the United States. In order of importance the principal producing states are New York, Iowa, Michigan, Ohio, Texas, and Oklahoma. Production from western states is not differentiated. About 1,397,000 tons of stucco, plaster of paris, wall plaster and Keene's cement were made from calcined gypsum in 1919

Magnesite*

By R. W. Stone
Geologist, U. S. Geological Survey, Washington, D. C.

THE quantity of domestic magnesite mined in 1920 exceeded that mined in any previous year except 1917. Despite the contention of domestic producers in 1919 that without a tariff the eastern market would be supplied with European magnesite and that companies having large investments in magnesite deposits and plants in California and Washington would be forced out of business, no tariff legislation was enacted, and the industry has not suffered.

Preliminary figures reported by the U. S. Geological Survey indicate that the production of crude magnesite in Washington was about 225,000 short tons, as compared with 106,200 tons in 1919. Practically all was dead-burned and was sold as refractory material to steel companies and manufacturers of refractory products east of Chicago. The figures for California are not yet available, but the output of crude magnesite in the state was about 60,000 tons. California and Washington are the only producing states, and the total output for the United States was therefore probably between 275,000 and 300,000 tons.

The imports from Jan. 1 to Sept. 30, 1920, amounted to 20,730 tons of crude and 10,439 tons of calcined magnesite, as compared with 6,381 tons crude and 9,471 tons calcined entered in 1919. Estimated as crude magnesite, the imports for the first nine months of 1920 were about 41,600 tons, as compared with 25,300 tons in 1919. The imports in 1920 probably amounted to about 50,000 tons of crude magnesite, or double those of 1919.

On Jan. 13, 1920, the Senate Finance Committee held a hearing at which users and importers of foreign magnesite presented their objections to a tariff on magnesite. An investigation of the relations of time, temperature, and size of particles in the decomposition of magnesite was made during the year by the Bureau of Mines in co-operation with the Northwest Magnesite Co. at the mining experiment station at Berkeley, Cal. An electrically heated rotary furnace was used for the experiments in calcination. Experiments show that Washington magnesite is suitable also for use as plastic material, and preparations are being made to calcine it at the mines near Valley, Wash., for use in cement.

The Mica Industry

By J. Volney Lewis
Professor of Geology, Rutgers College, New Brunswick, N. J.

THE mica industry was prosperous during the first three quarters of 1920, but the year did not end with the promise with which it opened. With the general industrial decline during the last quarter demand rapidly fell off, surplus stocks (both domestic and imported) accumulated, and prices dropped 10 to 20 per cent in the various grades.

Importations of mica increased in 1920, reaching in the first ten months of the year 1,375,927 lb. of uncut mica, valued at $1,206,443, or nearly double that of the corresponding period of 1919. Cut mica was imported to the value of $1,656,182 in the same period. Good mica is coming not only from India but in increasing amounts from Brazil and Argentina, and some also from South Africa, China, and several other countries. Excepting in India, standard methods of grading and preparation for market have not yet been established, and hence the product is at a disadvantage in competition with mica from India. Exports of mica during the ten-month period were valued at $242,381, about 10 per cent of the value of imports.

Despite the depressed condition of the industry as the year closed, there is a note of optimism in many quarters. A gradual resumption of suspended industrial activities is expected within the next few months, and with it a revival of the demand for mica in its numerous applications. Some even go as far as to predict a decided increase in domestic production and imports in 1921, compared with 1920. A more conservative view is that 1921 will do well to equal 1920.

DECLINE IN PRICES OF DOMESTIC MICA AT FRANKLIN, N. C., IN THE LAST QUARTER OF 1920.

Sizes	1st Three Quarters	Last Quarter	Sizes	1st Three Quarters	Last Quarter
2 x 2	$1.15	$0.85	3 x 5	$2.75	$2.50
2 x 3	1.65	1.25	4 x 6	3.75	3.50
3 x 3	2.10	1.75	6 x 6	6.50	6.00
3 x 4	2.50	2.25			

Monazite

By H. C. Meyer
Vice-President, Foote Mineral Co.

THE two important commercial sources of monazite sand are those along the coast of Brazil from Victoria north to Bahia, and the deposits along the seacoast of Travancore, in southern India. The purification of the sand is effected on concentrating tables and finally by electro-magnetic separators. By this means, practically all the quartz, zircon, ilmenite, garnet, and other impurities are eliminated, and a product is secured which contains over 90 per cent monazite, a cerium-lanthanum-didymium phosphate.

Monazite sand is the only important commercial source of thorium. Brazilian sand carries from 4½ to 6 per cent of the oxide and Indian sand runs from 8 to 9 per cent. At one time there were numerous small producers scattered through the states of North and South Carolina, but such deposits have not been worked for many years. An extensive source is said to exist near Pablo Beach, Florida, and an attempt has been made to work the deposits on a commercial scale.

It has been estimated that the world's consumption of monazite is approximately 3,000 tons per annum, all of which is used for its thorium content, which is converted into the nitrate. The only commercial use of thorium nitrate is in the manufacture of incandescent gas mantles.

The rumor that the British government intends to return the Indian deposits of monazite to Germany may have a decided influence on the price of the nitrate, which remained firm throughout 1920. Case lots containing 144 lb. of nitrate sold at $3.75 to $4 per lb., depending on quantity. Monazite sand, guaranteed minimum 6 per cent thorium oxide, ranged from $25 to $30 per unit, duty paid. So far as is known no Indian monazite was offered in 1920 on the open market in this country. Enormous quantities of cerium, lanthanum, and didymium are obtained as byproducts in the manufacture of thorium nitrate, but only a small portion of these so-called cerium residues are utilized in the manufacture of ferrocerium.

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Nitrates

PREPARED BY EDITORIAL STAFF

AT THE close of 1920 there were considerable stocks of nitrate in the hands of producers and dealers, due to the delay of purchases until the actual consuming season. Prices declined during the year, being quoted in February at $3.85 per cwt. and in December at $3. The decline has tended to hold off consumers from the market and has made curtailment of production probable. The deliveries in the United States for the last half of 1920 are estimated from advices abroad at 545,000 tons, compared with 105,000 tons for a similar period in 1919. Total supply in sight on Dec. 31 was estimated 2,241,000 tons (of which 1,340,000 tons is the stock in Chile), compared with 2,134,000 tons on the same date in 1919. The prospects of a large increase in consumption are doubtful because of the uncertain economic situation.

Chile supplies practically the entire world with nitrates, and has a Nitrate Producers' Association, consisting of about 97½ per cent of the producers, which negotiates the sales. Since its inception on Jan. 10, 1919, it has sold 3,285,000 tons. About 620,000 tons was sold outside the organization during the same period. Cost of production, due to a drop in the price of coal and bags and lower exchange, has fallen appreciably. Germany prohibits the importation of Chilean nitrate and relies entirely on domestic production of synthetic nitrates, which is greatly encouraged through financial arrangements. It is estimated that German synthetic nitrogen production will amount to 1,250,000 tons for the year ending June, 1921.

Phosphate Rock*

BY R. W. STONE

Geologist, U. S. Geological Survey, Washington, D. C.

THE notable feature of the phosphate-rock industry in 1920, according to the U. S. Geological Survey, was the increase in production in the Western States. Shipments from Idaho ran from 2,000 to 3,500 tons per month in the early part of the year, but were more than 8,000 tons in a single month after midsummer. About 20,000 tons was shipped before July—more than in any previous entire year. The total output of the Western States in 1920 is estimated at 65,000 tons, in comparison with 17,000 tons in 1919.

Early in the year reports were published that a contract had been made for large shipments of Idaho phosphate rock to Japan. Several hundred tons were shipped from the Idaho field to Yokohoma in March, May, and June, but regular shipments were not continued. A large part of the Idaho output was sent to points on San Francisco Bay, and a few shipments were made to Chicago and farther east. Several thousand tons was sent to Anaconda, Mont., for conversion into acid phosphate at the new fertilizer plant of the Anaconda Copper Mining Co., built in connection with its smelter. Shortage of freight cars hampered the industry in Tennessee, but the production of the old and some of the new companies was probably considerably greater than in 1919. Operations in Florida phosphate were pushed throughout the year. The shipments from the pebble field were probably more than 2,000,000 tons, and it is estimated that the total shipments from the state were as great as those in the peak year 1913, and may even have surpassed them. The demand for phosphate for exportation was good, and many shipments were made to northern Europe.

Total production of phosphate rock in the United States in 1920 was about 3,265,000 long tons, as compared with 2,249,000 tons in 1919.

Phosphate lands in the Western States are now open for leases and permits, which will be issued by the General Land Office. The minimum royalty is 2 per cent of the gross value of the output, and a rental of 25c. an acre will be charged for the first year, 50c. an acre from the second through the fifth year, and $1 per acre thereafter. No leases will be given for more than 2,560 acres.

Potash

BY FREDERICK W. BROWN

Secretary, U. S. Potash Producers' Association, Washington, D. C

MOST of the American potash plants operated continuously in 1920. Importations of German and French material were heavy during the first six months, and though the official figures are not available, they will undoubtedly show a total close to 220,000 tons K_2O. This is to be compared with 270,000 tons in 1913. The price of the foreign salts held up to a level permitting American competition until November, when price-cutting by both French and Germans resulted in cancellations of many contracts with American plants by the fertilizer companies.

Complete figures of American production during 1920 are not available, but it will probably amount to about 40,000 tons K_2O. This is considerably below the normal capacity of the plants, which is at present close to 75,000 tons. In Nebraska, the weather for the first time since the plants were established proved unfavorable for maximum summer production. The same climatic conditions also hampered the Utah companies using solar evaporation.

At Searles Lake two companies produced continuously throughout 1920, but not at full capacity, owing to changes of equipment being installed. A third company, which will use solar evaporation and a seasonal process, has about completed its plant, and should market its first "crop" of potash in 1921. The large plant being constructed at New Brunswick, N. J., to recover potash from greensand, will start up early in 1921, but will not come into full operation for several months.

With the uncertainty as to the future of the industry, new development has been limited. Several companies which planned to produce from alunite in Utah are waiting for more stable conditions, and operations on Texas brines have not progressed beyond the acquisition of the lakes, either by lease or purchase. There has been no extension of the industry in cement mills, blast furnaces, sugar factories, or molasses-distillery plants, although many companies in these industries have made all preliminary investigations and are waiting to install potash-recovery apparatus as soon as it appears that American potash is to be protected in some way against the German syndicate. Every effort is to be made to bring the situation of American potash before Congress, so that proper action to encourage the development of the industry may be taken. American producers feel more than ever convinced that, with a brief period of protection, the industry can be put on a basis where it need not fear competition from any foreign source.

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Precious Stones

By George F. Kunz
Gem Expert, New York

THE mining and search for diamonds and other precious stones was actively pursued in 1919 and in the first half of 1920, the extraordinary demand offering the greatest possible encouragement. In 1919 the imports of precious stones and pearls reached the enormous total of $105,273,543. In 1920 heavy imports continued, the total for the first nine months being $63,185,739, a higher figure than for any similar period except that of 1919. The decrease applied to diamond and pearl imports only, the value of other precious stones showing an increase of nearly $4,000,000.

The South African diamond mines were successfully worked in 1920. Several new areas have been opened up, notably in the Postmastburg region, about 140 miles west of Kimberley, where several productive "pipes" have been discovered during the last two or three years. Thlaping farm, on Taung's Reserve, Bechuanaland, proved disappointing, as only 7,207 carats of diamonds had been secured up to the end of June. The Southwest African fields, formerly exploited by Germany and now under English control, have been worked by the new owners, the Consolidated Diamond Mines of Southwest Africa, an enterprise in which some Americans have an interest.

In the Belgian Congo, in 1920, the development in the Kasai diamond fields by the Forminiere Co. was pushed, but no attempt was made to increase the diamond production. About 215,000 carats of diamonds were produced. The company directed with satisfactory results the development work of six associated companies in their respective concessions. One of these companies operating in Angola, or Portuguese West Africa, in 1920, produced approximately 100,000 carats.

Pike County, Ark., was exploited for diamonds in 1920, and mining for diamonds in the United States has actually begun. The preliminary work brought to light about 3,000 stones, averaging four-tenths carat in weight. British Guiana produced 18,159 carats of diamonds in 1920.

Sapphires have been much favored, and command higher prices than ever before. In the last twenty years as much as $2,000,000 worth of sapphires has come from the Montana fields. Queensland, Australia, and Burma have also produced many sapphires. The Burmese mines continue to supply the bulk of the world's rubies. Two new gem minerals are of interest. Scapolite, yellow, transparent, and of gem quality, has lately been found by Lacroix, together with beryl, euxenite, and monazite, in a potash-pegmatite at Tsarasaotra, Madagascar. Fibrolite (sillimanite), susceptible of being cut into gems, has been found in Burma and Ceylon, and is described by L. J. Spencer. A new and interesting find of precious turquoise has recently been reported from Argentina. Jade, the rich green variety of jadeite from Burma, has been mined to a greater extent in the last year than previously. California produced a number of the minor gems, such as tourmaline, kunzite, and beryl. A new and promising opal field was discovered in 1915 at Stuart's Range, South Australia, and in 1920 still another good field has been found in Tintenbar, not far from Sydney, New South Wales. The opals from Nevada, having a large water content, are chiefly of value as mineralogical specimens.

Strontium

By J. B. Pierce, Jr.
Chief Chemist, Rollin Chemical Corp., Charleston, W. Va.

THE strontium industry was practically at a standstill during 1920, both as regards the crude ore, celestite, and the manufacturing of strontium products. So far as can be ascertained at the moment, there was no development or production of celestite in this country in 1920.

It is reported that a small amount of strontianite was mined in California. A small quantity of celestite was imported from England, which was used to manufacture strontium nitrate, which was the only strontium product manufactured in the United States in the year under review. No figures are available for 1920 production.

Sulphur and Pyrites

By Arthur E. Wells
Metallurgist, New York

THE use of brimstone for the manufacture of sulphuric acid was even more widely practiced in 1920 than in 1918 and 1919, and present indications are that all acid plants situated at any distance from the seacoast will continue for several years at least to find brimstone the more economical material. Any general competition between brimstone and Spanish pyrites which was active during the first half of 1920 will probably be confined to the sea-coast districts. After some months of active competition with brimstone, the delivery of Spanish pyrites was greatly hindered and nearly completely eliminated during the latter half of the year, because of strikes and transportation difficulties in Spain. As these conditions are gradually being remedied, it is expected that the Spanish pyrites will make its reappearance early in 1921, in even larger tonnage than during the first part of 1920.

To meet the price of brimstone during 1920, Spanish pyrites has been sold at seaboard for as low as 12 and 13c. per unit of sulphur contained, which approaches closely the pre-war price for that material and is equivalent to $16 to $18 per ton of brimstone. Most of the domestic pyrites producers in the East have not been able to meet the low prices at which brimstone and Spanish pyrites have been sold, and operations have been greatly curtailed or in many cases completely stopped. The present outlook for the domestic pyrites producer is not encouraging, for only in a few special cases where high-grade lump pyrites can be produced cheaply and immediately adjacent to inland acid plants is there any field for the domestic pyrites in competition with the cheap and at present plentiful brimstone, or the potentially enormous supply of cheap Spanish pyrites.

As producers of brimstone, the Texas Gulf Sulphur Co., at Matagorda, Tex., has taken the lead, maintaining a steady output, averaging more than 2,500 tons per day, and accumulating a stock of approximately 800,000 tons. The Union Sulphur Co., at Sulphur, La., was practically closed down during many months of 1920, and on resuming operations later in the year, experienced some difficulties in production, and has not as yet returned to a pre-war normal production. In filling orders during 1920 the Union Sulphur Co. shipped from its accumulated stock, which in 1918 and 1919 amounted to over 1,000,000 tons. The Freeport Sulphur Co., at Freeport, Tex., has been producing 700 tons per day.

The prices for brimstone have been irregular, averaging around $14 at the mines, though considerable tonnages were sold for much less, even as low as $10 per ton. With these prices, the sulphuric-acid industry, except for some sea-coast plants which have extensive pyrites burning equipment, will probably continue largely on a brimstone basis.

Talc and Soapstone*

By Raymond B. Ladoo
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THE talc industry was active in 1920. Preliminary estimates for the year indicate a production of over 200,000 tons, valued at more than $2,200,000, which will exceed that of any previous year, both in tonnage and in value. Imports of talc were heavy, and probably totaled over 24,000 tons, with a value in excess of $475,000. The largest total of imports in any previous year was 18,882 tons, in 1916, and the largest value was $269,497, in 1917. About 70 per cent of the imported talc came from Canada, about 20 per cent from Italy, about 8.5 per cent from France, and the remainder from England, Austria, British West Indies, Denmark, Germany, and Sweden.

In the United States, Vermont easily leads in tonnage and possibly in value, with a production of over 94,000 tons, valued at over $830,000. New York stood second; but, although no figures are available, it is probable that production was not much larger than in 1918, when about 71,000 tons, valued at about $900,000, was mined. Though Vermont production is increasing, that of New York seems to be declining. Talc production in California was probably the largest ever reached. Several companies have been operating to capacity, and one company reports production increased from 3,200 tons in 1919 to 8,000 tons in 1920. Production in the South was small, but may show some increase over 1919.

Prices on the average increased 10 to 15 per cent. individual companies reporting from 0 to 25 per cent increases. Demand was strong until November, with orders unfilled owing to car shortage. Little new business was booked after November, many consumers withdrawing from the market and withholding contracts for 1921. Producers are now either stocking finished talc or working part time. Although some mill expansion is under consideration, the outlook for 1921 is uncertain.

Soapstone—Little information on production is available, but probably there was some increase over 1919, due to the large volume of building contruction during the early part of the year. At the close of 1920 the demand was poor.

Arizona

By Chas. A. Mitke
Consulting Mining Engineer, Bisbee, Ariz.

IT HAS BEEN estimated that Arizona produces over 40 per cent of the copper mined in the United States. Over one-half of this amount comes from the low-grade or so-called porphyry deposits. Most of the silver and gold is derived from copper ores, and may, therefore, be classed as byproducts.

At the beginning of 1920, sales of copper metal were fairly satisfactory, and it was hoped that production, which approximated 50 to 70 per cent at that time, might possibly be increased to normal by the end of the year. Unfortunately, reversal of economic conditions necessitated further curtailments and reductions in wages, and many of the small producers were forced to close down.

Practically all of the larger companies have from one to six months' production of unsold copper on hand, which in some instances has required the borrowing of considerable sums of money in order to continue operating. As most of this copper was produced under conditions of high wages and high costs of supplies, the present market price of the metal is inadequate to balance the cost of production.

Labor conditions in the state during 1920 were satisfactory. The recent advances in freight rates will involve an appreciable increase in the net cost of copper, so much so that relief is being sought through the proposed construction, by a company representing a number of the copper interests in the state, of a railroad from the town of Ajo to a port on the Gulf of Lower California. This line would be a continuation of the present railroad from Gila Bend (on the main line of the Southern Pacific) to the mining town of Ajo, where the New Cornelia Copper Co. is situated, and would offer water transportation from the proposed port, through the Panama Canal, to the refineries in the East. A local powder factory is under construction at Land Station, eleven miles southeast of Benson, and connected with the E. P. & S. W. It is proposed to obtain a large proportion of the necessary sulphuric acid from an acid plant which this same company is erecting near the Calumet & Arizona smelter at Douglas.

Under new construction work may be placed the new concentrator which the Copper Queen branch of the Phelps Dodge Corporation is building for the treatment of the company's Sacramento Hill ores. This is to have a capacity of approximately 4,000 tons per day and will be completed within 1921. During 1920 the Iron Cap Copper Co. at Copper Hill also completed the construction of a 400-ton mill. The exceptional feature about this mill is the high recovery attained, at times averaging over 90 per cent.

A large percentage of the big companies in the state are engaged in shaft work. The Copper Queen is deepening, enlarging, and concreting its Dallas shaft, with the purpose of ultimately making it the main hoisting shaft for the entire group of Copper Queen mines. The company has also completed sinking operations on its C. & C. shaft, which work was undertaken with the object of developing an abundant water supply for the new mill. The Calumet & Arizona is sinking the Junction shaft to the 2,300-ft. level and continuing the sinking and concreting of the new Campbell shaft. The mines along the Old Dominion lode, that is the Old Dominion, Arizona Commercial, and Iron Cap Copper Co., have all been engaged in deepening their shafts, with a view to exploring the vein at lower levels.

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In the Miami district, the Miami Copper Co. is completing its new crushing plant at its No. 5 shaft, which will then become the main hoisting shaft. Considerable construction work has also been done by the United Verde Extension at its smelter at Clemenceau, and also by the United Verde Copper Co. at Clarkdale.

Progress has been made in exploratory work in the various mines in the Jerome district. A steam-shovel plant was in operation during 1920 at the United Verde, by which the overburden and slag dump over the old fire district is being removed, with the object of reaching the high-grade, as well as lower-grade, ores which are sealed within the old fire districts. The United Verde Extension has been exploring its 1,500 and 1,600 levels to develop the confines of the ore on these horizons.

Steam-shovel operations at Sacramento Hill, Bisbee, have been carried so far that the waste capping is nearly all removed, so that ore could be mined during operations in 1921, upon the completion of the mill.

Worthy of inclusion among the achievements of 1920 is the successful mining of the ore in the Coronado mine, of the Arizona Copper Co., under mine fire conditions. Even though a large fire exists in the timbered mat, through the use of the pressure system of mine ventilation the mine has been kept in continuous operation. Exploration work is also being carried on in the deeper workings of the Magma Copper Co., Superior & Boston, Inspiration, Ray Consolidated, Miami Copper Co., and, indeed, in a majority of the larger companies of the state.

Considerable experimental work has been done by the Miami Copper, Inspiration Copper, Arizona Copper Co., and the New Cornelia Copper Co. in the treatment of mixed ores. Satisfactory results have been obtained through the use of a combination of leaching and flotation.

Montana

By F. A. Linforth
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During 1920 the copper mines of Montana were operated at 40 to 50 per cent of their normal production, and the silver mines generally operated at full capacity, but most of the gold mines were forced to close. Butte was the center of activity, as usual. Although harassed by labor difficulties and unfavorable market conditions, the copper mines were worked through the year.

The Anaconda Copper Mining Co. operated at an average of 50 per cent capacity and mined 1,800,000 tons of copper ore, 435,000 tons of zinc ore, and 65,000 tons of manganese ore. Development work on all levels was carried on as usual, and shaft sinking reached a new depth of 3,950 ft. at the Steward mine. High-grade copper ore consisting of chalcocite and bornite was encountered at the 3,850 point, which is a significant discovery in that there is no change in mineralogical relations after an increment of 650 ft. below good ore on a relatively deep level.

At the Washoe reduction works, at Anaconda, a fifty-ton experimental plant for treating phosphate rock was built and is now operating. The Anaconda company's plant at Great Falls operated its zinc refinery throughout the year, as well as the rod and wire mill. There was also some production of ferromanganese.

The North Butte company operated its Granite Mountain and Speculator shafts throughout 1920, developing and mining at about 75 per cent of its normal rate. Work was done on all the deeper levels down to the 3,400, and further extension of the 3,600 will be undertaken. The company also continued the extensive development program at its east side property. Long crosscuts were run from the Sarsfield shaft on the 900 level, and some raising was done. The East Butte company operated the Pittsmont mine at about two-thirds normal rate, producing about 10,000 tons per month. Development work was done largely on the 1,500 and 1,800 levels. The smelter treated the company's own ore, together with the entire output of the Davis-Daly company's Colorado mine, making a total of 1,500,000 lb. of copper per month, or about 75 per cent of normal production.

Operations at the Black Rock mine of the Butte & Superior company were curtailed to about two-thirds of normal capacity, but the usual grade of zinc ore was mined throughout 1920. New development work extended to the 2,300 level, and the shaft is now being sunk to the 2,600. The Elm Orlu Mining Co. operated its Elm Orlu mine at the rate of 750 tons per day, or about 75 per cent of normal, throughout 1920. Work was done on all deeper levels to the 2,600. The ore was largely zinc, but some copper was mined, all of which was treated at the Timber Butte mill, together with a large tonnage of copper tailings, so that the mill had an active campaign for the year. This company also sank the Travona shaft to the 1,500 level, and explored the "ancient vein" at this depth.

The Davis-Daly company reached the 2,700 level at the Colorado mine, and crosscut to the orebody which has been developed and mined on levels above. Drifting is now in progress at this point, and regular shipments are still being made to the East Butte smelter. The Tuolumne Copper Co. mined and made shipments of about 100 tons of copper ore per day from levels between the 800 and 1,200. Development work was actively carried on during the first half of the year, but not much was done during the latter part. However, the Main Range shaft is now being sunk from the 1,200 to 1,600, where crosscuts and drifts will be driven. The Tuolumne company has installed the first successful heavy-duty centrifugal pumping plant in the state. The installation consists of a ten-stage machine which raises 500 gal. per minute against a 1,200-ft. head.

For a portion of 1920, the Barnes-King Development Co. operated its North Moccasin, Piegan-Gloster and Shannon mines, together with exploratory work. In May, however, the Piegan Gloster was forced to close. It is significant that this mine, probably the most important gold mine in the state, could no longer stem the tide of increasing costs. The North Moccasin property ceased to operate in September, but was put in the hands of lessees at that time, and is now being worked by them. At the Shannon mine, about 2,500 tons per month was mined and treated throughout the year. The total dividends of the Barnes-King company to date amount to $440,000.

Clancy District—This famous old high-grade silver-mining district enjoyed a period of considerable activity in 1920, and nearly all the mines were worked to capacity. The Liverpool made regular shipments of silver ore from its 750 level. The Free Coinage mine of the Amalgamated Silver Mines Co. sank its shaft from the 250 to 350 level and opened new drifts there. It shipped high-grade silver ore throughout the year. The Little Nell mine is sinking its shaft from the 450 level. Development work was carried on at several other small properties. The Legal Tender mine was not operated during the year, but undoubtedly will be as soon as new financing can be arranged. The ore from the Clancy district consists of lead and zinc sulphides with silver content from 125 to 150 oz. per ton. Ore is mined from narrow fissures, and even outside the limits of the main ore shoots assays from 25 to 35 oz. silver.

Neihart District—The principal operators at Neihart were the Cascade Silver Mines and Mills and the Ripple mine. The mill at the Cascade property worked nearly all the year treating silver ore. The Ripple mine shipped chiefly the broken ore left in the stopes by early operators, but it is closed now.

Basin-Wickes-Corbin—There was considerable activity in the old silver mines of this district. The famous old Alta mine has installed a new electrically driven compressor, and has done development work which reaches points 500 ft. below the old openings. Drifting is now in progress at this depth. The Corbin Copper King has prepared to start active operations about April 1 of next year. The Jib mine, at Basin, worked throughout the year on levels down to the 300. Its ore is a complex sulphide, but has exceptionally good gold content in short shoots. Probably the most important development in this district is the Mount Washington mine of the Angelica Mining Co. A large tonnage of lead and zinc sulphides, with satisfactory silver content, has been developed. A mill will be built this spring.

The Boston & Montana Development Co. had an active year at its property at Elkhorn. The company completed a twenty-six-mile narrow-gage railroad from Divide to the mine and is building a 500-ton mill. The development work on the mine was carried on throughout the year.

The Champion mine, in the Oro Fino district, near Deer Lodge, cut a vein in its long tunnel which contained 600 oz. silver ore in a short shoot. Further development has disclosed considerable milling ore, and a 150-ton mill is being built.

Mining in Michigan

By D. E. A. CHARLTON

Managing Editor *Engineering and Mining Journal*

DESPITE several handicaps, including strikes, transportation difficulties, and fuel shortage throughout 1920, iron-ore shipments from the Michigan ranges were higher than in 1919 and constituted a little over one-third of the total iron ore produced in the Lake Superior district.

The principal item of interest on the Marquette Range was the purchase by Henry Ford of the holdings of the Michigan Land & Iron Co., the lands being distributed over Marquette, Iron, and Dickinson counties. The only proven mine of the concession is the Imperial, formerly operated by the Cleveland-Cliffs Iron Co. and situated at Michigamme. The Ford interests, which are now preparing to operate this property, which has been idle for some time, have established an office at Iron Mountain.

Operations at most mines on the Marquette Range were normal, excepting the Breitung properties, which curtailed to a considerable extent and toward the later part of the year were reorganized as the Marquette Ore Co., with John W. Dougherty as president. The Rolling Mill mine of Clement K. Quinn & Co. has become one of the large operations of the district. Shipments approximating 300,000 tons were made during the season.

The mines of the Cleveland-Cliffs Iron Co. were worked to capacity during the greater part of 1920, the Negaunee mine being the largest producer. The Maas and the Athens increased their production and the South Jackson pit produced over 60,000 tons of low-grade ore, mined by steam shovel. The Maas mine put in a large storage sump, and the Negaunee mine built a new pump house, which was lined with metal lath covered with "gunite." The Athens mine completed the shaft pockets, which are on alternate levels, ore from intermediate levels being transferred to the pockets through raises near the shaft. The Holmes mine increased its production and the Salisbury and Angeline mines maintained about the same output as in 1919. In the Gwinn district, the Austin mine remained idle, and the Princeton mine has been practically closed while changes are being made in hoisting equipment. A new hoist and engine house are being erected and a second skip will be put in the shaft. The Stephenson mine, which was unwatered in December, 1919, was reopened in 1920. The Gwinn, Francis, and Gardner-Mackinaw mines maintained their usual production, but operations were curtailed in December. At the Republic mine, at Republic, hoisting at the Pascoe shaft has been discontinued, and all ore is now taken out through No. 9 shaft. The usual production was maintained, and new ore was developed.

During 1920 the Gogebic Range shipped its record tonnage, which was about eight million. Some exploration was done—principally by the Jones & Laughlin company, on the eastern end of the range—but development was largely confined to the mining of orebodies previously discovered. The McKinney Steel Co. completed a general office building near the Ironton mine at Bessemer, and also completed and put into operation one of the most modern engine houses in the Lake Superior district. The plant is electrically equipped with a 1,300-hp. Ilgner set, with a 40-ton flywheel which serves the ore skips and a 1,650-hp. hoist motor which serves the cage. The Oliver Iron Mining Co. has finished thirty-five of the fifty new dwellings at its Puritan mine and has also completed the new "H" Pabst vertical shaft to the 26th level—a depth of 2,040 ft.—

and erected a permanent steel headframe. Automatic stokers of the Westinghouse-Taylor type have been installed at the Pabst mine power house, and from the same power plant transmission lines have been laid underground in conduit to all of the Oliver properties west of the Pabst. A surface transmission line on steel towers has been completed east of the Pabst to the Davis and Puritan mines. The Yale mine of the Charcoal Iron Co. at Bessemer cut wages 20 per cent on Dec. 1. The Steel & Tube Co. laid off a total of 200 men from its Anvil and Newport mines. The No. 1 shaft at the Windsor mine of Pickands, Mather & Co. has been shut down, although all men laid off have been transferred to other mines of the same company or employed by other companies.

Little attempt was made during 1920 to discover ore on new properties on the eastern end of the Menominee Range. However, the Escanaba Exploration Co. did some drilling near Escanaba and encountered an iron-bearing formation about twenty-five miles east of Waucedah, which is the most easterly point at which mining has been done on the Menominee Range. No ore was discovered. The Peninsular Power Co., finding that its plants at Iron Mountain and Florence were inadequate to supply the demands placed upon them, is building a new plant on Pine River, a few miles southeast of Florence. The electrification of the Aragon mine has been completed, and all equipment, with the exception of the hoist, is now operated by electricity. At the Loretto mine an electrically driven compressor and hoist were installed.

The Iron River-Crystal Falls district was active in 1920, owing to a good demand for the ores produced, which are generally high in phosphorus and desirable for the manufacture of foundry iron. Owing to the car shortage during the first part of the season, shipments were held up to such an extent that many of the mines were unable to clean up their stockpiles. There was a distinct labor shortage during the first eight months of 1920, but the supply remained ample during the rest of the year. The Cleveland-Cliffs Iron Co. reopened its Spies mine and also acquired a lease to the Virgil mine, an adjoining property owned by the Wickwire Mining Co. Shaft sinking was in progress at the following mines: Homer, Davidson, No. 2 and No. 4 shafts; Chicagon, Cardiff, Hiawatha, Dober, Zimmerman, and Berkshire. The Cardiff mine installed electrical equipment and erected a steel headframe, and at the Rogers mine electrical pumps were placed underground. Pickands, Mather & Co. reopened their Baltic and Fogerty mines and also took over the Amasa-Porter mine, formerly controlled by the Nevada Mining Co. The McKinney Steel Co. electrified its equipment at the Richards and Tobin mines, at Crystal Falls.

In a review of copper mining conditions in Michigan during 1920, James MacNaughton, vice-president and general manager of the Calumet & Hecla Mining Co., writes as follows:

"It is with unintentional irony that the editor of the *Engineering and Mining Journal* asks that the review of the copper industry of the Lake Superior district be limited to sixteen hundred words. Ours requires no such length, for this year it is 'the short and simple annals of the poor.'

"The history of the district for the last two years is most graphically portrayed in the report of the Mine Inspector. In the Houghton County mines for the year ending Oct. 1, 1918, there were employed underground an average of 12,650 men. In 1919 this had dropped to 7,865, and in 1920 to 6,082, being just three-eighths of the number employed in 1916. That production has not fallen proportionately is due to the lack of exploration and development and to the continuous introduction of labor-saving devices, beginning with the one-man drill and extending to power tramming, and more recently to the installation of power scrapers and other loading devices.

"One by one the weaker companies have succumbed to scarcity of labor, carrying with it decreased production and increased costs, all in the face of a lowering copper market and decreasing demand. The increase in the cost of coal alone has added a burden of over 1 cent per pound of copper produced, and the sharp falling off in price of copper in October has wiped out any possible profit for the companies other than Champion, Ahmeek, and Mohawk.

"The most hopeful development in the way of saving labor and reducing costs has been in the use of mechanical scrapers for bringing the ore down the stopes into the tram cars. Mechanical loaders of various types have been experimented with for some years, and with varying degrees of success, but the weight and the initial cost were such as to make their extensive installation problematical, allowing for the most favorable development with use. The scraper seems to meet the problem nicely. It is easily transported from place to place, is simply rigged, requires no skill to operate, and makes possible as laborers a class physically incapable of the former work of the trammer. It is being installed as rapidly as possible in all mines where the dip of the lode requires handling of the "rock" in the stopes, and when the copper market improves the normal output can be resumed with decidedly fewer trammers. The old type of trammer required physical qualifications such that the supply has been decidedly limited in recent years, and the big hope for the scraper, whether it reduces costs or not, lies in the widening of the field of available labor.

"Other developments underground have not been noteworthy. The plans of the Quincy and of the Calumet & Hecla for working at great depth are being carried forward with an apparent optimism not, in my judgment, warranted by present conditions. Values at depth are not falling rapidly, but operating costs are mounting steadily, and the point where outlay will overtake income is hard to establish in advance because of the multitude of fluctuating conditions.

"The mills and smelters of the district have introduced no startling features. Neither leaching nor flotation has been extended. The Mass, Franklin, Lake, and Osceola stamp mills are shut down and the old Tamarack has been demolished. In its place is being erected a plant to treat the accumulated conglomerate sands by the process developed at the Calumet & Hecla plant at Lake Linden.

"As 1920 closes, the industry is facing the worst crisis in its history. The richer mines are increasing production to lower their costs, and the leaner ones are either closing down entirely or radically reducing their non-producing forces. Wages have been lowered, but high-priced supplies, particularly coal, must be reckoned with for at least six months more. If the district is to hold its place as one of the important producing centers, the results must come through an increased price for the commodity."

Alaska

BY GEORGE J. YOUNG

Western Editor, Engineering and Mining Journal

ALASKA is recovering from the conditions imposed by the war. Experienced miners and common labor have been short, but labor conditions are improving. The white population is gaining. Despite depression, the gold-mining industry is active in southeastern Alaska. Long a bureaucratic football, there is a hope that the change to a more direct and sympathetic control of Alaska's internal affairs is close at hand. Steps to secure legislative authority for an Alaska Development Board have been taken, and the President has appointed an interdepartmental Alaska committee.

The visit of Secretary of the Interior John Barton Payne, and the Secretary of the Navy, Josephus Daniels, resulted in the approval of the report of the Alaska Advisory Committee, which recommended lowering freight and passenger rates and improvement of transportation and mail service; concentration and co-ordination of Federal control of Alaskan lands and resources under an Alaska Development Board; co-ordination of Federal road construction and the development of plans for a comprehensive system of roads and trails; investigation of the commercial feasibility of a copper smelter; and immediate development of a wood-pulp industry. Oliver C. Ralston, of the U. S. Bureau of Mines, reported in November adversely upon the location of a copper smelter in Alaska under present conditions, and recommended concentration mills or hydrometallurgical plants at the mines as the logical solution of existing difficulties.

The U. S. Geological Survey reports the value of the 1920 mineral production as: Gold, $7,856,000; copper, $12,400,000; silver, $900,000; platinum and allied metals, $80,000; tin, $20,000; lead, $142,000; coal, $380,000, and miscellaneous, $148,000; or a total of $22,070,000, against $19,620,913 in 1919. Gold production from placers is estimated at $3,630,000, as against $4,970,000 in 1919. In 1920, twenty-two gold dredges operated, of which seventeen were in the Seward Peninsula. In lode mining fifteen mines and five prospects were operated, which produced 3,270,000 tons of ore, from which $4,360,000 gold and 106,000 oz. of silver were recovered, slightly less than for 1919. Total silver was 792,751 oz. (488,034 in 1919), lead 880 tons (564 in 1919), copper 71,000,000 lb. (56,534,992 in 1919).

Alaska Gold Mines Co. continued to operate throughout 1920. The first two quarters of the year showed recoveries of 68 and 66c. per ton, respectively; operating expense 79c. per ton and operating losses of 11c. and 13c. per ton. The position of this mine changed little during the year. More definite plans for a paper mill adjacent to its property were made by the Alaska Gold Mines Co.

For the first eight months of the year, Alaska-Juneau reports gold assay value of $1.15 per ton for 589,270 tons. Gold recovery was 85.55c. per ton; mining cost 20.48c., milling cost 45.37c., general expense 5.54c., total operating cost 71.39c., leaving an operating gain of 14.16c. per ton. In addition, silver and lead approximate 5 to 10c. per ton. The milling cost is being made a special study, and improvements are under way that it is believed will bring this cost down to 20c.

The Alaska Treadwell Mining Co. is seeking a new property, and believes that it has one on Nixon's Fork, a branch of the Kuskokwim near McGrath, a wireless station eleven miles north of the Kuskokwim River. The ore shoots occupy a contact between limestone and granite. The ore contains gold and silver associated with chalcopyrite. The prospects have been attractive, but so far the ore shoots are small in size. A vigorous development campaign is in progress with the objective of developing tonnage. The district is not a bad one to operate in. Living conditions are good and navigation is open for five months in the year. In the district contiguous to McGrath, placers have been successful, a shipment of placer gold having been made and a dredge successfully operated by the Union Construction Co., of San Francisco. The same company is planning to put in another dredge on Gains Creek. The Kuskokwim region was the most active in prospecting inland.

On Chicagoff Island, the Chicagoff mine, which has been operating steadily for ten years, continued operations with its twenty-stamp mill on high-grade gold ore. North of the Chicagoff mine small high-grade gold-bearing veins have been discovered. Much prospecting and development are in progress. The El Nido and two or three small properties are mining high-grade gold ore.

In the Copper River country, Kennecott Copper acquired control of the Mother Lode properties. As far as can be ascertained these are developing satisfactorily and showing similar characteristics to the chalcocite orebodies of the Kennecott. At the Kennecott, shipments of copper continued practically throughout 1920.

In 1919, petroleum production was limited to the Katalla field. In this field the output has increased and there was great activity throughout the Gulf of Alaska region. According to Colonel Alfred H. Brooks, the Katalla field is a region of shallow pumping wells, the petroleum coming from sands at depths of 300 and 800 ft. A superior grade of gasolene and distillate is being produced and supplied to a local market, which absorbs the entire production. The favorable leasing conditions as well as the occurrence of geological horizons considered to be promising have caused applications for 380,000 acres to be filled in Juneau since the passing of the new leasing regulations. The applications aggregate 175 in number. Somewhat less than half the acreage lies in the Cold Bay district. Other districts are Katalla, Yakataga, Chitina Bay, Seward, and Wasilla. Colonel Brooks calls attention to the fact that geologic conditions are particularly good for the occurrence of oil at a number of places in Alaska.

Most of the first 260 miles of the Alaska Government Railroad has been completed, as well as the last 100 miles. The total length is to be 468 miles, leaving 108 miles to be completed. Development of coal for local and railroad use continues in the Matanuska field under the direction of the Alaska Engineering Commission. During the year, the U. S. Geological Survey dispatched seven field parties to Alaska.

This report was compiled from interviews, published statements by the U. S. Geological Survey, and news notes appearing in *Engineering and Mining Journal.*

California

By George J. Young
Western Editor, *Engineering and Mining Journal*

MINING in California in 1920 faced a number of difficulties, among which were a pronounced water shortage that resulted in curtailment due to lack of power in the last part of the year, a restricted supply of fuel oil, and labor scarcity. Mining costs increased, and there was a marked tendency among the gold mines to suspend operations temporarily. Copper production was almost entirely restricted to the Engels and Walker properties. Quicksilver mines were in difficulties. Nevertheless, a number of older properties were unwatered, and much prospecting and development that should bring good results in the ensuing year was accomplished.

Advance production estimates for 1920 by Charles G. Yale, of the U. S. Geological Survey, are as follows:

	1920	1919
Gold	$14,305,300	$16,695,955
Silver, ounces	1,513,495	1,107,189
Copper, pounds	12,934,900	21,732,507
Lead, pounds	5,071,600	3,568,267
Zinc, pounds	1,572,000	472,990

Alluvial Mining—It is difficult to estimate accurately the number of gold dredges in operation in 1920, but thirty-five or thirty-six were probably working, as compared to my estimate of forty-three in 1919. The Yuba Consolidated Gold Fields operated eight dredges.

The Natomas operated ten dredges. The American Gold Dredging Co. operated four dredges. The Yukon Gold Dredging Co. operated four dredges. The Valdor Dredging Co. operated its dredge in Trinity County; the El Oro Dredging Co. operated its dredge at Yreka up to April. Marysville Dredging Co. operated one dredge near Marysville. The Estabrook put a 20-cu.ft. dredge in operation in Trinity County. It was shut down temporarily in October. In the latter part of the year the Yankee Hill Gold Mining Co. put a dredge into operation between Oakdale and Knights Ferry. There were other dredges in operation in northern California, but specific information was not received from them. Cost of supplies generally did not diminish, although there were slight reductions in some items. Increase of wages and increased cost of power more than counterbalanced such reductions. As a whole there will be less gold from dredging in 1920 than there was in 1919.

The prevailing water shortage resulted in a short water season, and there will be less production from desultory placer and hydraulic operations. There was some activity during the year, both in the Yuba-Feather River region and northern California, in hydraulic and drift mining.

Mother Lode—At Jackson, both the Kennedy and Argonaut were in operation at the beginning of 1920, the former with twenty-five to sixty stamps, and the latter with sixty stamps, operating continuously. In April the Kennedy was flooded to stop fires which had persistently broken out. The Argonaut proceeded to unwater both properties. By the middle of October the 2,800 level of the Kennedy had been recovered. It is expected that mining will be resumed in both properties early in 1921.

The Carson Hill Gold Mining Co., the most important new operation in the Mother Lode, was formed to take over the Carson Hill Gold Mines, Inc., which controlled 160 acres of important mining ground, together with the Morgan, Union, and Kentucky claims. The Melones property is under option, and by independent agreement all the plant and facilities of the Melones property are used by the company. In the Morgan tunnel a strong lead was followed, resulting in the discovery of a high-grade orebody. This orebody was developed to the surface and below the tunnel level down to the 1,350-ft. level, which is now being stoped. Preparations are being made for stoping on the 1,600-ft. level. The 1,750-ft. level is being extended northward. On the 1,200-ft. level another orebody has been opened up. In addition to these two, there are two more orebodies, both important.

In the Tuolumne region, 1920 opened with moderate activity, but during the last half many properties closed and activity almost ceased. The Eagle Shawmut operated seventy to eighty stamps and employed 150 men until September, when work was suspended.

In Mariposa, the Mountain King struck good ore on its 1,800 level, and is deepening its shaft to 2,000 ft. Fifty men are employed, and 1920 was more successful than 1919. The White Gulch Mining Co., near Bagby, operated, as did other small properties.

At Plymouth the Plymouth Consolidated Gold Mines, Ltd., since July 30, 1914, has mined 800,000 tons of ore, from which a gross recovery in excess of $4,000,000 and a profit in excess of $1,000,000 were made. The orebodies gave out just below the 2,400-ft. level, and for a time the outlook of the mine was blue; but sinking and development to the 2,900 level brought improvement, and the 3,050 level is considered to be the best level ever opened in the mine. A winze is being sunk from the 3,050 to the 3,200 level, pending the sinking of the shaft. It will probably be some time in 1921 before the property reaches the dividend stage again. The Plymouth is another example of the necessity of sinking below the barren zones which have almost universally occurred in Mother Lode mines. Credit is due W. J. Loring for his persistent work.

Grass Valley and Nevada City—The Empire Mines continued in 1920 to be the most important operation in the Grass Valley district. The addition to the mill was completed, resulting in concentrating milling operations in one plant. By the middle of the year the largest tonnage in the history of the mine was being treated. New ground below the 4,500-ft. level was being opened up satisfactorily, and the working force was increased. In July, a new wage scale was put in force. Owing to power shortage 150 men were laid off early in September, but in October restrictions were removed, and operations increased to normal. The North Star curtailed operations in May owing to high costs and leaner ore at depth. Instead of laying off men due to power shortage, surplus men were transferred to other jobs. A new tailings dam was constructed on Wolf Creek. At the Idaho-Maryland unwatering was completed and sinking of the shaft to 2,500 ft. and lateral development were planned. Station pumps were installed on the 1,000-ft. level. A fifteen-stamp mill was erected. Power shortage also interfered with the operations of this property. Allison

Ranch prospected its tenth level. The Alcalde (Kenosha) reported a sensational strike of high-grade ore. During the year its milling facilities were increased. Norambagua began deepening its main shaft to 1,500 ft. and installed a twenty-stamp mill.

Nevada City mines were inactive during 1920. The Champion mine plant was dismantled and sold. In contiguous areas the Penn-California Mining Co. acquired a number of gravel properties and drove a tunnel to tap the channel under Harmony ridge.

At Alleghany the Sixteen to One acquired the property of the Twenty-one, and litigation was thus ended. The Alleghany Mining Co., owner of the Tightner mine, took over the Gold Canyon mine, unwatered the shaft, and made preparations to sink. There were other minor operations in small lode, drift, and hydraulic mines.

Copper Mining—Of the three copper-producing areas, the Shasta, Plumas, and Copperopolis, the Plumas County mines, and of these the Engels and Walker properties principally, made practically the only copper production of 1920. In this area twenty mines and prospects were in operation. The Engels Copper Mining Co., employing 450 men, added to its reserves over 500,000 tons in the year. Its flotation mill operated continuously. In the mid-year the Walker Mining Co. completed its eight-mile wire-rope tramway and shipped accumulated concentrates. Two hundred tons per day was treated in the mill. In November, high cost of power, freight rates and labor caused most of the working crew to be laid off, and work was confined to development through the winter. The Gruss Mining Co. completed and put a 200-ton mill in operation. The Mason Valley Mines Co. acquired the Blue King group of claims and started development.

In the Shasta region the Bully Hill Copper M. & S. Co.'s group of mines was taken over by Hayden Stone & Co. and the Shasta Zinc & Copper Co. formed with D. C. Jackling as managing director. A zinc-oxide plant and reverberatory are under construction, and operations are expected to begin in March, 1921. The Balaklala smelter was torn down, and the steel will be used in the construction of the new plant at Bully Hill. At the Mammoth mine of the U. S. Smelting, Refining & Mining Co. operations were restricted to development during 1920, 100 men being employed. The smelter at Kennett was not operated. Ore reserves were increased. Mountain Copper Co., Ltd., operated its Hornet mine steadily throughout the year, producing pyrites. Its copper properties were idle. Early in 1920 operations by the Afterthought Copper Co. were indefinitely suspended. At Copperopolis the Calaveras Copper Co. restricted its operations to development work.

Southern and Eastern California—At Randsburg, California Rand Mines Co. continued shipments to the Selby smelter, and was reported to be paying dividends of $25,000 per month. The Slate Range Minerals Co., northeast of Trona, operated a flotation mill and made shipments of crude lead-silver ore and concentrates. At Masonic, the Pittsburgh Liberty was reported sold and the Golden Gate bonded for the twelfth time. In Inyo and San Bernardino counties numerous small properties were reported as active.

Miscellaneous—Magnesite mining was active in the vicinity of Porterville. Levy, Gilman & Moore, of Oakland, are reported to be developing a barite deposit near Lowell Hill. The General Petroleum Corporation leased 320 acres on Otay Mesa, and expects to mine soapstone. The U. S. Borax Co. bought borax claims near Mohave. American Trona made extensive improvements at Searles. West End Chemical Co. acquired control of the West End Consolidated Mining Co.'s operation at Searles Lake. The property consists of 220 acres of the Searles deposit. A plant has been established on the western edge of Searles Lake, at a point known as Westend, and the company expects to produce potash and borax in 1921.

Colorado

BY GEORGE E. COLLINS,

Consulting Mining Engineer, Denver, Col.

AFTER four disastrous years, the close of 1920 finds the mining industry of Colorado in a more depressed condition than at any time in its history, though during the last month some signs of improvement have become apparent. For the first time since 1916, there is a surplus of skilled labor. If the labor surplus persists during the winter, as all anticipate, the industry will, by next summer, have regained something like the degree of efficiency that prevailed in 1915. Wages will not fall to quite the same level, but this is of less relative consequence than regained efficiency. The costs of most materials also show a tendency to drop, and there is fair reason to hope that in 1921 the average costs of mining may be reduced to something like 30 per cent in excess of those ruling in 1915.

At Cripple Creek, the Portland has suspended its regular dividend payments, in order to accumulate a cash reserve. It is understood that the developments in the deepest levels, below the Roosevelt drainage adit, are favorable. The Cresson, which also passed its last dividend, maintains a large output, but is no longer a bonanza. The Vindicator has exhausted its reserves, and reduced the scale of work, but just in the nick of time has developed a new orebody of some promise. The Modoc has opened up good orebodies, and expects to be an important producer during 1921. The falling off in production from this district has been marked, and it would have been more so but for the generous policy of the Golden Cycle plant in maintaining the former rate schedules. A rather romantic enterprise, which must be considered a forlorn hope, is being backed by several local operators, headed by the Vindicator management. W. H. Trask, a Denver banker and student of geology, advanced the hypothesis that the northeastern end of the Cripple Creek volcanic neck has been covered by a huge rock slide. A series of boreholes is being drilled to test this hypothesis. It is not claimed that the enterprise is anything but a one hundred to one shot, but the great importance of adding to the life of the district by opening additional territory is considered to justify spending money on the chance.

Leadville and vicinity are exceedingly depressed. The Down Town mines, the Yak, and Ibex are the principal producers. A considerable tonnage of low-grade pyrite is being shipped from Kokomo, and some high-grade ore from the London and Dolly Varden, near Alma. The Hilltop, in the same vicinity, is producing considerable lead-silver ore. At Aspen, the Smuggler is maintaining a considerable output, and prospecting in the district is yielding promising results. At Creede, the American Smelting & Refining Co. has abandoned its work below the adit level on the Amethyst vein. Considerable shipments of siliceous silver ore are being made from surface deposits in this district. The zinc properties at Red Cliff controlled by the Empire Zinc Co., and which are believed to contain orebodies of the first magnitude, remain practically closed down, awaiting better market conditions. Meantime the zinc-oxide plant at Canon City is being enlarged. At Breckenridge, the Wellington resumed production, as foreshadowed in my last annual review; but in October the increase in freight rates and the unfavorable spelter market together decided the management to close the mill again.

In the Silverton district, the Gold King was operated for a short time during the summer of 1920, when glowing reports were circulated of the opening of rich orebodies, which have not been confirmed. A considerable production is maintained from the Iowa and other properties which are being operated under lease, but in general the district was not active, with the exception of the Sunnyside. Owing to the increase in freight and treatment rates, and the recent fall in metal prices, it is doubtful whether even this property can continue in operation much longer, without some substantial relief.

At Telluride, the Tomboy maintains a large production, but, according to the last annual report, the profit margin has been changed into a loss. The year's results at the Liberty Bell, on a new vein discovered toward the end of 1919, just as preparations for closing were completed, have been disappointing. This great mine must be considered as finally exhausted, and will probably soon close down. At the Smuggler-Union, just as the prospects began to look brighter than for many years, the sheer ill-luck which has so often dogged the steps of this enterprise once more came into play, and a disastrous fire in July destroyed the office and flotation plant. These are being replaced with all possible speed, but in the meantime production is greatly curtailed. Around Ouray a considerable amount of prospecting was done in 1920 and some steady shipments were made by leasing companies, but there is not at present any important producing mine. It is reported that in the Camp Bird some good ore was cut in driving west at the new adit level, but for the present the financial condition has necessitated suspension.

Gilpin County has perhaps suffered as much as any county in Colorado and the output has fallen to a low point. Around Georgetown, the increased activity which a year ago seemed to be under way has been arrested. In the Idaho Springs district, few of the lessees are making more than a bare living. The most important operation is the Gem, which has been taken over by Canadian interests, which have also, it is understood, obtained an option on the Argo Tunnel and the Argo mill at the mouth of the tunnel. In Boulder County lead production has practically stopped and the gold mines are mostly closed down awaiting the advent of lower costs, and tungsten mining is out of the question at the present price for that metal.

The only remaining lead-smelting plants in the state are the Pueblo, Leadville, and Durango plants of the American Smelting & Refining Co., which have, with few changes, continued the high-treatment schedules announced toward the end of 1919, and even increased them to an extent proportionate to the latest increase in freight rates on coal, limestone, and other materials. As might have been expected, the result was a considerable profit at first, followed by reduced production of ore and consequent disappearance of the profit margin. The general opinion among those best qualified to judge is that the smelting industry cannot become remunerative without increased output, and that this can be secured only by a considerable reduction in treatment costs, direct and indirect, with resulting increase in the present low percentage of the gross value of the ore returned to the miner. A bold change of policy on the part of the American Smelting & Refining Co. seems the only hope in this direction.

An attempt is being made to reopen the Salida smelter in connection with the Rawley mine, at Bonanza, which contains considerable reserves of silver-bearing lead-copper ore, and certain producers in the territory adjacent to Salida are being approached with a view to assisting in the financing of the project. Unfortunately, owing to the heavy losses which the industry has suffered during the last three years, but few of them are in a position to make the attempt.

It is now generally recognized that the oil-shale industry will eventually reach immense proportions, and even that some favorably situated deposits may be profitably worked in the near future. So far, little progress has been made in the actual production, under commercial conditions, of marketable products, but it may be confidently asserted that the problems of local oil-shale technology have now been specifically defined, and it is hardly credible that in the course of the next year or two Western inventiveness will be baffled. It is not improbable that, even now, the solutions of these problems have been worked out in their essential features, and that what is required is the sifting out of the sound grain from the chaff—a process for which the trained engineering mind is better fitted than the abilities of the inventor and promoter, who now occupy the field.

Idaho

By Robert N. Bell
Late State Mine Inspector of Idaho, Boise, Idaho

DURING 1920, for the first time in the history of Idaho, non-metallic minerals received more attention than metal mining. Lead-silver mining in the Cœur d'Alene district had made rapid strides back to normal when the slump in metal prices and the increase in railway freight charges in the last part of the year again slowed up production.

Estimates of the year's production indicate a gross yield of 250,000,000 lb. of lead and 7,500,000 oz. of silver for Idaho, all of which, except approximately 15,000,000 lb. of lead and 1,000,000 oz. of silver derived from the producing mines of Boundary, Blaine, Custer, and Lemhi counties, will be credited to the Cœur d'Alene district.

In the Cœur d'Alene district, owing to labor scarcity and high operating costs, development was restricted, but the larger mines, such as the Bunker Hill & Sullivan, Hecla, Morning, Tamarack & Custer, Hercules, and Callahan, continued to develop their lower levels with satisfactory results. In the principal operating mines of the outlying districts, especially at the Continental mine, in Boundary County; the Ramshorn mine, in Custer County, and the Pittsburgh-Idaho mine, in Lemhi County, encouraging results were obtained from development operations. The Idaho Bureau of Mines and Geology completed a geological survey of territory in Idaho bordering the Snake River Canyon, including a detailed topographic and economic survey of the Seven Devils quadrangle. Efforts are being made to have the work continued in co-operation with the states of Idaho, Oregon, and Washington.

A number of properties in the Yellow Pine quicksilver district of central Idaho continued prospecting work in 1920. Several interesting copper-ore deposits in the Pre-cambrian formations of the Salmon City district in Lemhi County were actively developed and ore shipments made. The Bradford volatilization process was given an experimental run at the Pope-Shenon mine, where a 100-ton plant is under construction.

The phosphate fields in the southeastern corner of the state in Bear Lake and Caribou counties were the center of activity. During the year the Western Phosphate Co., at Paris, completed a three-mile railway spur and a 500-ton mill. An adit tunnel on the company's principal 7-ft. vein was extended to 2,000 ft., and stoping started at this point at a rate of 250 tons per day. On the opposite side of Bear River Valley in Montpelier Canyon, four miles above Montpelier, the San Francisco Chemical Co. installed a substantial compressor plant to facilitate further development, which has already reached a depth of 800 ft. The company has shipped 100 tons of crude phosphate rock per day for the last six months. The Neibly-Newhouse Co. has driven a 1,000-ft. adit and is making an output of fifty tons of crude rock a day. A 500-ton mill has recently been completed on this property. The mines are four miles from Montpelier, the nearest railroad point. The rock is delivered to this station by auto trucks at a cost of $1.25 per ton. A railway spur to be jointly constructed by the two companies is under consideration.

At Soda Springs, thirty miles further west, on the Oregon Short Line, the Anaconda Copper Mining Co. has started upon extensive development of its phosphate deposit. The company has just completed the construction of a nine-mile railway spur, including yardage, tracks, and sidings. A crosscut adit, 9 x 9 ft. in the clear, has been driven several hundred feet. A compressor has been installed. The adit, when completed, will be 9,000 ft. long. Steel and concrete storage bins and a milling plant of 3,000 tons' daily capacity have been designed, and the mill machinery for the first 500-ton unit is already on the ground. This, it is expected, will be completed and in operation by early spring. The company's plans include a model mining town. A large part of the crude phosphate will be treated by a chemical process that will enable the phosphoric acid to be shipped in a highly concentrated condition. Most of the phosphate rock shipments have gone to the Pacific Coast to supply the Hawaiian and Oriental trade, as well as the coast. Increased freight rates interfere with shipments into Mississippi Valley points. There is a growing demand for Idaho phosphate rock and the future of this industry is promising.

Utah*

BY EDWARD R. ZALINSKI
Mining Engineer, Salt Lake City, Utah

MINING in Utah in 1920 was abnormally poor for the producer, owing to increased freight rates, decreased efficiency, high cost and scarcity of labor, and, in the latter part of the year, declining metal prices. The operation of the Pittman Act alleviated the situation somewhat, and Utah probably suffered less than most states.

Production—According to preliminary figures of the U. S. Geological Survey, the 1920 output of Utah was 6,900,000 tons of ore, containing gold, silver, copper, lead, and zinc to a value of approximately $16,000,000, or a slight increase over 1919. Gold and copper decreased, silver decreased slightly, and lead and zinc increased as compared with 1919. Approximate figures for 1920 are: Gold, $2,076,400; silver, 11,564,155 oz.; copper, 117,000,000 lb.; lead, 134,000,000 lb.; zinc, 6,000,000 lb. Utah mine dividends amounted to $11,447,327, as compared to $11,682,838 in 1919.

Bingham Canyon—The output of Bingham Canyon was about 50 per cent of normal. Utah Copper continued at 50 per cent capacity, as compared with 1919. The average tonnage per day was 14,877 in the first quarter, 16,905 in the second, 18,632 in the third, and the fourth quarter was approximately the same as the third. Total production for 1920 was approximately 105,000,000 lb. of copper.

Underground mines at Bingham increased wages 25c. per shift on April 1. Lead-silver ore was mined and shipped by the Utah-Apex, Utah Consolidated, U. S. Smelting and the Utah Metal & Tunnel companies. Utah-Apex shipped 100 to 150 tons of lead ore per day and the concentrates from 300 to 325 tons of ore milled per day as well as occasional cars of lead-copper ore. The shaft was sunk to the 2,400 level. Utah Consolidated began the construction of a 1,000-ton flotation mill for the treatment of copper ores. The mill is on the Tooele side above the International smelter. The decision in the Utah-Apex suit was adverse to the Utah Consolidated, and on Oct. 20 the Utah Consolidated company stopped mining lead ore on the dip of the Highland Boy limestone, under Utah-Apex territory, and turned the workings in dispute over to the Utah-Apex. Shipments of lead and copper ore were stopped Dec. 1, and about one hundred men retained on development work. Utah Metal & Tunnel shipped eighteen to twenty tons of lead ore per day during the favorable lead market. U. S. Smelting shipped 100 to 150 tons of smelting ore and 300 tons mill ore per day to its plant at Midvale. Total output of lead ore ranged from 14,000 to 17,000 tons per month up to December. Total ore tonnage shipped during 1920, including copper ores, was 6,400,000 tons, compared to 6,086,739 tons in 1919.

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*Greatly condensed from original manuscript.

Park City—Park City did not suffer as much as some parts of the state, owing to the silver content of the ores. Approximate output for 1920 was 99,864 tons of ore and concentrates, as compared to 75,623 tons in 1919. The metal content was 3,702 oz. gold, 2,535,000 oz. silver, 850,000 lb. copper, 25,290,000 lb. lead, and 4,646,000 lb. recoverable zinc. Labor conditions were poor for ten months, and then improved. The most important producers were the Judge Mining & Smelting, Silver King Coalition, Ontario Silver, Daly West, Daly, and Park-Utah. The abrogation of power contracts caused the Judge electrolytic zinc plant to be temporarily closed down Oct. 23, pending final adjustment of the difficulty. Interests closely allied to the Judge Mining & Smelting acquired the Daly mine. Development was active at the Ontario and Silver King Coalition. The Three Kings, north of the Silver King, did diamond drilling on the lowest level. The Naildriver shipped ore and made arrangements to work through the Ontario mine at depth.

Tintic—The output compared favorably with 1919 and amounted to 311,000 tons, exclusive of iron ores, by forty-two shippers, as compared to 296,832 tons in 1919. The largest producers were the Chief Consolidated, Tintic Standard, Eagle & Blue Bell, Mammoth, Iron Blossom, Grand Central, Dragon, Victoria, Centennial Eureka, Gemini, and Bullion Beck. The Chief Consolidated completed its concrete-lined shaft to the 1,900-ft. level. The total output was slightly less than 100,000 tons.

Alta and the Cottonwoods—Alta was handicapped by labor shortage. The principal shipper was the South Hecla, which markets silver-lead ore, mostly carbonate. The downward extension of the Rustler orebody on this property was cut at a depth of 1,100 ft. The Columbus-Rexall was the next largest shipper, sending an excellent tonnage of carbonate silver-lead-copper ore to the smelters. The Emma Silver and the Michigan-Utah made shipments. The Wasatch Mines put its mine into shape for production, and ore was produced by lessees. The Sells shipped silver-copper ore containing lead and bismuth. The Alta Consolidated made two shipments, the Louise one, and the Albion Consolidated developed and extended its adit. The West Toledo, Native Copper and Peruvian did development work. The total production of the camp was about 10,000 tons.

Miscellaneous Camps—In Beaver County, the Horn Silver, at Frisco, was the principal producer, all other properties being engaged in development work. In Tooele County, in the Ophir-Stockton district, the Ophir Hill, Bullion Coalition and Hidden Treasure were the principal producers. The approximate output of the district was 33,000 tons of silver-lead and zinc ores. The Western Utah Copper Co., at Deep Creek, shipped lead ore and a good tonnage up to 200 or 250 tons per day of a hydrous iron arsenate ore to the Valley smelters for arsenic recovery. In Box Elder County, the Vipont Silver Mines Co. operated its 100-ton flotation plant on a silver-gold ore. The Silver Reef Mines, in Washington County, were acquired by the McQuatters Corporation, of New York, and a power line and hoisting equipment installed. A mill will be built in the spring of 1921. The Deer Trail mine, at Marysvale, Piute County, shipped lead ore and concentrates from its 100-ton flotation and cyanide mill. The Mineral Products Co. treated alunite near Marysvale and shipped potassium sulphate. Good shipments of carnotite ores were made from Thompsons, including the Grand and San Juan County fields, up to October, when inquiries fell off and shipments declined.

Smelting Conditions—Increased freight rates and relatively limited tonnages made a poor year for the smelters. Excepting one, all smelters operated at reduced capacity toward the end of the year, and stock-piled ore for winter was conspicuous by its absence. The A. S. & R. at Murray had five, six, and seven lead furnaces in blast; three on lead ores, three on siliceous ores, and one on low-grade iron arsenate ores. The Garfield plant of the A. S. & R. operated three reverberatories at 40 per cent capacity on copper ores and concentrates from the Utah Copper. The International, at Tooele, operated three and four lead furnaces, and about the middle of November temporarily shut down its copper plant. The Utah Zinc Co. erected a new plant for zinc-oxide production from lead-free carbonate zinc ores.

Nevada

By Editorial Staff

The high price of silver in 1920, sustained by the operation of the Pittman Act, helped silver mining in Nevada. There was more activity in prospecting and looking for likely properties than in any other of the Western States. Labor troubles at Tonopah and Virginia City interfered somewhat, but less than in 1919. The U. S. Bureau of Mines moved the rare-metals station from Colorado to the Mackay School of Mines, at Reno.

Copper mining was almost entirely confined to the Nevada Consolidated, which operated at about one-half capacity. Somewhat over 7,000 tons per day was mined, three-quarters from steam-shovel pits and one-quarter from the Ruth mine. A new orebody of 7 per cent copper that was found upon the lowest level (700 ft.) of the Ruth mine was the most significant event of the year. Extensive improvements were made at the McGill plant.

Consolidated Copper Mines, in the Robinson mining district, restricted its operations to development, and in the Mason Valley district there was only incidental development. The Thompson smelter was idle. Late in the year favorable freight rates from copper-mining centers in Plumas County, Cal., to Thompson were in prospect and, if finally allowed by the I. C. C., two reverberatories are to be erected at this plant.

Tonopah easily maintained its lead. Labor troubles interfered for a time, but throughout 1920 there was a pronounced shortage of underground workers, although top men were plenty. A miner's mercantile store operated by the companies sold necessities to the miners at cost. Local mills operated regularly.

The Tonopah Mining Co. reopened its mill at Millers, and preparations were made by the Tonopah-Belmont to re-treat tailings at its old plant at Millers.

Tonopah-Belmont produced about 400 tons per day by reworking old stopes and faulted segments and extensions of its principal veins. Production was decreased by scarcity of labor that prevailed over half the period, but was increased in the second half. Operating costs, supply costs and freight were higher, and the average price of silver was slightly lower. Production is estimated for the year at 128,000 tons of ore, from which 13,876 oz. gold and 1,345,000 oz. silver are expected to be recovered. Total output, including custom ores, is estimated at 19,200 oz. gold and 1,789,500 oz. silver. Mine development was satisfactory.

A plant for treating concentrates formerly shipped to smelters was installed during the year. Tonopah Extension deepened its Victor shaft to 1,930 ft., and preparations were being made at the close of the year to cut a station on the 1,885-ft. level. The Merger and Murray veins were crosscut on the 1,780 level. The McKane shaft was retimbered. It is to be sunk from the 1,100 to the 1,540 level and connected with the Victor shaft. Development of the company's western territory will be carried out from this shaft.

The Victor shaft is the deepest in the Tonopah district, and at the 1,780 level development showed vein structure and assays consistent with higher levels. The year's production is estimated to be 80,000 tons, of a total value of $1,225,000. West End ore production caught up with mill capacity, and the amount of custom ore treated in its mill became negligible. Scarcity of miners caused ore shortage later in the year. Under agreement with the Tonopah "76" this company's ground is being prospected on the 800 level of the Ohio Tonopah. In its own operations from the Ohio shaft, development on south-dipping veins was encouraging, as such veins showed characteristics identical with those shown by north-dipping veins.

At Virginia City, Whitman Symmes, long a constructive element in Virginia City mining affairs, retired, and Alex Wise became superintendent of the North End group. Outside of the working of a comparatively rich shoot below the 2,150 level, there is little to record for the North End mines. Up to Sept. 1 production exceeded 117,000 oz. silver and 6,898 oz. gold. The Middle Mines, under H. W. Slosson, Jr., explored with diamond drill and in other respects marked time. Gold Hill mines were brought under the control of Bulkeley Wells, who has his engineers now engaged in constructing a mine adit and preparing the foundations for a 2,000-ton cyanide plant, preparatory to working low-grade ores and old stope fills. Under Bulkeley Wells' control, the Gold Canyon Dredging Co. started on Sept. 5 a steel, 9½-cu.ft. dredge about half way between Silver and Dayton. Both enterprises are well managed, and should make important production.

The Rochester Silver Corporation, under date of July 31, 1920, reported 26,570 tons of ore milled. Average silver was 12.91 oz. and gold 0.153 oz. per ton. Total costs were $9.23 per ton. Recoveries were 92 per cent of gold and 81.3 per cent of silver, yielding a net operating profit of $151,614.77 for the six months. Development reached 4,871 ft. Operations were hampered in the latter part of the year by power shortage. The Nevada Packard went into the hands of a receiver with $55,000 owing. The Nenzel Crown Point Mining Co. was foreclosed and ordered to be sold at public auction. Minor operations were carried on by other companies.

The Divide district failed to reach expectations, although a few properties reported development of milling ore in moderate amounts. At Candalaria, the Candalaria Mines Co. actively developed its holdings on Lucky Hill and prepared plans for a mill.

The Pioche district was prosperous throughout 1920 and made large shipments of low-grade iron-manganese ores to Salt Lake smelters. Assurance by railroad officials that fair treatment would be given in impending freight-rate increases prevented anything more than a nominal interference with operations.

The Louisiana Consolidated Co. completed a 125-ton lead smelter, a power line, and a flotation addition to its mill. The Bull's Head Mining & Smelting Co. did not operate its smelter. The Spruce Monarch mine, also at Spruce Mountain, made steady shipments to Murray. At Goodsprings, the Yellow Pine Mining Co. investigated, in co-operation with the U. S. Bureau of Mines, the volatilization of lead and zinc as chlorides from zinc carbonate concentrates. The Eureka district was active in prospecting, developing and shipment of ore. Arrowhead was the center of much prospecting, and activity was reported at Austin and Broken Hills. The Simon Silver-Lead Co., east of Mina, developed in excess of 500,000 tons of ore and extended development to the seventh level, 565 ft. deep. A milling unit of 100 to 125 tons' capacity is being designed, and it has been stated that the U. S. Smelting will advance funds for its construction and has contracted for the concentrates. Other properties near by were active.

Jarbidge, toward the close of 1920, had exceeded 1919 production. Elkoro, Jarbidge-Buhl and the New York Jarbidge mining companies are the important operators. From the Long Hike mine the Elkoro had milled up to Nov. 1, 104,469 tons, which yielded in bullion $1,181,900, with a net operating profit of $555,229. This profit has been expended in completion of plant, development, and other expenses. A minimum estimate of probable ore in the different claims is stated to be 100,000 tons, with promise of more.

At Gold Circle, the Elko Prince maintained its production of sixty tons per day. Other mines were also active. At Tule Canyon, W. J. Loring prospected and developed the Silver Hills Nevada Mines with varying but encouraging results. Birch Creek, Searchlight, Spanish Belt, Rye Patch, Rawhide, Willard, Denio, and Pioneer were active.

At Round Mountain, placer and lode mining continued, with encouraging returns. The White Caps, at Manhattan, extended its development, discontinued milling, and during 1920 shipped 1,496.4 tons of ore to the Tacoma smelter. Arsenic content was 669,392 lb. and gold $38,146 in value. The main shaft was deepened to 1,000 ft., and a station cut on the 800-ft. level. Goldfield operations were restricted by difficulty in securing capital. Both the Goldfield Development and Goldfield Deep Mines, under the leadership of A. I. D'Arcy and H. G. McMahon, conducted minor operations.

New Mexico

By James P. Porteus

Lordsburg, New Mexico

MINING operations in New Mexico during the first three quarters of 1920 were fairly steady. The production of copper, notwithstanding adverse market conditions, showed a gradual increase up to October. In the last quarter, however, there was a pronounced "tapering off," which movement culminated in December in a severe shrinkage in all operations. The price of silver, maintained by the Pittman Act, caused a number of old mines to be reopened. No great production developed, but in some operations, as at Lake Valley and Central, considerable ore was profitably shipped. A number of new silver developments look promising. Gold mining was not altogether neglected.

The Mogollon mines were consistent producers throughout 1920, and both Steeple Rock and Pinos Altos districts showed some activity. The production of zinc increased in the Hanover district, but decreased elsewhere, total output for the state being less than last year. Manganese in the vicinity of Deming and fluorspar at Lordsburg and in the lower Rio Grande Valley attracted attention. Iron shipments were quite regular, and ferromanganese ores moved briskly from June until the increase in freight rates put a stop to the business.

The general advance in freight rates has operated most severely against the mining industry of the state. Most low-grade shipments have ceased. An increase in smelter charges, forced by the same conditions, together with a plan for partial settlements on copper ore shipments, balance to be paid when, as and at the prices prevailing at the time of sale, stopped much tonnage that otherwise would have moved. There is an indication that old rates on all low-grade ores will be restored, as it is clearly in evidence that this must be done if the traffic is to move at all. The labor situation has been reasonably satisfactory. Mexican miners are employed to a very large extent.

The Chino Copper Co. continued to be the largest producer of copper in the state in 1920. The output for January was 3,081,937 lb. of crude copper, and output increased steadily to September, when it reached 5,161,000 lb. The total for the year is estimated to be 43,000,000 lb. During November production was cut to approximately 40 per cent, but up to December no change had been made in the general wage scale, although a part of the working force had been laid off.

At Tyrone, the Burro Mountain branch of the Phelps Dodge Corporation built a new 2,000-ton concentrating mill, and carried on development work at a rate of about 10,000 ft. per month. The first 1,000-ton unit of the new mill was started on Aug. 2 and the second unit a few weeks later. The production of crude copper for that month was 92,000 lb., the new mill showing an increased recovery of 10 per cent. The Austin-Amazon was inoperative throughout the year. At Pinos Altos the U. S. Copper Co. lost office and shafthouse by fire. The Calumet-New Mexico operated a sixty-ton mill until the zinc market dropped, but after a limited shutdown milling was resumed on custom ores from the surrounding district. The Cora Miller mine, in the Mangas Valley, west of Tyrone, was reopened after lying idle for many years. Silver ores in paying quantities were developed and a fifty-ton cyanide mill was built and is in operation.

The total tonnage of ores shipped from the Lordsburg district up to December amounted to 53,620, of an approximate value of $800,000. On June 1, the Calumet & Arizona Mining Co. took possession of the Eighty-five mine by purchase. The price paid is believed to have been over $1,000,000. A year previous to June 1, the production had been approximately 7,000 tons monthly. Since that date production has been 4,500 tons per month. These ores, like those of the Bonney and Miser's Chest, are highly siliceous copper sulphides, carrying gold and silver, and are very desirable for fluxing purposes. When taken over, the property was developed to the 750-ft. level. The new owners have carried the work to the 1,050-ft. level and intersected the vein at 950 ft., where it is strong and of excellent grade.

The Bonney mine has done a large amount of successful prospecting outside of its main vein. The Octo mine has operated steadily since June. A large amount of development work has been done and strong veins of low-grade ore have been opened. Buildings have been constructed, and a 500-hp. steam-power plant has been purchased to be installed at an early date at No. 3 shaft, which is in ore. The Miser's Chest mine was taken over by a syndicate of Tyrone and Silver City people, who shipped twelve cars of good copper ore and extended the main shaft to 450 ft. in depth. The Co-operative Mining Co. completed a 50-ton flotation mill and shipped 190 tons of high-grade ores and concentrates. Development work has reached the 200-ft. level. On the Monte Rico property, a number of veins giving good assays in silver-lead have been opened.

The Great Eagle fluorspar mine was operated for about five months by the owners, then leased for four months, and then sold to Michigan capitalists, who are erecting a 200-ton mill, intending to turn out an acid-grade product. Production up to November was 1,500 tons. A number of other fluorspar prospects have been opened in this vicinity, but none of them has as yet produced commercially.

At Hanover, the Empire Zinc Co. worked practically its full force through the year. In May, the company bought the Republic mine for $500,000 cash. The Hanover-Bessemer, notwithstanding the increase in freight rates, maintained steady shipments of iron ore to the Colorado Fuel & Iron Co. The new mill of the Grant County Copper Co. continued to turn out a good grade of zinc concentrates. The Mogollon Mines Co. operated both mine and mill full time throughout 1920. The mill output was increased, new orebodies were opened and a substantial addition was made to the ore reserves of the company. Through good management a satisfactory working force has been built up.

South Dakota

By Otto Ellerman

State Mine Inspector, Lead, S. D.

THE production of gold in South Dakota for 1920 will be somewhat less than $5,000,000, or about the same as for 1919. The high cost of supplies and the scarcity of labor were responsible for the low yield during the last two years. Only two gold producers operated in the Black Hills in 1920. The labor situation was greatly relieved in the last two months of the year, and in a short time the producers will be operating all their departments at full capacity. Continued high costs will prevent numerous small concerns from resuming work. The year 1921 will show an increase in the precious-metal output, but the normal pre-war production cannot be looked for yet.

The Homestake continued active, with 840 stamps dropping for the greater part of 1920. The company's plant at Terraville was placed in operation on Dec. 2, and 920 stamps are now being used. The remaining 100 stamps will be utilized early in 1921, and the production for this year will be nearly normal.

The Trojan was active during 1920, and in addition to the regular production, the sinking of the new shaft was continued. This had reached a depth of nearly 300 ft. when work was temporarily suspended on Dec. 1. The gold production from the mine will show a decrease during the year as compared with 1919. The Cutting continued the sinking of its main shaft to a depth of 500 ft. Laterals were driven at several levels, but all work was stopped in October, owing to the large amount of water encountered. New pumps are being installed, and the further development of the property will be started soon after the first of 1921. In the Carbonate district, the Elder tunnel was completed and tapped the old Iron Hill workings at a distance of 1,385 ft. The mine was unwatered through this drainage tunnel, and some development work is now being done.

The Ofer property at Lead was merged with the property of the Reliance company during 1920 and that of the old Dakota company. The Reliance cyanide plant will be enlarged and the railroad will be extended to the property. The combined properties contain a large acreage of mineral ground in the Bald Mountain district and extensive work will be started in 1921 under the name of the Ofer company.

The Echo, at Maitland, did some development work, but operations were suspended early in 1920. The New Silver Queen, at Galena, made shipments of lead-silver ores, and late in the year completed the installation of electric equipment, which will greatly increase the production from this property. The Golden Crest was sold to James Hardin, of Deadwood, and associates, and work has been started to place the mine in condition for regular production. The Anaconda company has erected buildings for employees, and mine work will be started soon.

The National Tin Corporation continued the development of its properties near Hill City. The concentrator was placed in operation during the summer, but operated only for a short time. All work was suspended early in the fall. The First National Co. took over the Golden Summit mine, near Hill City, under bond and option, but did only a few months' development work. The Maywood Chemical Co., at Keystone, made regular shipments of lithia ore during the summer months. Shipments of gypsum products were made by the U. S. Gypsum Co., at Piedmont, and the Dakota Plaster Co., at Blackhawk, and the Refinite Co., at Ardmore, made an increased production of water softener. Small amounts of mica, tungsten, and placer gold were recovered by individuals, but the quantity was negligible. One oil well at a depth of 700 ft. was brought in early in December on the Slocum lease, two miles southwest from Edgemont. In this and other districts test wells are being drilled.

Oregon

By Henry M. Parks

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THE most distinctive single feature of the mining industry in Oregon for 1920 was the development of iron ore both in important quantity and of good quality in Columbia County. The ores, as far as developed, are all limonites, the larger part of them analyzing 50 per cent or better in iron (dry analysis). They are very low in sulphur and carry but 0.3 to 0.5 per cent of phosphorus.

The Oregon mining industry was, in common with that of most mining states, hampered in 1920 by conditions caused by the war. The shortage of labor was greater in mining than in other industries. In addition, the gold producer could purchase less labor and supplies for his gold than before the war. In most operations it has cost more than $20.67 to produce an ounce of gold, so that operations were conducted at an actual loss at the majority of gold mines. The great increase in the cost of supplies, made still greater by the two raises in freight and express rates, added materially to mining and milling costs. The high freight rates have added to the cost of marketing concentrates and to smelter rates, and consequently reduced the net smelter returns to a marked extent.

Notwithstanding decidedly adverse conditions, a considerable amount of new work was done in 1920. The Waldo Corporation, operating the Logan hydraulic placer mine, at Waldo, Ore., completed its 1,650-ft. tunnel. This tunnel obviates the necessity of hydraulic elevators. The gravel is now flumed through the tunnel. The water formerly required by the hydraulic elevators is used in washing the gravel, thus increasing the output and efficiency of the plant. The Old Channel Mine, another well-known placer mine, which had been idle for some years, now has a force of men working on the property under the management of J. R. Harvey. Renewed activity is reported at the Almeda copper mine, at the Sylvanite gold-tungsten mine, and at a few other properties in southern Oregon.

In eastern Oregon extensive development work is being done on the properties of the Cornucopia Mines Co. at Cornucopia. The two cyanide mills are being operated twelve hours daily. The E. & E. mine, at Bourne, which completed a twenty-stamp mill and flotation concentrating plant last spring, is in operation, with John Arthur as manager. The Ben Harrison mine completed its flotation plant and operated one shift daily during the summer months of 1920, but closed down in October because of labor conditions and high operating costs. The manager, W. C. Fellows, stated that when normal conditions return full scale operations would begin.

The Empire Dredging Co., at John Day, was operated steadily throughout 1920, and the gold dredges of the Powder River Gold Dredging Co. and the Sumpter Dredging Co. have been operated since May 15, having been idle during the winter of 1919-20, owing to a shortage of electric power caused by the unusually light rainfall the previous year. Several other mines were closed for the same reason, the Eastern Oregon Light & Power Co. having been unable to furnish the necessary power.

The Iron Dyke copper mine, at Homestead, was operated steadily throughout 1920. Development at the

Gem mine, at Susanville, was continued through the year, and additional equipment was placed there last fall, and the owners are now planning on the erection of a mill on the property in 1921. The La Belleview mine partly completed a mill at its property northeast of Granite. The Buffalo mine, which has been shipping silver ore for several years, closed down late last fall, owing largely to troubles within the leasing company operating the mine.

The rapid drop in the price of materials and supplies; the change from a shortage of labor to a surplus; the clearing up of the freight situation with assurances of prompt delivery are decidedly encouraging to the gold miner. The year 1920 was a most difficult one for the mining industry, but operators are confident that there will be a considerable revival in 1921, especially in the development of gold and silver properties.

Washington

By Ernest N. Patty
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THE 1920 mineral production of Washington will total approximately $20,000,000, with coal, cement, magnesite, metals, and clay products ranking, in the order named, as the major mineral industries.

The total value of the metal-mine production during 1920 will exceed that of 1919 by 30 per cent and almost equal the $1,500,000 production made during 1918.

Approximately fifty properties shipped ore during 1920, but 80 per cent of the metal production came from eight mines. The copper came principally from the Sunset mine, in the Cascades, and the United Silver-Copper mine, in northeastern Washington. The Electric Point mine, in the Northport district of Stevens County, produced the major portion of the lead. Silver came principally from the United Silver-Copper mine, just mentioned; the Arlington mine, of Okanogan County, and the gold ores from the Republic district. A recent discovery of high-grade zinc carbonate in the Northport district gives an appreciable production of that metal for 1920. The Republic district, in Ferry County, produced most of the gold ore, which it shipped crude to the smelters as a siliceous flux. It is declining rapidly under present gold-mining conditions. Its ultimate rejuvenation is contingent upon the economic solution of certain metallurgical problems which will make the lower-grade ores commercial, and, of course, on a decided betterment in the gold situation. There are several excellent gold properties in the Mount Baker district of northwestern Washington which will resume operations when the mining of gold again becomes profitable. A gold dredge was put in operation a few months ago in the Swauk Basin of west-central Washington. If this operation proves successful the gold production will be saved from a decided decrease during 1921.

The present metal market discourages the opportunity for an increased copper and lead production during 1921. The copper and lead mines of the state cannot operate profitably under present costs with copper at 13c. and lead around 5c. If such conditions continue most of the major producers will be closed down. The silver production for 1921 will receive a decided increase with the Pittman Act operative. A large part of the 1921 production should come from the Nighthawk and Ruby-Conconully districts of Okanogan County.

This has been a prosperous year for the magnesite industry of Stevens County. Just at the close of 1920, the long-feared importations of Austrian magnesite were appearing in formidable shipments. The domestic producers with their mines in Washington and California and the markets in the eastern United States are so severely handicapped by the costly transcontinental freight haul that they cannot hope to compete on an even basis with magnesite mined in Austria by cheap labor and shipped to this country as ballast. The American Mineral Co. announced the suspension of operations Jan. 1, 1921. Investment in machinery and equipment in Washington magnesite mines exceeds $2,000,000, and several hundred men are employed.

The copper smelter at Tacoma operated continuously throughout 1920, as also did the lead smelter at Northport. The Bilrowe electric smelter, at Tacoma, operated four electric furnaces throughout the year, and produced approximately ten tons of ferromanganese daily to supply foundries and steel works along the Pacific Coast.

A number of oil companies are drilling on the west coast of the Olympic Peninsula, in the northwest corner of Washington, but so far no oil has been brought in. The Standard Oil Co. has one well down over 1,500 ft., and is starting a second hole.

Joplin-Miami District

By Jesse A. Zook
Correspondent *Engineering and Mining Journal*

SHIPMENT of blende from the zinc-lead mines of Oklahoma, Kansas, and Missouri in 1920 exceeded 500,000 tons, an excess over 1919 of 90,000 tons. Lead increased 16,570 tons, and the value of all ores is over $10,000,000 greater.

Oklahoma gained 52,280 tons blende and 16,610 tons lead. Kansas gained 49,320 tons blende and 6,760 tons lead. Missouri lost 15,050 tons blende, 1,930 tons calamine, and 1,300 tons lead. The year was wholly unparalleled in production of zinc and lead, and the value returns are the greatest recorded. Oklahoma zinc shipments were lightest during the last half-year, Kansas loaded heaviest in the last half-year, and Missouri slowed down during the last half.

The Oklahoma-Kansas group of mines extends north and northeast from the point of origin, four miles north of Miami, Okla., the northward trend passing into Kansas north of Picher. The northeast swing of operations has made no alignment of contiguous development, but produced several splendid mines, with intervening undeveloped territory, leading toward the Chanute Spelter Co.'s great Hartley mine in Kansas. The older Oklahoma mines in the vicinity of Lincolnville, nearly due south of the Hartley mine, made some progress during the year. To the northward group in Oklahoma belongs the credit of heaviest lead production, the Barr mine of the Vinegar Hill Co. being the largest lead producer in the Kansas portion of this area.

Discovery a few years ago of a mine of promise west of Waco, Mo., has, with subsequent development, enlarged the Waco area well across the state line in Kansas, until there are several mines producing zinc blende from an ore level as richly mineralized with zinc as the Picher area, but lean in lead, yielding a splendid zinc for rolled-zinc products. The increase in 1920 of the Waco area was from the Kansas side of the Missouri-Kansas state line, with development on the Missouri side neglected. The older Missouri mines producing blende, aside from Oronogo, are a negligible quantity as regards output and the calamine mines are making a lower record each succeeding year.

TABLE I. SHIPMENTS OF ZINC–BLENDE, CALAMINE AND LEAD CONCENTRATES IN THE JOPLIN DISTRICT, 1920, WITH VALUES

Oklahoma	Blende, Pounds	Calam ne, Pounds	Lead Concentrates Pounds	Values
Ottawa County ...	792,688,810	....	120,117,920	$25,026,620
Kansas				
Cherokee County..	254,126,970	....	44,028,510	8,154,190
Missouri				
Jasper County....	76,523,580	1,790,750	10,830,160	2,357,070
Newton County...	2,369,680	16,481,540	....	371,120
Lawrence County.	1,944,030	1,146,900	....	64,180
Other counties (*a*).	451,720	243,110	....	16,030
Missouri totals..	81,289,010	19,662,300	10,830,160	$2,808,400
1920 District totals..	1,128,104,790	19,662,300	174,976,590	35,989,210
1919 District totals..	937,745,880	23,516,360	141,944,470	25,392,340
Increase..........	190,354,910	....	33,032,120	10,596,870
Decrease.......	....	3,854,060	....	.....

(*a*) Includes ores brought by Joplin purchasing agencies in Greene, Barry, Ozark, Wright and Howell counties. Two cars each of blende and calamine from Arkansas are not included.

TABLE II. MONTHLY AVERAGE PRICES OF BLENDE, CALAMINE AND LEAD CONCENTRATES IN 1920, IN THE JOPLIN DISTRICT

(Per Ton of 2,000 Lb.)

	Blende	Calamine	All Zinc Ores	Slab Zinc(*a*) Cents	Lead Concentrates	Pig Lead (*a*) Cents
January....	$53.90	$31.02	$53.35	9.265	$94.39	8.154
February...	51.82	36.00	50.69	8.737	85.33	8.533
March.....	52 15	36.75	51 27	8 691	102 18	9 87
April.......	51 22	38 20	51.11	8 356	107 09	8 666
May.......	46 45	37 98	46.34	7 679	105 67	8 381
June.......	47.04	37.17	46.90	7.834	101.93	8.437
July.......	43.47	35.59	43.33	7.72	98.85	8.283
August.....	45.99	38.35	45.64	7.824	101.35	8.686
September..	46.55	37.42	45.12	7.763	101.99	8.47
October....	44.89	36.93	44.53	7.277	90.05	7.169
November .	44 66	38 13	44 52	6 448	84 67	6 373
December..	36.00	30 00	35.00	..	70 00	
Year.....	$47 01	$36 16	$46 49	.....	$95 71	

( ) Monthly averages drawn from weekly averages of daily quotations in the *Engineering and Mining Journal*.

TABLE III. ORE PRICES IN THE JOPLIN DISTRICT FOR TWELVE YEARS

(Per Ton of 2,000 Lb.)

	Zinc Ores		Lead Ores	
	High	Average	High	Average
1909	$55.00	$41 08	$60 50	$54 56
1910	52 00	40 42	58 00	51 98
1911	51.00	39 90	64 00	56 76
1912	67.00	53.33	68 00	56 60
1913	59 00	42 26	58 00	52 52
1914	54 00	40 46	54 50	46 55
1915	138 90	79 30	80 00	55 08
1916	131 70	84 72	104 84	84 07
1917	101.95	67 70	135.50	98 00
1918	78 70	51 33	106 00	88 98
1919	57.60	43 08	89 00	66 43
1920	61 50	46 49	112 50	95 71

The large reserve stock in the bins at the end of 1919, from lack of transportation facilities, was carried on advance buying throughout three-fourths of 1920, as shippers could obtain few cars except on a showing of tonnage purchased. Box cars were unobtainable, and shipments were made in cattle and coal cars. Following the initiation of increased freight rates, cars began arriving, until at the close of November a mile of empty cars were reported on side tracks in the three mining counties.

Prices--Prime Western grades of zinc blende opened 1920 at $57.50@$55, holding through January, closing February at $52.50, March at $47.50, then opening April at $50 and closing at $45, the price varying from $45 down to $42.50, until the end of June, when $45 was resumed, up to $47.50 through July and August, receding to $45 the end of September, and from here declining to $30 with the advent of December. Premium grades generally were $1 higher and fines $2.50 and slimes $5 lower all of the year.

Zinc calamine established a new record, the strong demand bringing a price level far above a generally conceded parity with blende. Only by maintaining a high basis was there a possibility of continuing production sufficient to meet the unusual strength of demand. The basis price was $35 and $36 ten months, showing the first weakness in November, receding to no demand at the year end.

Lead advanced from $92.50 at the opening of 1920 to $110 basis in April, fluctuating around $100 to $110, until at the end of August purchases were made on $112.50 basis. Then the price dropped to $80 at the end of September, to $65 at the end of October, to $55 at the end of November, and the metal was weak in demand in December, on $50 basis. Settlements were made on $110 basis, for ore contracted in August, up to December.

Average prices for both zinc and lead ore appeared disproportionate to basis prices during October and November, as the averages were derived from settlements on contract ores. Zinc blende was $27.50 per ton lower at the close than at the opening of 1920, and lead receded $62.50 per ton from the high level in August.

Southeast Missouri Lead District

BY H. A. WHEELER

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THE pig-lead output of the Southeastern or disseminated lead belt in 1920 was about 158,000 tons (December production estimated). This is about 3 per cent greater than 1919, but is about 20 per cent below the record year of 1917, when lead reached the peak price of 12c., as the result of war conditions. Had there not been a continuous shortage of labor throughout 1920, the output would have been considerably larger, despite decreased efficiency.

The year 1920 was marked by violent changes in the lead market. Labor was paid the maximum war rates throughout the year, but beginning Jan. 1, 1921, a reduction of 20 per cent was made where the wage exceeded $4 per day and 9 per cent upon less than $4, with a minimum of $3. In the Joplin district, which experienced low prices for zinc ore, a horizontal reduction of $1 per day has been made recently.

Several shafts and two mills have been shut down in St. Francois County, which produced almost the entire output in 1920. The Missouri Cobalt Co., in Madison County, closed its plant in October. A small amount of lead is produced by this company as a by-product from four to five tons of copper and about three tons of nickel and cobalt products per day from the former North American property at Fredericktown. The St. Joe company found a new orebody two miles west of Leadwood, and is sinking a new shaft on the old Donnelly tract in Flat River. It is also erecting an additional electric power plant at Rivermines, which will enable the entire property to be operated by electricity. Its Crawley, or No. 8, shaft will connect underground with the 6,000-ton mill of the former Doe Run plant, thus supplying this mill entirely through mine haulage and doing away with surface transportation over the M. R. & B. T. R.R. The old Mine la Motte property, in Madison County, remains closed down through litigation, and no lead is being produced in the county. The Picher Lead Co. has optioned the Schulte tract, near Fredericktown, and is doing additional diamond drilling. The Einstein tungsten property, on the St. Francois River, remains closed, but some prospecting for tungsten in the granite is being carried on in the neighborhood. In the neighboring counties of Washington, Franklin, and Jefferson only small amounts of lead were produced from shallow "diggings" in 1920, with no attempt to prospect for the deep disseminated lead.

Zinc in Wisconsin

By J. E. Kennedy

Correspondent *Engineering and Mining Journal*

THE tonnage of zinc ore shipped in 1920 from the Wisconsin district decreased 35 per cent from that of 1919, as shown in the table. The gross tonnage of zinc ore shipped from mines to smelteries without and to separating plants within the district decreased 25 per cent.

Ore Prices—Market conditions were unstable throughout 1920. The margin between premium and Prime Western grades of blende, both bought on a basis of 60 per cent zinc, was practically eliminated. Buyers of the higher grade, formerly well represented in purchases, made little or no effort to buy. A larger percentage of the tonnage was sold under contracts, and weekly open-market quotations were not always obtainable. The base price for January was $60 to $61 per ton, and this was the highest level attained throughout the year, the average base approximating $50, with the year-end price at $40 and lower.

WISCONSIN ZINC ORE SHIPMENTS
(In Short Tons)

	Net to Smelteries		Gross from Mines	
	1919	1920	1919	1920
Highland	8,112	2,551(a)	8,112	2,551(a)
Linden	56	50	865	1,869
Mifflin	89	316	20,874	29,405
Mineral Point	29,097	25,592		....
Platteville	1,859	1,887	1,993	1,887
Dodgeville			190	....
Cuba City	24,581	18,289	6,887	11,278
Benton-New Diggings	33,439	14,372	82,516	50,501
Hazel Green	80		9,836	4,467
Shullsburg	2,742		8,585	3,024
Galena, Ill.	80		24,873	17,966
Total 1919 and 1920	100,135	63,057(b)	164,731	122,948(b)
1918	120,854		189,058	
1917	148,766		247,993	
1916	133,035		219,118	
1915	104,670		163,916	
1914	84,836		134,362	
1913	76,017		105,887	
1912	99,409		119,280	

(a) Crude [illegible] (b) Totals to Dec. 11, 1920

A total of thirty-two concentrating mills and five separating plants operated at various times during 1920, as against forty-two mills and five separating plants in 1919. High labor and material costs stimulated effort toward increased efficiency. The U. S. Bureau of Mines established a substation at the Wisconsin State Mining School, at Platteville, to carry on research and experimental work. A change in milling practice initiated in 1920 by D. I. Hayes, of the Wisconsin Zinc Co., reduced tailings losses. Little new construction and development work was undertaken. The Vinegar Hill Zinc Co. completed its mill on the Fields-Meloy property. The Wisconsin Zinc Co. moved one of its milling plants to the east end of the Champion tract, where it utilized the Blackstone shaft. The Connecting Link Co. completed its No. 1 mill. A Chicago company was sinking a shaft and completing a mill on the Nightingale lease at Benton at the year end. The Mineral Point Zinc Co. wrecked its last mill at Highland, which fact indicates the apparent depletion of practically the only remaining zinc carbonate deposits of this district. The National Zinc Ore Separating Co. purchased and completed the Government's partly finished acid plant at Cuba City, making a high-grade sulphuric acid.

Tennessee

By Wilbur A. Nelson

State Geologist of Tennessee, Nashville, Tenn.

THE year 1920 in Tennessee was a remarkable one in the mining industry. Starting out with all mines working at full capacity, and with an excess of advance orders and upward revision of wages, the year ended with many mines working part time and others shut down, and substantial cuts in wages have been made in some of the districts.

Phosphate Mining.—In the phosphate district of middle Tennessee, new plants have been constructed at Wales by the International Agricultural Corporation, with a capacity of 300 tons per day of brown rock; at Toomey, by Armour & Co., for mining, crushing, and drying blue rock (capacity 100 tons per ten hours); and by the Tennessee-Illinois Fertilizer Co., which has erected a 100-ton plant for grinding brown rock. Methods have been improved by the introduction of settling devices such as Dorr thickeners and Allen cones for the saving of fine sands formerly wasted. There have been no strikes in the district. A 50 per cent reduction per day in all wages went into effect in the Centreville district on Nov. 1. In the other districts there were no changes, except that the efficiency of labor about doubled. Little rock is being stored by producers.

Iron Mining—All the iron furnaces and ore mines were operated at full capacity for the first nine months in the year. In the last part of 1920 the pig-iron market dwindled so that all the furnaces in the state shut down temporarily.

Copper Mining—The copper industry at Ducktown was limited in the last part of the year, and the company put into effect wage reductions of 10 per cent, as well as reducing the number of men employed.

Clay—The ball clay mines in west Tennessee operated continuously during 1920. During the first ten months of the year there was a 50 per cent labor shortage, but this has disappeared. There have been no strikes and no reductions of wages. The large producers have improved their operations by adding new equipment and machinery and additional steam shovels. The Mandle Clay Mining Co., of Whitlock, Tenn., is building a forty-ton plant for the reduction and preparation of clays. Small stocks of the different grades of ball clay are on hand for winter use.

Petroleum—Small oil production was obtained in 1920 from three counties, Scott, Sumner, and Pickett. The Scott County field is situated around the town of Glenmary, where oil is obtained from the St. Louis limestone at a depth from 1,200 to 1,300 ft. The few producing wells in this area have a capacity of about ten barrels each. In Sumner County four wells are producing on the Miller farm, 1½ miles northwest of Sugar Grove. Oil is found at about 300 ft. This is an extension of the Allen County, Ky., field. There is considerable wildcatting in this section. In Pickett County one small well on the Parris farm, near the mouth of Eagle Creek, on Obey River, has produced oil at a depth of 247 ft. Much wildcatting is now going on in this region, and several good structures are being drilled. Additional wildcatting is going on in nearly every county on the middle Tennessee Highland Rim.

Illinois

By L. A. Mylius

Geologist, Urbana, Ill.

EXCLUDING coal, raw mineral products in Illinois, in their order of commercial value as closely as it can be estimated were in 1920: Petroleum, sand and gravel, limestone, fluorspar, lead and zinc, clay, quartz, and tripoli. Petroleum, with an approximate value of $41,500,000 in 1920, has nearly four times the total value of all the other raw products.

Petroleum—Oil production in 1920 will total approximately 10,750,000 bbl., about 12 per cent less than the production in 1919, and but one-third of the annual production in the years from 1908 to 1912 inclusive. The price of oil reached $3.77 per barrel in April, and held that price to the end of the year. The average price of Illinois oil in 1919 was $2.50 per barrel and in 1920 was $3.66 per barrel. This increase of 45 per cent over 1919 prices gives a gross value for Illinois oil of $40,300,000. The value of gasoline extracted from natural gas was approximately $1,300,000. The total value for 1920, $41,600,000, is $10,000,000 in excess of any previous year's production.

The increased value of petroleum stimulated somewhat prospecting for new production. Approximately 381 holes were completed during 1920, of which 110, or 30 per cent, were dry. Of these completions 350 were in Clark, Crawford, Cumberland, and Lawrence counties; sixteen were in eastern Illinois north of Clark County; and fifteen in the remaining parts of the state.

The profitable horizon in the Trenton and its possibilities attracted attention during the year. Six producing wells and two dry holes were drilled in the Trenton in Parker Township, Clark County; four dry holes were drilled to this sand over an area of 120 square miles north of Clark County; and one test southwest of Robinson, Crawford County, was dry. Several small wells were brought in near Borton, Edgar County, in shallow Pennsylvanian sands, and wells to the "Corniferous" in Coles County gave encouraging "shows" of oil, but no production. At Waterloo, Monroe County, the doming has proved productive, but its commercial importance has not been ascertained. East of Gillespie, Macoupin County, a Pennsylvanian pay horizon was discovered at slightly over 600 ft., and five wells were completed.

Sand and Gravel—The increase of road work during 1920 strengthened the demand for this material. With improved conditions, the outlook is good.

Limestone—The limestone quarries should show an increased production over 1919, and several plants are being enlarged. Road making and other demands are strengthening this industry. As the capacity of the quarries is at least 7,000,000 tons per year, and as the car shortage and labor conditions have already improved, the outlook is favorable, and a considerable increase in production is expected.

Fluorspar—The production of fluorspar in 1920 will probably show an increase over 1919, due in part to the depletion of stocks held by the steel companies when the armistice was signed. The price obtained for gravel spar, the principal product, was about $4 per ton lower than in 1919. The prices obtained for ground spar and acid lump were in excess of 1919 prices. At present, the market is dull, but prices seem firm. Most of the small mines are shut down. The large producers are working at about capacity. Preparations are under way to open a new mine of considerable size, and 1921 should see the opening of a mill to treat ores of high zinc content.

Lead and Zinc—The production of lead and zinc in Illinois shows a decrease in 1920. The average price of the lead concentrate throughout 1920 was considerably in excess of the 1919 quotation, but the price of zinc concentrate was about $1 less for the first eleven months of 1920 than in 1919. In November and December the depression in prices became acute. Only two mines of any size are operating in Illinois. No new activity is expected before the summer of 1921.

Arkansas

By Jim G. Ferguson

Commissioner of Mines, Manufactures and Agriculture, Little Rock, Ark.

INDUSTRIAL conditions following the war had a depressing effect upon mining in Arkansas in 1920, but in coal and bauxite this depression was only temporary. Coal production has again reached normal, and the bauxite output for 1920 promises a substantial increase. In the mining of zinc, lead, and manganese there has been a decided slump, from which it is feared a return to former prosperity will not take place until there has been advance in prices.

Should the recent rate of production of bauxite be maintained, the total production of Arkansas by the American Bauxite Co., the Republic Mining & Manufacturing Co., the Globe Bauxite Co., and one or two small, independent producers will be approximately 500,000 long tons for 1920.

Arkansas produces 90 per cent of the bauxite mined in the United States. In 1919, all of the bauxite used in the United States in the manufacture of aluminum came from Arkansas, as did 28,981 long tons used in the chemical industries, 31,180 long tons applied in the manufacture of abrasives and 1,059 long tons consumed by the makers of refractories.

On account of the initiation of a $100,000,000 road-building program in Arkansas, an unusual impetus has been given to the crushed-rock industry. The largest plants in the state, situated near Little Rock, have had an unprecedented year. Clay production for the manufacture of brick, tile, and pottery was about normal in 1920. The future outlook for this industry is encouraging, as it is also for the production of building stone, marble, and granite, large deposits of which are found in Arkansas. The production of antimony, slate, and whetstones was nominal in 1920.

More capital was invested in Arkansas during 1920 in oil and gas development than in all other mining activities combined. It is estimated that 100 prospect wells have been drilled or are in process of being drilled in the state. In the proved natural-gas district contiguous to Fort Smith, the daily production has been increased to 240,000,000 cu.ft. One well has a record of 24,000,000 cu.ft. per day, and is rated one of the largest gas wells in the United States. The present production is in excess of the immediate needs of the cities and industries dependent upon natural gas for fuel, but is estimated to be only about 10 per cent of the capacity of this field. What may prove to be a new gas field, situated in south-central Arkansas, was discovered during the summer of 1920 while drilling for oil on the Constantin leases, near El Dorado. A considerable production of natural gas was developed, and is now being piped to El Dorado for consumption. Other wells are being drilled in the vicinity, and the extent and character of the field will probably be determined.

During 1920 Arkansas made its first commercial production of petroleum, from the Hunter well, near Stephens, in Ouachita County. The output of this well is only ten barrels per day, but it has demonstrated that south Arkansas has oil and has stimulated development in that district.

Recently, some of the large oil development companies formed a million-dollar syndicate for a thorough and systematic exploration of the area favorable for oil production in Arkansas and obtained the technical services of Dr. John C. Branner, former State Geologist of Arkansas and later president of the Leland Stanford Junior University in California.

Kansas

By Raymond C. Moore

State Geologist, Lawrence, Kan.

THE mineral resources of economic importance in Kansas are: Petroleum, natural gas, coal, lead, zinc, cement, salt, gypsum, sand, gravel, limestone, sandstone, clays, and pumice. Of these, petroleum is of greatest importance, both for the total value of the yearly production and the interest which attends prospecting for new fields. Including estimates for the month of December, the total value of the mineral products for 1920 will amount to nearly $170,000,000, exceeding considerably the figure for 1918, $158,684,000.

With estimates for December, 3,075 wells have been drilled in Kansas during the last year, of which 2,250 have yielded petroleum in commercial quantities. The total production is estimated at 33,920,000 bbl., of a total value of $118,720,000. The largest oil-producing fields are in the south-central part of the state, in Butler and Marion counties, where the El Dorado and Augusta districts continue to furnish a large proportion of the oil from the state. The development in 1919 which resulted in the important Peabody and Elbing production north of the El Dorado field was extended in 1920 northeastward to the vicinity of Florence. The Covert-Sellers, Florence, and Urschel pools contain good producers, and, on account of their geological situation with reference to the well-known buried granite in central Kansas, are of unusual interest. It is probable that other pools will be found under geological conditions similar to those of the new 1920 fields of Marion County. Shallow field production in the southeast part of the state has been large, the most important new production being obtained in Elk, Chautauqua, and Linn counties.

Natural-gas production declined somewhat in 1920, but there was an increase of more than 100 per cent in the number of natural-gas gasoline plants within the state. Total value is estimated at $6,000,000.

Operations in the lead and zinc district in the southeastern part of Kansas were active, especially considering the difficult conditions arising from the low prices offered for zinc concentrates.

A mine at the northwest edge of the Picher-Treece extension is working good ore at a depth of 285-320 ft., the deepest in this part of the district. New discoveries of deep ore at Galena indicate possible development in this area. In the Kansas portion of the Waco-Lawton district, and in the Badger-Crestline area, new mills have been built, and with higher prices there will be extensive operations. At Waco, ore has been found to a depth of 419 ft. with a continuous face of ore more than 300 ft. in thickness. The estimated value of lead and zinc marketed from Kansas in 1920 is $9,100,000.

Oklahoma

By C. W. Shannon

Director Oklahoma Geological Survey, Norman, Okla.

A MARKED activity in the development of the principal mineral resources of Oklahoma was shown in 1920. Petroleum stands at the head of the list with 103,087,400 bbl., an increase of 14,127,800 bbl. over 1919, and a value for 1920 of $347,355,400, an increase of $190,842,500 over 1919. During 1920 there were approximately 9,100 completions of wells, of which about 75 per cent were productive of either oil or gas.

Drilling for oil and gas has been done or is now being carried on in every county in Oklahoma, and thirty-six of the seventy-seven counties of the state are to be classed as oil and gas producers. At present 30,000 wells in the state are producing either oil or gas or both. The Hewitt field, in Carter County; the Empire pool, in Stephens County; the Beggs pool, in Creek and Okmulgee counties; the Deaner pool, in the northeastern corner of Okfuskee County, and a few other immediate areas, such as Osage County, are responsible for the increased production. Other important pools showed active development, and a large number of wells throughout the various centers of activity, with initial productions from 500 to 15,000 bbl., were brought in. Numerous wildcat wells were drilled, but the percentage completed and showing production of either oil or gas will be lower than that for 1919, in which year 60 per cent of the wildcats proved productive.

The oil and gas producing area of Oklahoma, according to the new map which has just been completed by the Oklahoma Geological Survey, is divided into 170 pools, each of which bears a specific name. Among the miscellaneous wells drilled and the wildcat wells, several are deep tests, and among these in the western part of the state are two or three wells at depths of approximately 3,000 ft. which were drilled into granite and abandoned, thus discouraging development in that section of the state, although the surface structures are favorable. From a geological standpoint the wells in the Beggs district being drilled to the Wilcox sand are of much interest, as this production is known to come from rocks older than those of Mississippian age. The proving of production below the Mississippian has created considerable interest in the redrilling and deeper drilling of considerable areas in the older oil fields of the state.

The amount of commercial gas produced in Oklahoma in 1920 was in excess of 70,000,000,000 cu.ft., having a value at the well of $10,500,000. The use of gas for manufacturing and smelting purposes is being largely curtailed, that the supply for domestic use may be bettered.

The lead and zinc district of northeastern Oklahoma has been one of the most active of the lead and zinc regions of the country, and though prices have fluctuated and at times have been too low to give an incentive to development, the production for 1920 shows a good total. More than 100 mines and mills are operating in the district The total zinc shipped during 1920 was approximately 6,275,560,500 lb., with a total value of $17,350,000. The total lead shipped was 130,950,500 lb., with a total value of $7,250,500. The total value of lead and zinc for 1920 was in excess of $24,500,500.

The total mineral resources of Oklahoma for 1920 will have a value of approximately $400,000,000 as compared with $260,000,000 in 1919.

Interest was considerably revived in the clay and shale resources of the state, and asphalt, of which there is an enormous supply, has been investigated to a large extent, and development of some of the deposits is now under way. Other mineral resources such as glass sand, portland cement materials, gypsum, and building stone received as much attention during 1920 as general conditions warranted.

Minnesota

By D. E. A. Charlton

Managing Editor Engineering and Mining Journal

THERE were several interesting developments on the Mesabi Range during 1920, all of which exerted considerable influence on the increase shown in the iron-ore shipments as compared with those of the year previous. The trend toward the use of heavier machinery in the open pits and the increasing use of mechanical devices were particularly noticeable. Among the former may be mentioned the following: Spreaders for use on the stripping dumps, electrically operated 300-ton shovels; 30-cu.yd. stripping cars; small revolving shovels, supplied with caterpillar propelling gear; 100-lb. rails and 75-ton ore cars in place of the 50-ton cars which have been used for some time. Underground, the use of ore loaders and small hoists with slushers has increased. A development of interest at some of the mines where top-slicing is done is the substitution of wire fencing for the cull lumber formerly used in boarding up the stopes.

State legislation is particularly absorbing to the iron ore operator in Minnesota, and the events of 1920, as concerning attempts to "put across" a tonnage tax, indicate that the result appears inevitable, as Governor-elect J. A. O. Preus was elected on a platform favoring the enactment of a "just and equitable" tonnage tax on iron ore. Two bills have been prepared for introduction at the coming session of the Legislature at the suggestion of the Minnesota Tax Reform Association; one taxing royalties, and the other taxing "unearned profits" on iron ore shipped out of the state.

Three new washing plants were erected during 1920. The Cleveland-Cliffs Iron Co. placed its Hill Trumbull plant at Calumet in operation in August, the Bowe-Burke Co. has completed a 1,000-ton washer at its Mariska mine, at Gilbert, and the Interstate Iron Co. recently began the operation of its plant at the Hill-Annex mine near Calumet. At the Warren mine, near Hibbing, the Tod-Stambaugh interests completed a crushing plant which has a capacity of 1,400 tons in ten hours.

Among the new properties opened on the Mesabi are the Boeing mine of the Cleveland-Cliffs Iron Co. and the Sergeant mine of the Wisconsin Steel Co. Considerable stripping was done at both of these properties, the former being handled under contract by the Winston Dear Co. Stripping was also in progress at the Scranton, Sweeney, and Webb mines, at Hibbing, and at the Bovey-Judd, at Bovey.

The development of greatest interest in the entire Lake Superior district is the work being done by the Mesabi Iron Co. at Babbitt, on the eastern end of the Mesabi Range. Within another year high-grade iron ore from the company's plant should be going forward to the furnaces, and there seems to be little doubt in the minds of Lake Superior operators that the plans of the company for the concentration of finely disseminated low-grade magnetite ores will be carried out successfully. The success of this enterprise has caused no little speculation and some experimentation in the direction of developing processes which will make possible the utilization of siliceous low-grade hematite ores which are not now marketable.

Little exploration was done on the Cuyuna Range, and this condition may be said to be generally true of the other Minnesota districts. It is worthy of mention that the attitude of the tax commissions, in both Minnesota and Michigan, in valuing—at such rates that the ordinary explorer cannot afford to hold it—all reserve mineral that has been discovered has been somewhat detrimental to prospecting. Although less than half of the mines which were developed on the Cuyuna were operated during 1920 the production increased over that in 1919 and was slightly less than in 1918.

The only new development was at the Maroco mine of the Marquette Ore Co., where a shaft was sunk, a washing plant built, and stripping was started. The Portsmouth mine of the Gordon Mining Co. entered the shipping list for the first time, although this property was stripped in 1918-19. Shafts were sunk to deeper levels on the Armour No. 2 of the Inland Steel Co., the Meacham mine of the Rogers Brown Ore Co., the Bonnie Bell mine of the Liberty Mining Co., and the Ironton mine of the American Manganese Manufacturing Co.

The underground mines in the manganiferous ore belt to the north of Ironton and Crosby were uniformly closed in 1920, with the exception of the Merritt mine, which opened up for a while during the summer. All of the stockpiles of manganiferous ore were shipped during the year, and a considerable tonnage of manganiferous ore was produced by the three open pits operating on this grade of ore, viz., the Portsmouth, Sagamore, and the Mahnomen.

Approximately 950,000 tons was shipped in 1920 from the Vermilion Range, which occupied a less spectacular position than either of the other two Minnesota ranges. One property change of note was the transfer of the Zenith mine, which has been operated for a number of years by the Oliver Iron Mining Co., to the Pickands, Mather & Co. interests. It is reported that the Phoenix Mining Co. has given up the lease to the property obtained from Thomas Walsh at Mud Creek.

Alabama Iron Mining

By Y. A. Dyer

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NOTWITHSTANDING the fact that since Nov. 1 1920, several blast furnaces in Alabama were blown out for the purpose of making needed repairs—with the accrued advantage of curtailed output to offset, in a measure, the contraction in demand for "spot" iron and requests for "hold-up shipments"—iron-ore production of the state for 1920 reached approximately 6,398,000 tons. Production figures distributed as to kinds of ore mined and relative production percentages are given in Table I.

TABLE I KINDS AND RELATIVE PRODUCTION OF IRON ORES IN ALABAMA IN 1920

	Tons	Per Cent
Red Mountain, self-fluxing red-ore groups	4,750,000	74.25
Red Mountain, non-self-fluxing red-ore groups	440,000	6.88
Gadsden-Attalla semi-self-fluxing red-ore groups	290,000	4.53
Woodstock-Champion brown-ore groups	590,000	14.34
Appalachian range brown-ore groups	153,000	
Russellville brown-ore groups	175,000	
	6,398,000	100.00

It is a notable fact that the entire self-fluxing iron-ore tonnage was mined from territorial workings approximating an area of six square miles along the crest of Red Mountain, starting at a point about five miles southwest from the center of the city of Birmingham, and located within the minimum raw-material freight-rate zone of twenty-five miles. It is also a fact that one large company mined, at its three divisions on the mountain, 57 to 60 per cent of the total self-fluxing ore tonnage for 1920.

The twin-slope "Shannon" red-ore mine of the Gulf States Steel Co., in Shades Valley, about 14,000 ft. southeast of the portal of No. 7 "Fossil" outcrop mine of the Tennessee Coal, Iron & Railroad Co., has been entirely concreted from the surface to the depth of the ore, a distance of 2,600 ft. A small amount of ore, which was mined and removed from the mine to accommodate the erection of a depressed inside skip bin, has been shipped to the blast furnace, at Alabama City. Considerable "heading" and "neck-work" has been done, thereby supplying additional ore for shipment to the furnace. Total shipments in 1920 were negligible.

The mine is reached and served by the main line of the Louisville & Nashville R.R., which enters Shades Valley by way of Graces Gap through Red Mountain and parallels it for a distance of five miles to a point where it emerges into the Cahaba Valley by way of Brocks Gap through Shades Mountain. The Shannon slope was opened by the Gulf States company on the showing made by a single diamond-drill core obtained at a depth of 1,900 ft., which revealed 9 ft. 6 in. of the upper bench Big Seam ore, analyzing 39.54 metallic iron, 14.10 calcium oxide, and 13.14 per cent insolubles. Since that time an additional drill hole was put down about 1,800 ft. to the southeast of the slope. At this point there was a net difference of about 475 ft. in the depth of hole over the original one, and the ore analysis practically checked that of the first, or original ore log. The ore at the foot of the slope dips between 16 and 17 deg., compared with 25 to 30 deg. at the outcrop.

Machinery for the 13 x 22 x 1,400-ft. five-compartment steel and concrete shaft of the Woodward Iron Co., approximately 8,000 ft. southeast from the outcrop at Muscoda division mine, has been ordered for installation. This mine is reached by a spur leading from the main line of the Atlanta, Birmingham & Atlantic R.R. which parallels considerable accessible territory between the crest of Red Mountain and Shades Valley by way of Readers Gap through Red Mountain, and emerges into Cahaba Valley by way of Brocks Gap through Shades Mountain. Three diamond-drill holes were put down on the section of land on which this shaft is situated, showing following average thickness of upper bench Big Seam and ore analysis: Thickness, 9 ft. 2 in.; iron, 35.66 per cent; insolubles, 13.72 per cent; lime, 17.44.

The sinking of the shaft has marked the introduction of the vertical shaft-mining method in the Birmingham district, which will make possible the winning of millions of tons of high-grade self-fluxing red ore underlying the various strata of Red Mountain, Shades Valley, Shades Mountain and extending far into the Cahaba Valley. The tonnage of self-fluxing ore conservatively estimated by the engineers of the district to be fairly well proved by prospects, and which can be economically won by shaft exploitation, is approximately 1,000,000,000 tons.

During the year 1920 there was a persistent tendency on the part of certain iron-producing companies in the district to prospect in the self-fluxing and non-self-fluxing ore areas of the Birmingham district for reserve ore tonnages. Probably the most persistent efforts were made in the non-self-fluxing areas, due to the fact that practically all desirable ore acreage within the so-called 35,000-acre, or fifty-four square mile, self-fluxing area has been acquired and is now the property of strong companies. At present, diamond-drilling operations are in progress at points east of Graces Gap and as far as Irondale. Between Irondale, or Gate City, and Morrows Gap, the present northeastern extremity of Red Mountain ore operations, numerous drill holes have been put down in the valley southeast of the outcrop. No developments, as to improvement in quality of ore over outcrop ore, have been reported thus far. In many instances the cores have shown very siliceous ore.

Brown-ore operations for 1920 recorded considerable improvement over recent previous years, due to the fact that several furnace stacks in the Gadsden-Anniston-Talladega district were put in blast. One new ore mine in the Rock Run district has been opened and is producing a very high-grade low-phosphorus high-manganese ore.

Considerable interest is being manifested in a virgin deposit in the Blue Mountain section east of Anniston, Ala. Prospecting work is also being carried on in the Alpine section west of Talladega, Ala., and prospects are exceedingly fair for the discovery of an excellent deposit. Much interest has naturally centered in brown-ore operations, due to the fact that with the approach of normal conditions in the pig-iron market it is expected that the foundrymen, in general, will become more insistent in their demands for a uniformly high-grade pig iron of rigid specification. The furnacemen realize that such conditions can be best met by the manipulation of brown-ore mixtures. As a consequence a consistent supply of such ores is assured a ready market.

New York

EDITORIAL CORRESPONDENCE

MINING operations in New York in 1920 were normal, labor conditions in general being fair. Witherbee, Sherman & Co., continued the largest producer of iron ore, with 950,000 tons. Other operations included those of the Port Henry Iron Ore Co., the Chateaugay Iron & Ore Co., the Fort Montgomery Iron Co., the Ramapo Ore Co., as well as those at the Clinton Hematite mines. The Nipissing Mining Co., of Cobalt, Ont., took over the Croton magnetite mines at Brewster. Salt production will probably be about that of the last two years, when it approximated 2,000,000 tons. Other non-metallics of importance that were produced in 1920 included talc, gypsum, marble, limestone, natural cement, graphite, and garnet. There was also some production of pyrites.

North Carolina

BY JOSEPH HYDE PRATT

State Geologist, North Carolina, Chapel Hill, N. C.

DURING 1920 there was a decidedly increased interest in the mining industry of North Carolina, both on the part of the consumer of the products mined and on that of the capitalist. There was also a decided increase in the production of many of the minerals, particularly mica, feldspar, barytes, structural materials, and clay products.

Notwithstanding the high cost of labor and the lack of sufficient cars, 1920 shows a gratifying development of the mining industry of the state, and a considerable increase in the quantity and total value of its mineral production is expected. The impetus which the iron-ore industry received during the war has continued, and investigations of the state and Federal bureaus have interested capital to the extent that North Carolina may probably become in the near future a producer of iron ore in considerable quantity.

Although the non-metallic minerals are of greatest importance, there is still much interest shown in gold and copper ores. Recent investigations show the probability of a large body of good-grade copper ore in the Ore Knob mine, in Ashe County. During the last year several companies have been purchasing the old tailings and dumps at many of the gold and copper mines. These tailings and dumps are being treated, and in some instances the coarser waste material is being used for road construction, so that the entire dumps are being utilized. Tin ores have received some attention, and it is probable that during 1921 tin ore will be added to the minerals produced in this state. Another interesting development in the mining industry is the mining of certain mica schists to be used in the production of ground mica.

Georgia

BY S. W. MCCALLIE

State Geologist, Atlanta, Ga

THE mining industry in Georgia during the first part of 1920 was seriously affected by labor shortage; but at present the trouble has been largely remedied and the mines and quarries are gradually resuming normal production.

The clay industry, and the fullers' earth and cement industries, have been quite active, and in many instances the production has run far short of the demand. The same condition also prevails in the broken-stone industry. This was brought about by the unusual activity in highway and concrete construction.

The iron-ore and manganese mines were not as active as during the war period. This is due largely to unsatisfactory prices. The activity in the barytes, coal, ocher, and talc industries is rapidly approaching normal.

The pyrite mines, owing mainly to the competition of cheap sulphur, are practically shut down. One or two of the larger mines are considering the erection of acid plants and will go into the production of fertilizers so that they may continue to operate their mines. This plan has already been adopted by the Tennessee Copper Co., that is just completing a large fertilizer plant in Atlanta, where much of the acid made at Copper Hill will be manufactured into fertilizer.

Gold mining has been very inactive, and as a result the output has been meager, smaller than for any years since 1834, the earliest date for which there are reliable statistics. Increased cost of labor and diminished purchasing power of gold are the causes.

New Jersey

BY HENRY B. KUMMEL

State Geologist, Trenton, N. J.

THE production of zinc ore in New Jersey in 1920 will be 12 to 15 per cent less than in 1919, and during the latter part of the year the mines were run on part time. Iron ore is estimated at 485,700 tons, about 83,000 more than 1919, with prices from 90c. to $1 per ton better. A six-months' strike, closing the Richard mine; the successful location by diamond drill of the Replogle orebody at a depth of 1,250 ft., and the reopening of the Beech Glen mine, where a new 7-ft. vein of low-phosphorus ore has been uncovered, are the most noteworthy developments in this industry during the year.

Raw clay, brick and tile, pottery, sand and gravel, and crushed stone industries will show increased production, although in certain lines there may be slight decreases. Raw clay sold is estimated at $1,100,000; pottery and brick and tile, $21,000,000 or more; sand and gravel, approximately $2,750,000, and stone $2,500,000 to $3,000,000. Other mineral products include zinc and lead pigments, portland cement, peat, mineral waters, fuel briquets, coke, lime, ground quartz, and greensand marl. A large plant is being erected for the extraction of potash from the greensand marl and manufacture of sand-lime brick from the residue, and will be in operation the spring of 1921.

For several years New Jersey has ranked third among all states in the per square mile value of its mineral products. Total value for 1920 is estimated at upward of $50,000,000. Following were prices in November: Crushed limestone, $1.60 to $2.25; crushed trap, $1.50 to $2.35; glass-sand, washed, [illegible]; dried, $3; run-of-bank sand, 50 to 75c.; washed gravel, $1.40; molding sand, $1.90 to $2.10 per ton.

British Columbia

By Robert Dunn
Secretary to Minister of Mines, British Columbia

A SURVEY of 1920 in all of British Columbia leads to the conclusion that, in development and in output, the record of the year will not be found far behind that of 1919. Labor conditions are improving, and as soon as metal prices increase the mining industry of British Columbia, now depressed, will revive with a bound. Development everywhere is making rapid strides, and prospecting activity is increasing.

There will be a decline in output of gold for 1920, in comparison with the previous year. Whether this will be true for placer mining is doubtful, because there has been considerable activity in the Cariboo and in sections further north and northeast. Much of the work, however, has been preliminary, so that the results may not accrue until next season. In 1919, British Columbia produced 14,325 oz. of placer gold. Lode mining will not equal the previous year in output, as the Rossland mines, Consolidated Mining & Smelting Co. of Canada, Ltd., are not on the working scale of a few years ago, and the Nickel Plate mine of the Hedley Gold Mining Co. had been restricting operations prior to the final closing of the plant over three months ago.

Copper is expected to attain last year's production, 42,459,339 lb. During the first nine months of 1920, the larger companies maintained their output at a high level, but there was a slump in the last three months of the year. The Britannia Mining & Smelting Co., Ltd., milled in nine months as many tons of ore as it did throughout 1919. Production was cut down when copper reached 14c. in New York. The Granby Consolidated Mining, Smelting & Power Co., at Anyox and Hidden Creek, passed through a similar cycle. The returns of this company will not show a decline in production for any but the closing months of 1920. As at the Britannia, there has been a reduction in the force employed at the smelter and the mines. The Consolidated Mining & Smelting Co. of Canada, Ltd., is not a large producer of copper, although it is entering to a greater extent into that industry, its copper refinery capacity having been increased not long ago. The company is, however, not likely to show much increase in its copper output for 1920.

The construction of concentrating plants at the "Old Sport" group of claims, Quatsino Sound, Vancouver Island, and at the "Sunloch" copper mines, Jordan River, Vancouver Island, had been planned by the company for 1920, but costs of labor, supplies, and machinery were too high as compared with the average price of the metal, and the projects were permitted to stand. A start on these plants may be looked for during 1921. Development has, however, continued, the tonnage of available ore exposed having been materially increased.

The Tidewater Copper Co., operating the "Indian Chief" group of crown-granted mineral claims, Sidney Inlet, west coast of Vancouver Island, blocked out in 1919 and 1920 sufficient tonnage to furnish 300 tons of ore daily for two years. The output will be handled by a reconstructed mill. "Peterson" flotation cells and an electrical plant have been installed at the mill, which has been in operation since September. The Kamloops district, by reason of the closing down of the "Iron Mask" mine, will show a pronounced decline in copper output for 1920. Since April, work has been concentrated upon the installation of a water system and in improvements to the mine and plant.

A distinct falling off in silver output in 1920 is to be expected. The coast and Boundary districts should produce about the same as in 1919. There has been much development in the coast district, but comparatively little actual shipping. The Dolly Varden mine, at Alice Arm, is one of the most important of the producers. Probably it will be found to have done better than in 1919. The Premier mine, on Salmon River, Portland Canal, did some shipping, but only of ore that was transported over the snow during the winter of 1919-20, and which can be so handled this winter. The work so far done consists for the most part of development. The 1920 output of silver from the Boundary district is likely to be somewhat better than that of the previous year. There have been important developments of a portion of the Summit Camp silver-lead ores near the head of Tulameen River, and many new high-grade silver veins have been discovered on Wallace Mountain, Beaverdell, Greenwood Mining Division.

During 1919, the northern coast, which includes the Dolly Varden and Premier, as well as many small mines and prospects, produced 920,413 oz. of silver, the Boundary-Yale districts 231,599 oz., East Kootenay 274,134 oz., and West Kootenay 1,799,229 oz. The total for the province was 3,403,119 oz.

The lead production for 1920 will probably be equal to that of 1919. Much depends upon the output of the Sullivan mine, Kimberley, B. C., Consolidated Mining & Smelting Co. of Canada, Ltd. The mine has been extensively developed and its yield has increased. The 1919 production shows that of a total output of 29,475,968 lb., 29,218,254 lb. came from East and West Kootenays.

A substantial increase will be shown in the amount of zinc produced in 1920. The Sullivan mine produces the greater part of the zinc. In 1919, East Kootenay produced 46,460,705 lb. of the total, 56,737,651 lb. The Slocan and contiguous territory contributed something over 10,000,000 lb., which almost accounts for the entire amount. A reduction is likely in the Slocan production, but heavy shipments from the Sullivan will more than overcome this expected decline.

Manitoba

By R. C. Wallace
Commissioner of Northern Manitoba, The Pas, Man.

DURING 1920 the demand for structural materials in Manitoba did not perceptibly stimulate the building stone, gypsum, portland cement, and brick industries in the province, but indications now are that before another year elapses a considerable activity in those industries will take place.

An option for one year was taken on the Flin Flon property, in Northern Manitoba, in March, 1920, by the Thompson interests, of New York, and the Mining Corporation of Canada. Shafts were sunk 500 ft. apart, and the orebody has been crosscut at the 100 and 200-ft. levels, and will probably be cut at the 300-ft. level before the work done under the option is completed. The underground work has checked up closely the figures obtained by diamond drilling, and the holders of the option feel satisfied that the orebody contains at least 16,000,000 tons of ore. Assurance has been practically given that the option will be taken up. The preliminary survey for the railway from The Pas to the property has begun. At the next session the Legislature of Manitoba will decide on financing the railway and leasing it to the Canadian National Ry. for operation. Mining in northern districts will be stimulated by these developments.

The final shipments of ore from the Mandy mine to Trail were made in the summer of 1920 and there now remain approximately 200,000 tons of lower-grade ore in the mine. The smelter returns show that ore to the value of over $2,000,000 has been mined from this property.

There has been considerable activity in gold mining in the Rice Lake and Herb Lake districts. In the former area, there is an average of 200 ft. of undergound workings on eleven properties and many shallower workings. The district will probably reach the producing stage in 1921. In the Herb Lake district the Rex mine is operating steadily, and further production of gold and of silver from silver-galena discoveries may be expected in 1921.

An interesting and probably very important discovery in the Bear Lake district has disclosed a norite of the Sudbury type associated with copper and nickel sulphides.

Ontario

By G. C. Bateman

General Manager, La Rose Mines, Ltd., Cobalt, Ont.

MINING in Ontario during 1920 can be divided into two periods. During the first period, which lasted from January to September, there was an acute shortage of labor. During the latter part of the year there was a shortage of power in Cobalt, Kirkland Lake, and Porcupine, which resulted in a curtailment of operations and a surplus of labor.

Production for the first nine months of 1920 was $35,920,418, an increase of 27 per cent, in which practically all branches of the industry shared. The last three months will be the worst of the whole year, whereas the corresponding three months of 1919 were the best, but, notwithstanding this, 1920 will show a good increase over 1919.

Despite a severe decline in the price of silver, the production of the Cobalt mines was maintained, and for the nine months amounted to 7,831,143 oz., valued at $8,435,088, an increase of 8 per cent as compared with 1919. Owing to the low silver prices and to power shortage, the results for the last three months will be proportionately less. Total dividends paid by the Cobalt companies for 1920 were $3,458,142, as compared with $3,524,241 for the previous year.

No outstanding discoveries were made during 1920, and there were no particular changes in metallurgical practice. The Mining Corporation bought the Foster lease and the Buffalo property, and the Coniagas bought the Trethewey. Part of the Chambers-Ferland property was purchased by the Northern Customs Concentrator, Ltd., and the same company also operated the Silver Cliff, under lease. The long-drawn-out litigation of the Bailey resulted in its being amalgamated in a new company with the Northern Customs mill.

In Gowganda, the Miller Lake O'Brien maintained its production and a good discovery was made on the Castle property, which was taken over by the Trethewey. This caused considerable development in the district, but did not result in any new important discoveries. In South Lorrain, the Keeley resumed operations and built a mill.

In the gold camps of Porcupine and Kirkland Lake, production for the first nine months of 1920 was $8,707,718, an increase of 15 per cent. The Hollinger, McIntyre, Dome, and Lake Shore paid dividends of $2,994,012, as against $2,186,028 for 1919. The only dividend payer in Kirkland Lake was the Lake Shore, with a production of about $500,000, made from an average recovery of over $26 per ton. There was an increased amount of development throughout the district. The Wright-Hargraves continued construction of a mill, which will be in operation early in 1921. The Ontario-Kirkland completed excavation in the fall of 1920 for a mill to be built in 1921.

In Porcupine, the Hollinger maintained its leading position, and, in view of production, reserves, and possibilities, is probably the second greatest gold mine in the world. The Porcupine Crown amalgamated with the Thompson Krist, and was reopened. The Vipond was refinanced, and arrangements were made to resume operations. The McIntyre discovered the extension of one of the main Hollinger vein systems below the 1,000-ft. level, and was able to do sufficient work to be assured that the discovery was one of primary importance. The Dome, in addition to resuming dividends, exercised its option on the Dome Extension.

In the nickel field at Sudbury a peculiar situation existed. The British America blew in its furnaces at the beginning of the year, and worked on a limited production. The Mond, which refines and markets its products in England, in 1920, on account of the European market for nickel being almost non-existent, operated only a small part of its capacity, and piled up millions of dollars' worth of matte for future export. The International Nickel, on the other hand, gradually increased its output to 4,000 tons of matte per month, which was greater than its pre-war output. Owing, however, to the industrial depression in the United States, the output was cut to 3,000 tons in November and 2,000 tons a month in December. The production of nickel for the nine months, practically all of which was from Sudbury ores, was valued at $12,310,075, an increase of 51 per cent. Copper, also almost entirely from Sudbury, was valued at $3,159,920, an increase of 30 per cent.

In the Madoc district there are talc and fluorspar mines. The latter reflected the falling off in demand for fluorspar, but the talc companies did well. Ontario talc has very generally held its market against the best of the French and Italian grades.

In northern Ontario, during the first nine months of 1920 there was a severe labor shortage, which curtailed production and, particularly, development. A survey was made by the superintendent of the government employment agencies, who admitted a shortage of at least 2,000 men, which the government bureau was unable to fill. This shortage no longer exists, and 1921 should be a particularly favorable year for the gold mines. Lack of fall rains produced a power shortage resulting in a curtailment of operations, particularly in Cobalt and Kirkland Lake, and, to a less extent, in Porcupine. Early in 1920 the Ontario Mining Association was organized, with headquarters in Toronto.

Quebec

By W. J. Woolsey
Thetford Mines West, Quebec, Canada

THE asbestos production of Quebec for 1920 will show an increase of about 20 per cent, due principally to the larger production in the Coleraine and Broughton districts. The crude production is not greater, but would show a shrinkage, owing to substitution of mechanical separation of crudes for hand separation and cobbing. An attempt at unity of purpose among the operators augurs for ultimate success, and labor has adopted sound principles. The success attending the efforts of the manufacturers in their publicity campaign is acknowledged. The trend of developments has been: Extensive diamond drilling with a view to locating new orebodies, increasing development in underground methods of mining in contrast to original quarrying methods, and the establishment of the Coleraine mining district as an important fiber producer. No distinctive advance took place during 1920 in the mechanical treatment of crude asbestos rock.

Chrome operations during the year were confined to two companies: the Mutual Chemical Co., of New York, and the J. V. Belanger interests (U. S. Alloys), with the Black Lake Asbestos & Chrome Co. operating a short time on dump material. All operations were confined to the Caribou Lake district. The present status of the chrome industry shows an improvement.

Nova Scotia

By G. F. Murphy
Professor of Metallurgy, Nova Scotia Technical College, Halifax, Nova Scotia

THE production of gold in Nova Scotia in 1920 amounted to 745 oz., from 850 tons of ore crushed, an average of 0.86 oz. per ton. This shows a decrease of 20 per cent from the production of 1919, and only one-tenth of the gold produced in 1862, when gold mining was first established in this province. Since 1898, when the maximum production of 31,104 oz. was made, there has been a continuous decrease.

Only one company, the Montague Goldfields, Ltd., at Montague, Halifax County, made any attempt at continuous operation in 1920. The work was development, as the company intends putting in a new plant and opening the mine on a larger scale. The ore averages approximately two ounces per ton.

The provincial government has undertaken the production of hydro-electric power, to be distributed throughout the province. It is planned to supply the gold districts with cheap power. This should help to stimulate the industry, and, with labor again becoming plentiful, there should be increased activity in gold mining within the next few years.

The Consolidated Manganese Co., at New Ross, has a new concentrating mill about ready for operation. Approximately 100 tons of ore was shipped during the year. No further developments have occurred respecting the salt deposit containing potash recently discovered at Malagash. This deposit has been proved to be at least 600 ft. thick, and promises to become of great importance. The Canadian Geological Survey has recently published a report on the deposit by Dr. Hayes. Gypsum still continues in importance only second to coal. About 200,000 tons in the raw state was shipped in 1920, mostly to the United States, for manufacturing purposes. Several inquiries were made during 1920 for arsenic, which occurs so plentifully in some of the gold-bearing veins. About 500 tons of concentrates was shipped to the United States in 1920, to be treated for the arsenic content.

Mexico

Editorial Correspondence

AT THE END of 1920, mining in Mexico was depressed, although the petroleum industry was prosperous. Owing to the continued drop in the price of silver, the second week in December, 1920, saw many of the principal mines and camps closed and over 60,000 men out of employment. Efforts of the government to help by withdrawing taxation can hardly have more than temporary effect. The measures proposed may enable some of the high-grade properties to keep going a few weeks longer, but cannot materially prevent the depression that will fall upon the silver industry if the price of silver falls below 60c.

The beginning of 1920 was favorable and promised a largely increased output over 1919. With the sudden slump in silver most of the mining properties in Mexico were immediately affected. Although operation and even exploration and development were maintained under adverse circumstances over a period of several months, the breaking point was reached early in December. The copper camp at Cananea announced that it would close on Dec. 15, but later postponed this until after the first of the year. Teziutlan (copper), in the State of Puebla, followed, and then all the smaller copper properties in the republic. The second week in December saw the closing of several of the more important silver-producing properties in the Pachuca camp, and of others in the states of Mexico, Jalisco, Guanajuato, and Zacatecas, with a large number of men out of work.

Aside from the panicky condition due to the drop in price of silver and other metals, the general mining outlook has been considered good. On Dec. 1, 1920, there were 3,138 properties actively working. Many millions of foreign capital were put into mill construction and development during the year in anticipation that Mexico's civil troubles were over and that peace and prosperity had set in. Some of this capital comes from Europe, principally from English and French sources, but, most of it is American. Despite the setback, Mexico's silver output for the year will hardly fall below 80,000,000 oz.

Mining interests generally throughout the country are somewhat dazed at the immediate outlook, and fearful of the consequences of a prolonged decline of metal prices, but it cannot be said that they are either disheartened or by any means ready to shut down. Local conditions have not been so promising since the revolution of 1910. The present government has taken an intelligent interest in reforming tariffs and taxes, and whatever headway Bolshevism seemed to have been making six months ago has disappeared. Many of the properties have recently made a reduction in wages without any attempt on the part of labor organizations to resist. This is due probably to the fact that prices on almost all staple articles have been considerably reduced and are still dropping rapidly.

Statistics of mineral production for the first half of 1920 are given in the table. These statistics were compiled by the Department of Mines of Mexico and published in *Commerce Reports* late in December, 1920.

MINERAL PRODUCTION OF MEXICO

Mineral:	First Six Months of 1919 Kilos	First Six Months of 1919 Total Value	First Six Months of 1920 Kilos	First Six Months of 1920 Total Value
Antimony	4,148	$3,434	577,723	$381,875
Arsenic	1,358,860	898,206	770,797	309,860
Commercial copper	21,405,829	17,424,345	23,914,011	19,466,005
Tin	1,588	4,535	..	..
Amorphous graphite	3,686,563	405,522	2,441,240	390,598
Manganese	1,437,495	343,561	31,509	7,531
Mercury	52,094	262,970	42,505	220,218
Molybdenum	1,563	14,891	648	6,173
Gold	10,343	13,790,663	11,775	15,699,996
Silver	954,333	69,666,309	1,029,940	75,824,183
Commercial lead	30,918,282	10,821,399	44,898,902	17,465,673
Tungsten	1,389	11,633	4,471	37,445
Commercial zinc	4,485,115	1,323,109	8,543,132	3,434,339

The conditions which affect silver mining have been paralleled in all other kinds of mining. Lead has suffered heavily, as well as zinc and copper. The output of these metals, however, will be in excess of that of 1919, excepting graphite.

The oil problem in Mexico remains unchanged. The Government of Mexico and independent companies adhere to Article 27, which declares that oil, until it has been brought to the surface, belongs to the government. The so-called "Allied" companies maintain that the constitution infringes upon rights legally acquired previous to its promulgation. The "Allied" concerns include most of the important producers and most of the pioneers in oil development in Mexico. The Aguila company (British), next to the so-called Doheny interests the largest in the Mexican oil fields, and one of the earliest explorers, recently withdrew from the association, and is now understood to be in sympathy with the Mexican government's contention. What the next move will be, or who will make it, is unknown.

In the meantime, oil is the principal source of support of the government. A high official of the Department of Commerce and Industry states that the potential possibilities of wells now open are over 1,000,000,000 bbl. a year, and that, beginning with January, 1921, the government's income from export taxes alone will amount to 15,000,000 pesos ($7,500,000) monthly. This tax will be paid by fewer than thirty producing companies. The same authority estimates there are 160,000,000 acres of known oil-bearing land in Mexico, of which fewer than 400,000 have been "tromped" over.

There are now twelve refineries in operation and others under construction, and concessions have been granted for numerous pipe lines, including one to the City of Mexico and one from the Atlantic to the Pacific ocean across the Isthmus of Tehuantepec. According to government statistics, the value of the oil industry in Mexico (including physical assets) amounts to $660,000,000, whereas that of the mining industry totals only $400,000,000. Exports to the United States exceeded 100,000,000 bbl. in 1920, as compared to 51,000,000 bbl. in 1919.

Owing, possibly, to the fact that many wells in the older districts in Tamaulipas and northern Vera Cruz have run into salt water, there has been a tendency to increase exploration further south. During the last three months of 1920, a great deal of land changed ownership in the states of Tabasco and Chiapas and southern Vera Cruz. Despite the government's insistence on its ownership of oil, leases for oil rights are constantly being entered into between land owners and representatives of important companies now on the ground. The value of these leases must depend in a large measure on the government receding from its present position. There has been great activity also in oil concessions granted by the government, almost exclusively to newcomers in the field, as the older companies largely refuse to handle concessions, protesting that they are illegal and in contravention of established rights and interests.

Under these concessions, some of which involve millions of acres, considerable development work has recently been started in the states of Sonora, Lower California, Sinaloa, Guerrero, Puebla, and Oaxaca. British capitalists recently began borings at Port Angel, on the Pacific coast, where seepages and other external evidences of oil are abundant, although the territory has been repeatedly rejected by geologists. Considerable activity has also been shown in the tier of Mexican states bordering on Texas and Arizona, though no wells have been actually brought in.

The oil situation in Mexico for 1921 appears particularly bright, but the industry is so involved with political difficulties that, until the snarl is unraveled and the final attitude of the two governments (American and Mexican) is known, Mexican oil will not reach its full possibilities. No one doubts the tremendous potential possibilities of petroleum in Mexico, but the industry has been greatly handicapped by the uncertainty surrounding its legal status. The present government has repeatedly expressed itself as favoring a broad and liberal interpretation of the law and has denied any intention of making the law retroactive, at the same time insisting on its rights of eminent domain and showing no disposition to abrogate Article 27 of the new constitution, which article is the principal bone of contention.

Cuba

BY C. M. WELD

Mining Engineer, New York

HIGH ocean freights, combined with intense activity in sugar, which drove wages to a high level and practically monopolized railway transportation, were largely responsible for keeping mineral production in Cuba during 1920 at a low ebb.

It is reported that new production of manganese ore was represented by 3,000 tons of dioxide and 1,000 tons of furnace ore, all from the Bueycito district, Oriente Providence. In addition, about 2,000 tons of furnace ore was shipped from stockpiles in Santiago and Boqueron (Guantanamo Harbor). Exact figures are not at hand. The Ponupo manganese mines were idle during all of 1920.

Copper-mining activity was limited to the Matahambre property, in Pinar del Rio. Operations at the well-known El Cobre mine, near Santiago, were discontinued in January, 1919. Matahambre will show a production for 1920 of approximately 14,000 tons of hand-sorted ore, containing 18.5 per cent copper and 1.6 oz. silver per ton, and 23,000 tons of concentrates containing 24.5 per cent copper and 1.85 oz. silver per ton; a total of nearly 16,500,000 lb. of copper and 65,000 oz. of silver.

All producing iron mines are operated by the Bethlehem Cuban Iron Mines Co. During the first ten months of 1920, Daiquiri (near Santiago) produced 251,384 tons and shipped 471,071 tons. The total figures for the year will be roughly 300,000 tons produced and 550,000 tons shipped, a considerable amount of ore still being left in stock. At Mayari, near Nipe Bay, the mines have been idle, the date of reopening depending on the iron industry. Shipments for the year, amounting to 280,000 tons of nodules and 20,000 tons of raw ore, about cleaned up the stockpiles.

Exploration for oil continues. Pyrites and chrome will probably be exported at some time in the near future. The export tax on iron and copper ores was repealed and a new law was passed imposing a tax of 6 per cent on net profits, and an annual tax of 20c. per hectare on all mineral lands held under denouncement, whether working or idle.

The foregoing information has been gathered from a number of sources. I am especially indebted to William Pitt, of Santiago, and J. C. Porter, of Havana.

Central America

By M. B. Huston
General Manager, Eden Mining Co., Bluefields, Nicaragua

GUATEMALA.—Not much interest in mining was shown in Guatemala during 1920, and no new developments have been reported. This condition is probably due to the Cabrera revolution, which kept the country in an unsettled condition the greater part of the year.

Salvador.—The Butters Salvador Mines, Ltd., discontinued operations. The San Sebastian property of this company is reported to be worked out. The Divisadero mine of the same comapny has been sold to the El Salvador Silver Mines Co., which is continuing the production and development of the property.

Honduras.—No new developments of interest were reported. The mining interest in Honduras continues to center around the Rosario mine of the New York & Honduras Rosario Mining Co. This famous old silver mine, which has been in steady production since 1882 and which has produced a gross value of over $28,000,000, continues to be the largest and most profitable mining operation in Central America. During 1919, the tonnage milled was 133,900, giving a production of $2,115,158, and a net operating profit of $779,603. Operation was continued on the same scale during 1920, and it is expected that the results will be about the same as for 1919. The principal value is silver and the mine has benefited during the last two years by the prevailing high price of that metal. A. R. Gordon continues as general manager.

Nicaragua.—Two new interesting projects are under way in Nicaragua. In 1918, D. J. Pullinger and William Wallace Mein acquired, near the town of Santo Domingo, in the Department of Chontales, properties known as the Javali, Cedro, and Pabon, and are developing them under the name of the Chontales Mining Co. J. F. Thorn, formerly general manager of the San Sebastian and before that general manager of the Goldfield Consolidated, is in charge of the operation as consulting engineer and general manager. The company gives Mr. Thorn full credit for having discovered the possibilities of the property and for his recommendation to purchase it. The property covers about 12,000 ft. of vein, of which 3,300 ft. have been opened up, showing average widths of from 12 to 14 ft. A deeper crosscut tunnel is now being driven, which will intersect the vein at about the center of the property and give average backs of approximately 300 ft. A power plant and mill have been installed. Ore is being treated at present at an average rate of 210 tons per day. To date about 50,000 tons have been milled, giving a gross production of $1,000,000 with an extraction of 90 per cent. Eighty per cent of the recovery is gold and the remainder silver. At present a hydro-electric plant of over 1,000 hp. is being erected. With this completed, it is planned to enlarge the treatment plant and increase operation to a capacity of 600 tons per day.

In the Pis Pis district, Barry Searle and associates have taken over the old Bonanza, Lonestar, and Concordia properties and have started operations under the name of the Nicaragua Mining Co. Some work has been done on the Lonestar and Concordia, but to date their principal activities have been centered in the development and equipment of the Neptune vein, on the Bonanza property. A considerable amount of development work has been done. An amalgamation mill has been erected, operation having been started in the latter part of October.

The property of the Eden Mining Co. in the Pis Pis district was in continuous production throughout 1920. During 1919, 36,159 tons of ore (99.1 tons per day) was treated, giving a gross production of $443,399, with an extraction of 94.5 per cent. During the latter part of 1919 and early in 1920 the capacity of the mill was increased, since which time a production rate of 125 tons per day has been maintained. Owing to this increased capacity, the production for the year will be somewhat higher than for 1919. An extensive development campaign is being carried out in the effort to establish additional ore reserves. The company owns its own transportation system from the port of Prinzapolka to the mine and its own hydro-electric power plant of 1,200 hp. capacity. As with all gold mines, the operations have been considerably impeded by the prevailing high prices of supplies.

Work was carried on throughout 1920 at the Constancia Consolidated mine, in the Pis Pis district. The 80-ton cyanide plant was kept in operation during the first half of the year. Trouble was then encountered in the treatment process, due to the oxidized copper content of the ores from the secondarily enriched section of the vein. Tests are now being made to overcome this difficulty, and at the same time development work is being continued.

Costa Rica.—The Abangarez mine was in continuous operation throughout 1920. Considerable attention was given to petroleum during the year, and especially to the concessions granted by the government during a previous administration.

Panama.—So far as known, there was no mineral production in the Republic of Panama during 1920. Near Ocu, in the Province of Herrara, and near the headquarters of the Boqueron River, in the Province of Colon, where manganese deposits are found, considerable exploration work was done. At the latter place a railroad is projected for the transportation of the ore to the coast. The petroleum possibilities of the republic are still problematical, although numerous reports give encouragement.

Colombia

By Luis G. Johnson
Civil and Mining Engineer, Medellín, Colombia

PLACER mining for gold was conducted in Colombia in 1920 by American and native companies, principally on the rivers Porce and Nechí and also in Riogrande. On the Nechí, near Zaragoza, the Pato and Nechí mines were worked by two dredges with good results. On the Porce and Riogrande rivers two American companies successfully worked the rich placers about forty miles from Medellín, near a station on the Antioquia R.R. Of these two, McGuire Brothers worked the rich alluvial deposits in La Clara with hydraulic elevators and giants (made by the New York Engineering Co.) and the Segovia Mining Co. did the same on the Riogrande River. Below La Clara and for twenty-five miles on the Porce several native companies carried on mining operations, by the same methods, at the Guayabal, Pinal, La Isla, and Brazil mines. Good results were generally obtained by all these operators in 1920, and better returns are expected this year.

Rich alluvial deposits on several other rivers, including the Nechí, Nare, Nus, and Anorí, are awaiting American capital. One American company has already secured good results on the Nus and two others are preparing to begin at Totumo, on the Nus, and at Playarica, on the Nare. On the Nechí above the famous Pato mines, and on the Anorí the deposits awaiting investigation by engineers and capital for development include some that are very extensive, embracing both bars and high alluvials.

Quartzes are not so extensively exploited as placers. Nevertheless, the Frontino & Bolivia successfully worked their deep veins last year in Remedios and Segovia; likewise the Zancudo, a native company near Titiribí. Several other native companies milled ores in small plants in various parts of Antioquia and Caldos.

Near Barbosa, twenty-five miles from Medallín, an American-Colombian syndicate has done extensive development at the Guamal mines and has a large tonnage of $12 ore blocked out by several tunnels and crosscuts. All this region is rich in quartz veins and has good facilities in the way of water, head, timber, climate, labor, and freight.

Platinum in the Chocó region and on the Condoto and San Juan rivers paid those well in 1920 that had invested there.

As stated above, mining conditions are expected to improve steadily, especially if American capital will undertake to develop the natural resources of the country after experienced engineers have examined and reported on them.

During 1920, there were no new discoveries of importance reported in petroleum and no production was made, although roads were built and additional drilling equipment brought in.

Venezuela

Editorial Correspondence

ON JUNE 26, 1920, a new mining law repealing the law of June 27, 1918, and all decrees and resolutions relating thereto was put into effect in Venezuela. On June 30, 1920, another law concerning hydrocarbons and other mineral fuels was enacted. Revival of interest in a placer gold district in southeastern Venezuela on the British Guiana border was reported.

There was no further progress of importance in gold mining in Venezuelan Guiana. The Callao Co. started crushing after being stopped since 1914, but again suspended, owing to lack of development. The Goldfields of Venezuela continued to produce on a small scale only, most of their attention being centered on development. The output of alluvial gold fell off.

Oil development work was in progress by a number of companies. The Caribbean Petroleum Co. had eight wells producing in the Mene Grande field, in the State of Zulia, and was drilling in the La Sierrita field, in the State of Zulia. The British Controlled Oilfields, Ltd., had three standard drill rigs in the western part of the Buchivacoa concession, in the State of Falcon, in August, 1920. One well was producing oil in small quantities at 1,800 ft., another had reached a depth of about 1,000 ft., at that date, and the third was about ready to start operation. This company had also three standard rigs under construction in the eastern part of its concession. The Colon Development Co. continued drilling operations in the District of Colon, Zulia.

The government is seeking to annul the concessions of several oil companies, and has brought suit in the federal courts to annul the concession held by the Colon Development Co., which covers the entire district of Colon. Asphalt was mined from the Bermudez lake by the New York & Bermudez Co. during 1920. The oil refinery at San Lorenzo was in operation, producing petroleum products for domestic consumption. The Venezuelan Oilfields, Ltd., acquired five concessions in the State of Falcon.

The Guianas

Editorial Correspondence

THE most important mining work in the Guianas in 1920 was bauxite production, the Aluminum Company of America being the largest operator. In British Guiana this company owns about 30,000 acres of bauxite land on the Demerara River, about sixty-five miles from Georgetown, and 90 per cent of the known bauxite bearing land of the country. This is held under three or more names. All except about 1 per cent of the known deposits in Dutch Guiana also belong to the company, the acreage being comparable with that held in British Guiana. No commercial deposits have been found in French Guiana. Large piers are being built at the property on the Demerara River, and a fifteen-mile railroad reaching the furthest part of the property is under construction.

During the latter part of 1920 the Guiana Development Co. sent out a party from New York to install gold-dredging equipment on the Maroni River between French and Dutch Guiana. The company is equipped to meet all difficulties of transportation by water or overland. George A. Laird is in charge.

Brazil

By F. Lynwood Garrison
Mining and Civil Engineer, Philadelphia, Pa.

OUTSIDE the State of Minas Geraes and a few collieries in the lean coal deposits of the State of Rio Grande do Sul, Brazil possesses no mines whatever, if primitive diamond gravel washings, now being productively operated and only a few of which have ever been profitably worked, be excepted. At present, manganese is the most important mineral. In 1913, manganese mining reached its lowest ebb, but with the beginning of the European war it jumped to unprecedented proportions by reason of the enormously increased demand for the ore and the closing of the Dardanelles, which completely cut off the supply of the better Caucasian ore. During the last two years the Brazilian production of this mineral has greatly decreased. It has had to meet not only a slackening market, but competition with the Indian supply, which was greatly stimulated and developed by the war. The importance the strategic relation this source of manganese supply bears to the American steel industry cannot be overestimated, when considered in conjunction with the immense iron-ore reserves in Minas Geraes, as yet wholly unworked. These iron-ore deposits have been fairly well surveyed, sampled and explored. In quality the ore equals the best Lake Superior and in quantity it seems difficult to estimate within reasonable limitations.

With the exception of a few collieries in the Permian rocks of the states of Rio Grande do Sul and Santa Catharina, Brazil possesses no productive coal deposits, nor does it seem probable that any will ever be found except lignite and other inferior non-coking material of a similar character. There are, however, great areas of Eocene-Tertiary rocks extending along the coast for hundreds of miles, which contain thick beds of oil shale, some said to yield as much as 100 gal. of oil per ton of rock and averaging about 40 gal., with a proportionate yield of sulphate of ammonia. No notable discoveries of petroleum have yet been made in Brazil; but the country is so large, undeveloped, and unexplored in a mineral sense, and to some extent even geographically, that it would be rash to assume that this important natural product may not ultimately be found.

Monazite sand continues to be, as it has for a number of years, an important element of the mineral production in the State of Bahia. During the recent war chrome ore was mined for the first time in Brazil in considerable amounts at Santa Luzia, a small station on the railway connecting the city of Bahia with Joazeiro, an important shipping point on the Sao Francisco River. This ore carries from 43 to 47 per cent Cr_2O_3 and occurs in masses in serpentine near enough to the surface to be quarried. I discovered the deposits in 1916 in the thick catinga jungle about a mile west of the railway. The chrome mines are not being operated at present, but are likely to be in the near future if the price of such ore remains as high as it is now, and ocean transportation improves.

The gold production of Brazil has diminished greatly. The cream has long since been skimmed. The country's total gold output is now comparatively negligible. The Morro Velho, belonging to the St. John del Rey company, is apparently far from exhausted, although the workings have now reached nearly if not quite 6,500 ft. in vertical depth. The St. John del Rey is an English company, the management of which has always been very efficient. In recent years it has acquired large holdings of rich iron-ore properties in neighboring districts. As far as I am informed, no ore has been mined and shipped from any of these holdings.

Peru

By Joseph T. Singewald, Jr.
Secretary Maryland Geological Survey, Johns Hopkins University, Baltimore, Md.

COPPER, long the leading mineral product of Peru, reflected declining prices in 1919 by a 12 per cent decrease in production, and an even more marked decline of 25 per cent is estimated for 1920. The great decrease in copper production caused a decrease in the silver output, for most of the silver production comes from the silver content of the copper ores. Petroleum showed an increased output, so that final 1920 figures will doubtless give it first place in value among Peru's mineral products. The vanadium production was also in excess of that of previous years.

An unusual amount of development and construction work was projected and carried out during 1920. The Cerro de Pasco Mining Co. started the construction of its new $9,000,000 smelter at Oroya, which is to have a daily capacity of 2,500 tons. At the present smelter the company erected a 250-ton coal-pulverizing plant and prepared to equip its blast furnaces, reverberatories, and sintering plant for the use of pulverized coal, to reduce the consumption of coke and fuel oil. This change is largely experimental, the purpose being to apply the results to the installations in the Oroya smelter.

The Peruvian Copper & Smelting Co., which has acquired extensive copper deposits at Yauricocha and Felicidad and coal deposits in the Jatunhuasi district, proceeded with the development of its properties. It has under construction a road from Pachacayo station to the mines, blast furnaces, reverberatory furnaces, hydro-electric plant, and, at Jatunhuasi, coke ovens. At Yauricocha it has developed a considerable body of ore averaging 12 per cent copper and containing a high percentage of silver.

The Vanadium Corporation of America constructed six miles of narrow-gage railroad from its Minasragra mine to Jumasha, on Lake Pun Run, and an automobile road sixteen miles long from Casa Laguna, on the opposite side of the lake, to Ricran, on the Cerro de Pasco railroad. A contract was also let to replace this auto road by a railroad. The construction of a 20,000-kw. hydro-electric plant on Jumasha River was started, and plans were made for a new treatment plant at Jumasha. This is to produce 80 to 90 per cent V_2O_5 concentrates in place of the 35 to 40 per cent V_2O_5 roasted ore that is now shipped.

A sixteen-mile branch of the Chimbote railroad, northward from Kilometer 75 to the coal field of Ancos, called the Chuquicara railway, was expected to be completed before the end of 1920. The line will be extended eventually to Huamachuco and Cajabamba, and thus open up a richly mineralized region of Peru.

A live interest was manifested in the petroleum possibilities of the country in 1920, and Lima was a Mecca for representatives of oil companies seeking concessions. The most desirable territories were withdrawn by the government some years ago, and the policy to be adopted in the disposition of these reserved lands was one of the most agitated political problems of the year. Considerable exploratory work was done by some of the interests seeking concessions while awaiting the promulgation of a new petroleum law.

Bolivia

BY JOSEPH T. SINGEWALD, JR.
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DESPITE the falling prices of metals, the year 1920 was a notable one in the development of the mineral industry of Bolivia. The preliminary investigations of the Guggenheim Brothers in 1919 led to the acquisition of important tin properties on the east side of the Quimsa Cruz Range, and early in 1920 steps toward their development were initiated. Work was concentrated on a sixty-six-mile automobile road from Eucalyptus, on the Antofagasta and Bolivia railway, to the mines to replace the old pack trail. It was built at a cost of about $400,000. Water-power sites were purchased to develop power for the new operations, and a ranch was established at a favorable altitude below the mines to supply provisions. The ores are of high grade, running 10 to 15 per cent tin, but are not argentiferous. Some of the veins carry more tungsten than tin. Until the advent of the Guggenheim Brothers, the International Mining Co. was the only American corporation active in the development of Bolivian tin mines. When the extensive plans of the new enterprise have been carried out, not only will the Quimsa Cruz region rival the Uncia-Llallagua district as a tin producer, but American capital will be playing a leading rôle in Bolivian tin mining.

The International Mining Co.'s Carmen mine, in the Yungas district, east of La Paz, which was a tungsten-tin producer, was idle in 1920, as were practically all the tungsten mines of the country. The company centered its attention on the development of its Tanapaca tin mines, in the Araca district, on the northwest side of the Quimsa Cruz range. At Machacamarca, the Cia. Minera de Oruro installed a new type of roasting furnace which was developed for chloridizing its Oruro ores. British and American interests considered the possibility of treating the enormous dumps of the Cia. Huanchaca de Bolivia at Pulacayo, which are estimated to contain 22 oz. of silver per ton.

Another region of considerable activity in development work in 1920 was the south of Bolivia. In May the Bolivian government contracted with an Argentine firm for the construction of the last link of 128 miles needed to complete the connection between the Bolivian and the Argentine railroads, that is, from Atocha to La Quiaca. When finished the road will provide greatly improved transportation facilities for this region and undoubtedly result in greater mining activity. Present mining operations are conducted by Aramayo Francke & Co. and the Cia. Minera y Agricola de Oploco. Both of these companies have installed new facilities for handling their increasing production, especially at Chocaya. The former company is building a new reduction works for silver ores at that place, and the latter is introducing the new type of roasting furnace devised at Machacamarca. The operations of the Oploco company were also expanded at Choroma.

The petroliferous regions of eastern Bolivia in the departments of Santa Cruz, Chuquisaca, and Tarija attracted much attention in 1920. A number of geologic expeditions were sent in during the year, and preparations were made for drilling. American, Bolivian, and Chilean syndicates were most active in the work. Early in the year the Bolivia-Argentine Exploration Syndicate, headed by William Braden, announced the acquisition of a concession of nearly 5,000,000 acres.

Argentine Republic

EDITORIAL CORRESPONDENCE

THE installation of a 200-ton copper smelter by the newly organized Famatina Mining Co., operating at Santa Florentina, in the Chilecito region, was the principal event in mining in Argentina during 1920. This smelter, which is equipped with reverberatories fired with pulverized charcoal, was erected to treat a 5 to 6 per cent copper ore carrying gold and silver. Efforts were also made to organize a company with Chilean capital to exploit a wolfram mine in the Chilecito region. Benito Villeneuva, vice-president of the republic, endeavored to establish a company with Dutch capital to work the mines of Paramillo de Uspallata near Mendoza. Permits were sought by Argentinians, Chileans, and North Americans to explore 2,500,000 acres south of Mendoza for rafaelite, vanadium ore and petroleum.

Chile

BY GEORGE W. TOWER, JR.
Mining Engineer, New York

EXCEPT for the continuation of the construction programs of the Chile Exploration Co. at Chuquicamata and the Braden Copper Co. at Braden, the mining industry in Chile in 1920 seems to have continued on much the same scale as in 1919. Copper was the principal metallic product, major operations having been confined to six or seven companies, against twenty-four in 1913. The tonnage mined, however, in 1920 was about 7,000,000, yielding about 106,000 to 110,000 tons of copper, as against 1,050,000 tons of ore and 33,500 tons of copper in 1913.

Braden mined 2,275,000 tons of ore, which it is estimated will yield about 33,000 tons of copper. The grade of ore was a little poorer than in 1919, but operating costs were somewhat lower, or about 2c. per lb. copper, owing to improved labor or operating conditions. The construction program was continued during the year, and at the present rate will bring the plant to a 10,000-ton capacity in the fall of 1921.

The Chile Exploration Co. mined 4,000,000 tons of ore in 1920, estimated to yield 108,000,000 lb. of copper. The construction program progressed satisfactorily. Production was held down. About 15,000 tons of ore can now be mined and treated daily. The mine program has been so arranged as to permit an output of 30,000 tons per day by adding shovels, ore cars, and engines.

Anaconda's subsidiary, the Andes Copper Mining Co., continued development, but is not yet equipped to produce. A process of ore treatment is said to have been developed at Anaconda. A 60-mile railroad and a power plant on the coast have been built, and a water supply has been provided. Another subsidiary, the Santiago Mining Co., is said to be planning to erect a 750-ton concentrator, which seems to indicate a substantial tonnage of developed ore.

Other copper companies include the Catemou, at Aconcagua; the Central Chile, at Ovalle; the Naltagua, at El Monte; and the Poderosa, at Collahuasi. The Bethlehem Chile Iron Mines Co. is preparing to produce iron ore at the rate of 1,000,000 tons per annum from the Tofo deposit near Coquimbo, and has built five steamships and is planning five more for bringing the ore to this country.

The figures of production of other metals are not readily available. These include gold, silver, lead, manganese, mercury, molybdenum, nickel and cobalt. Aside from the precious metals, such production was small.

South Africa

By H. F. Marriott
Consulting Mining Engineer, Leeds, England

GOLD MINING in South Africa entered an eventful period in its history during 1920. The fluctuating price of gold in the London market continued, and its influence on the profits of the industry enabled some of the lower-grade mines to operate. For the first ten months of 1920 the gold production of the Transvaal was 6,887,673 oz., of a value at the standard price of gold of £28,928,227, as against 7,001,940 oz., of the standard value of £29,762,304, for the corresponding period in 1919. The additional revenue due to the increased price obtained from January to October, 1920, is estimated at approximately £8,315,196, 28.9 per cent of the standard total. Another aspect of the gold premium is its effect on the ore reserves, as it enables many of the shorter-lived mines to include within the profit limit many blocks of reef standing in the mines which had previously been classed as unpayable.

The number of producing mines on the Rand at the end of September was 41, as against 46 in September, 1919. The mines which ceased operations meanwhile were the Jupiter, Simmer Deep, Princess Estate, and New Heriot, and the City and Suburban was absorbed by the City Deep. At the end of September the 400-stamp mill at the Knights' Deep burned down, and as the mine was getting toward the end of its life, it was decided to cease operations. At the Village Main Reef mine the remaining reserves were nearly exhausted, when a serious fall of rock in October necessitated immediate and permanent closing down. On the Roodepoort United, shaft sinking and development ceased in June, and the standing ore reserves are to be mined so long as they show a profit. The New Kleinfontein company suspended development in the Apex section, which it acquired in 1914. The native labor freed by these reductions was quickly absorbed by neighboring mines.

The Low Grade Mines Commission appointed last year by the Union Government to investigate the position of the lower-grade mines published its final report in May, 1920. Its recommendations were:

(1) That no state subsidies should be given; (2) that a full inquiry be made by the government before any mine closes down; (3) that the piece-work system should be extended; (4) that inducements should be offered to the natives to remain at the mines for longer periods; (5) that the system of joint councils of employers and employees to settle points at issue should be developed; (6) that about 5,000 natives be recruited from north of Lat. 22 deg. south to test the contention of the medical authorities that the previous prevalent disease among tropical natives can be minimized; (7) that the color bar should be removed. The last recommendation was not unanimous.

No action has yet been taken by the government.

In February the white miners, influenced by the increase in the gold premium, demanded an increase in wages, and obtained an advance adding to the cost of the industry by £2,250,000 per annum. Some natives fomented a strike in March, and the readjustment of wages to meet differences added an annual charge of £800,000. The question of the shortage of native labor tends to become more acute. Competition has increased considerably, owing to industries which can offer higher rates of pay and better conditions. Another important point is that 50,000 natives will be required to replace Indian labor being repatriated from Natal.

The increased profit obtained by selling gold in a free market is reflected to some extent in the increased dividends paid. In June, 1920, the total amount of dividends declared by gold-mining companies in the Transvaal was £3,268,196, as against £2,561,977 for the corresponding period of 1919. The forecast for the December dividend indicates a further increase. Detailed notes follow:

The Anglo-American Corporation absorbed the Rand Selection Corporation during 1920, giving eleven shares for five, and increasing capital from £2,000,000 to £4,000,000 for this purpose. The City & Suburban company found it impossible to continue working at a profit through its 7,000-ft. incline shaft, owing to the cost of upkeep, and in May it was absorbed by the City Deep for 45,000 fully paid-up shares in that company. On the Western Rand, the south vertical shaft of the Randfontein Central cut the reef in June at a depth of 4,130 ft. The sampled value given was 12.1 dwt. over 48 in. Later in the year this company acquired the Randfontein Deep's assets for 250,459 £1 shares. High-grade ore has been found in the deeper levels of the central portion of the Consolidated Main Reef property, and the prospects of the mine are much brighter. Sub-vertical shafts are being sunk to open up the reef in the southern section of the Crown Mines property. The development for the year is good, and the outlook for this mine is satisfactory. The south circular shaft at the City Deep mine was 2,577 ft. deep at the end of September. This shaft is in two stages, and will be, when finished, the deepest shaft in the world. The question of dealing with the water from the outcrop mines as they become worked out is occupying the attention of the mines below them. The installation of a central pumping station is being considered.

The resources of the Rand are being upheld by the Far Eastern Rand, where eight mines, viz., Brakpan, Geduld, Government Gold Mining Areas, New Modderfontein, Modderfontein East, Modderfontein B, Modderfontein Deep, and Springs, contain reserves actually developed amounting to 35,177,515 tons, of a gross value, at the standard rate, of £77,000,000. The reserves of the New Modderfontein and Government Areas alone total nearly 20,000,000 tons of high-grade ore. For the year ending June 30, 1920, the total profit of the New Modderfontein was £1,493,845. Of this £464,657 was due to the gold premium. A circular shaft is being sunk on Modderfontein B to facilitate the extraction of the high-grade ore in the western section of the mine. It is estimated that the total depth will be 1,700 ft., and 750 ft. had been sunk at the end of September. The southeast circular shaft has cut the reef, but good values are not as yet disclosed.

The Modderfontein East began milling on April 23, at the Apex plant of the New Kleinfontein company, seven miles distant, which has a capacity of 27,000 tons per month. The ore reserves on June 30 were 1,755,400 tons, of a value of 32.5/- at standard rate. It is stated that this company is acquiring the Jupiter-Simmer Deep 300-stamp reduction plant, capable of treating 50,000 tons per month. At the Geduld Proprietary, 2,820 ft. on the seventh level near the new shaft has shown 64 per cent payable, averaging 17.5 dwt. over 66 in. The south shaft of the New State Areas intersected the reef in October at 3,676 ft., the assay being 89.8 dwt. over 18.9 in. The reef is nearly flat, the dip being 8 deg. By the terms of the lease under which this property is held the government will get the major proportion of the profits. No. 3 shaft at Springs Mines cut the reef at 3,676 ft. Development throughout the mine showed 58 per cent payability for the year, at 21.7 dwt. over 26.5 in.

Early in the year the Union Government found it necessary to issue an official warning in regard to speculation on the Far Eastern Rand. It condemned the misuse of reef nomenclature, and confirmed the continuity of the Van Ryn Reef, which is the only payable gold carrier known in the district. The burdensome Miners' Phthisis Act of 1919 was reported on during 1920 by a select committee. Its findings do not foreshadow relief. A further commission is now sitting. A movement is on foot to begin the manufacture of wire ropes in South Africa. Prominence has been given to the question of establishing an iron and steel industry on a large scale in South Africa.

The coal industry in South Africa, especially in Natal, is expanding, the gross output increasing from 7,665,753 tons for the first nine months of 1919 to 8,436,832 tons for the corresponding period in 1920.

Oil shales have been the object of considerable attention. In the Wakkerstroom district the deposit has been estimated at 3,000,000 tons of shale per square mile. Samples have given 23 to 25 gal. of oil per ton from the upper shale, and 14 to 18 gal. per ton from the lower shale. The shale formation extends north and south over a distance of 200 miles. The African Oil Corporation has been formed to exploit the Wakkerstroom area. A test shipment to Scotland gave a production of 31 gal. a ton. The Union Petroleum Co. has been formed, with a nominal capital of £150,000, to investigate properties in the same district.

TABLE I. TRANSVAAL GOLD PRODUCTION
Witwatersrand District

Year	Tons Milled	Value	Value per Ton Milled, Shillings	Outside Mines Value	[illegible]
1918	24,922,763	£34,823,017	27 9	£945,671	[illegible]688
1919	24,043,638	34,454,478	28 7	929,496	[illegible]974
1920(a)	24,836,609	33,979,075		885,112	[illegible]187

(a) Estimated. All values given are at standard price of gold.

The African Platinum Mines, Ltd., with a capital of £150,000, of which £100,000 is working capital, has been formed to work a deposit being opened up in the Cape province. Nickel has been discovered in the Barberton district. A sample taken over a width of 2 ft. 3 in. gave 17.2 per cent nickel. In the Messina district a new strike of copper is reported. The Messina (Transvaal) Development Co., Ltd., is erecting a new plant with largely increased capacity. A deposit of vanadium ore has been developed at Doornhoek, near Zeerust, and the African Vanadium & Lead Mines, Ltd., was formed, with a capital of £160,000, to work the mine. About 10,000 tons averaging 1 per cent V_2O_5 has been developed.

Interest has been revived in the silver deposits in the Transvaal, on which operations had been suspended for many years. The Transvaal Silver & Base Metals, Ltd., with a capital of £70,000, was formed to work the old mines of the Transvaal Silver Mines, Ltd., on Dwarsfontein. The Pretoria Silver & Lead Co., Ltd., with a capital of £80,000, has acquired the mineral rights of another portion of the same farm. Shipments of ore have been made from both properties.

The post-war boom in diamonds, in which record prices were obtained, came to an end in March, but the industry remained active during the year. De Beers Consolidated Mines, Ltd., paid a record dividend.

Tables I and II show respectively the yield and the labor position in 1920, as compared with 1918 and 1919.

TABLE II. LABOR EMPLOYED IN TRANSVAAL GOLD MINES

	Whites	Natives	Native Death Rate per 1,000
1918	22,953	161,095	23 72
1919	23,574	173,168	16 43
1920, January	23,581	179,502	
April	23,883	199,700	15 69(a)
July	22,366	186,021	
September	21,914	174,616	

(a) For twelve months ended Sept. 30.

Belgian Congo

BY SIDNEY H. BALL
Mining Geologist, New York

IN THE Belgian Congo the year 1920 was remarkable more for the amount of development and construction work done than from the point of view of production. Indeed, on account of the lower metal prices, the 1920 production was exceeded by that of 1919.

The Union Minière du Haut Katanga produced in the Katanga copper belt approximately 19,500 long tons of copper, the production being unsatisfactorily affected in March, April, and May by strikes on the Rhodesian railroads and in September and early October by a strike at the company's mines and smelter. The white strikers demanded an excessive wage increase, but returned to work upon the deportation from the oolony of E. J. Brown, an Australian agitator. The gross profit of the company for 1919 amounted to almost 30,000,000 fr.; the net profit being about 13,500,000 fr., of which 12,500,000 fr. was paid as dividends at the rate of 50 fr. per share. On Nov. 4, 1920, the capital of the company was increased to 15,000,000 fr. in common stock, there being, in addition, 150,000 dividend shares of no specified value. A debenture loan of 40,000,000 fr. was also authorized.

In 1920 the development in the Kasai diamond fields was pushed, but no attempt was made to increase the diamond production. The Forminière produced about 215,000 carats of diamonds and notably increased its reserves of diamondiferous gravel. The delimitation of the 4,000 miles of diamond-bearing land owned by the company is being pushed. In addition, this company directed the development work of five associated companies operating in the Belgian Congo, and the production, although not consequential in 1920, should in 1921 be important. A sister company, operating in Angola or Portuguese West Africa, known as Diamang, in 1920 had a production of approximately 100,000 carats.

The gold placer mines operated normally in 1920, and the production presumably approximated [illegible]. The tin production by the Geomines [illegible] important, and the Union Minière has recently created a new company to work its tin mines. [illegible] progress in 1920 was not as great as [illegible] years, the year is associated with fewer [illegible] factors than are to be noted in most other [illegible] districts.

Australia

EDITORIAL CORRESPONDENCE

MUCH of the following information has been supplied by Mr. Arthur Moline, general manager of Bendigo Amalgamated Goldfields, now in this country:

During 1920, the long-drawn-out Broken Hill strike, which lasted from May, 1919, until November, 1920, was settled. After many abortive conferences, the federal prime minister and the premier of New South Wales succeeded in settling the controversy.

As during the last five or six years, there was a marked shortage of skilled labor in 1920, though the sharp decline in metal prices at the end of the year will probably reduce the demand. Owing to conditions common throughout the world since 1914, gold mining was seriously handicapped. The saving feature of the situation was the premium obtained by the sale of gold abroad, chiefly in the Far East and also in the United States. This premium is approaching a total of £2,000,000, which has been of material help to the industry. Wages in various districts have been increased from time to time to meet the increased cost of living, usually by means of conferences between the respective parties in interest. Cost of living continued to rise until the third quarter, but is now falling, and wages may be expected to follow.

The various mining industries of the country maintained their relative positions: Mount Lyell, Wallaroo & Moonta, and the Cloncurry district retained their places as producers of copper, and Western Australia was first in the production of gold and Victoria second. For the first time in several years Victoria's gold production showed an increase, but this came from the output of a limited number of mines, and the future is somewhat uncertain. Hopes for increased yield of copper in the Cloncurry field were not realized, Mount Elliott remaining down and Mount Cuthbert running but a short time, although Hampden Cloncurry, and several small properties were in full swing. The total mineral production was seriously reduced by the cessation of work at Broken Hill.

Few new discoveries of mineral of any importance were reported. The early promise of Hampton Plains was not fulfilled up to the end of the year. Numerous small disconnected deposits of high-grade ore were found here, but so far that is all that can be asserted. A number of discoveries in various other sections of Western Australia were made as a result of those at Hampton Plains, but the same remark applies to them as to the latter.

Nothing new was published in the way of metallurgical developments during 1920. The idleness of Broken Hill owing to industrial trouble affected the position. Considerable work has been done by Mount Lyell on the Minerals Separation concentration of low-grade copper ores, with probably far-reaching results.

The production of electrolytic zinc at Risdon, Tasmania, reached commercial dimensions in 1920, and it can be accepted that the future of this project is assured. As a result, the Electrolytic Zinc Co., is proceeding with equipment costing another million sterling. During the year this company took over the mines and other assets of the Mount Read & Roseberry Mines, Ltd., thereby adding materially to its reserves.

A project of national importance undertaken during 1920 was the further extension of the Broken Hill Proprietary Steel Works, at Newcastle. Within a few years Australia should be in position to supply all the structural steel it requires. State mining ventures in Queensland suffered checks in 1920, though the Chillagoe State Smelters showed a profit for the first six months, despite the fact that operations were hampered from lack of ore. In Tasmania there was a tendency in industrial matters to break away from federal control and return to state jurisdiction. The Queensland government announced its intention of acquiring the important iron deposits on Yampi Sound, Western Australia, on which it holds an option. In New South Wales, steps were taken to realize the assets of Great Cobar, Ltd., after many attempts had been made to carry on operations. A profit-sharing scheme for its employees was proposed by the Wallaroo & Moonta, and the co-operative plans started in 1919 by Bendigo Amalgamated Goldfields operated satisfactorily.

Mining in Europe

BY W. A. DOMAN

London Correspondent of the Engineering and Mining Journal

THE metal-mining industry in Europe during 1920 is, in general, a long series of disappointments. Dealing first with England, tin winning is the principal metal mining industry, and it is rather surprising to relate that of the producing companies only one had paid a dividend up to the beginning of December. South Crofty disbursed only £20,000, and presumably the profit was obtained as much from wolfram as from tin.

It is scarcely necessary to state that such a poverty-stricken result, from the investor's standpoint, is the direct outcome of the weakness of the metal market. Tin started 1920 around £347 per ton. In March it exceeded £411 for cash, and forward metal was quoted as high as £416. Prices like these held out hopes of a flourishing industry, but a few thousand tons of tin unexpectedly arrived from the East and upset all calculations. At the time of writing the quotation is about £215, a drop of £130 from the beginning of the year and of £200 from the peak.

Only four companies made substantial outputs in 1920; namely, East Pool, with 666; Geevor, 198¾; Grenville, 225¾; and South Crofty, 448¾ tons of concentrates. The return of South Crofty is for both tin and wolfram. Grenville occupies a respectable place, or did until July, for lack of funds has brought trouble upon the company. Early in 1920 money was obtained, but the amount proved inadequate, owing to the coal strike and labor troubles, for Cornish miners, like others, demanded higher wages. The Cornishmen are not overpaid, though this is due rather to the industry being down on its luck than to differences with employers.

Attempts to fix a minimum price for tin are so far without avail. The industry applied to the government for a loan of £100,000. The government proved both stony and stony hearted. J. L. Collins has invented a chlorine process which is to be tried on tin ore to improve recovery. The original waste at Cornish mines is large. Streamers, however, make a pretty good living in treating it.

Apart from tin, the metal-mining activities of Great Britain were not extensive in 1920. Prices have not ruled at a level sufficiently high to attract capital. Representatives of the lead and zinc mines endeavored to get a subsidy from the government, but the authorities regard such matters as pertaining to private capital. Taxation is onerous, and though there are numerous deposits they are not of an extent to warrant the formation of large companies. Various lead mines are being reopened in Yorkshire. A "labor" lead mine is being worked in Derbyshire, and a zinc-lead property in Carnarvon. The outputs of these mines are not announced, but they are only small. The Great Laxey, a fine old lead mine, is being closed down on account of reduced yield and the demands of labor. The Swansea Vale and English Crown Spelter Works have ceased operations, as under present conditions they cannot continue profitably. The capital raised in England for mining companies in 1920 was approximately £4,200,000, of which more than half was for properties in the British Empire.

So far as can be gathered, metal mining on the Continent of Europe was not developed to any great extent in 1920. There the trouble seems to be identical with that in England—lack of capital to open up the mines. The Rio Tinto property has not been worked for many months, owing to a strike of workmen for higher wages.

In Portugal a tin-mining company called the Ervedosa Tin Mines has been formed to acquire the property of a French company, on the river Ruella, near Mirandella. Josiah Paull, of Cornish fame, reported upon the mine, and stated that the orebodies, though low grade, are large, the average content being 0.7 per cent to 1 per cent of tin, of which 70 per cent can be recovered. The method of working is by quarry. Although the capital was offered in England, the prospectus did not appear particularly attractive. Base-metal propositions have not the "pull" that formerly belonged to them.

A large amount of British capital is invested in Russian mines, these, by the way, being in Siberia. They form some of the finest gold, lead, zinc, and copper deposits in the world. Having been nationalized by the Bolshevik government, they are at a standstill, and are not likely to be reopened until satisfactory conditions can be restored. The Russo-Asiatic Corporation, which controls four of the largest mineral areas, embracing many thousands of square miles, is meantime turning its attention to oil and a silver-lead property in the Pyrenees. Some capital assays have been obtained from the latter. The principal attraction in the proposition, however, is the fact that the old workings can be traced for several miles, and consequently there is the possibility of the present company being converted into a parent undertaking. So far nothing in the way of production has been reported, according to information available at the present time.

The only satisfactory mining company about which occasional reports are heard is the Pennarroya, and this had to make a debenture issue. The methods of working practiced by French engineers differ materially from those of their British confrères, the latter always wanting to develop far ahead of requirements. A company called the Dome Mining Corporation has acquired a gold-mining concession in Spain. This covers a very large area, and in parts high assays are shown. The property was extensively worked by the Romans, and the remains of their engineering operations are still visible. Although the area was reported upon many months ago, operations do not appear to have yet begun. This may be due to the fact that conditions in Spain have altered, the workmen in nearly all industries demanding higher wages. Spain drew in large quantities of gold during the war, but her financial condition has taken a retrograde step.

Greece and parts of Turkey are highly mineralized. In the former country, attempts are being made to raise capital for working copper, lead, nickel, and zinc deposits, and the government has called for tenders to work argentiferous barytes concessions in Melos. According to estimates, there is 10,000,000 tons of the ore which contains on an average 164 gm. of silver per ton.

Mining in the Near East

By Leon Dominian

Washington, D. C.

THE condition of the mining industry for 1920 in the Near East may be defined as one of gradual recovery in the European section of the region. In the Asiatic area, however, the situation was at a standstill, and except perhaps in the case of the Heraklea coal field, there were few signs of progress toward the moderate activity of pre-war years. An outstanding fact deserves to be recorded, however, and that is that the Near East, taken as a whole, should be considered by American manufacturers as a good market and a virgin field for mining machinery of all kinds.

Of all the Near Eastern states, perhaps Jugoslavia and Rumania gave most evidence during the year of a partial recovery to pre-war conditions. The former nation, which now comprises the Kingdom of Serbia and Montenegro, as well as Dalmatia, Slovenia, and Croatia, is beginning to realize that its mineral resources constitute an asset of no mean importance in the appraisal of its national wealth.

According to surveys of the mineral situation made in the course of 1920, it was found that the lack of modern machinery and appliances hindered the metal-producing industry, which, like all industries in this region, still depends on foreign capital for its development. Local financial resources are still greatly depreciated.

Though complete statistics are not available, it is estimated that through improved transportation the coal production of 1920 will exceed that of 1919, which was as follows for the several provinces:

	Metric Tons
Bosnia-Herzegovina	[illegible]
Serbia	[illegible]
Croatia and Slavonia	[illegible]
Slovenia	1,150,000
Baranga	311,000

About 215,000 tons of oil was produced in the Rumanian oil field during the first half of 1920, or about 50,000 tons less than in the corresponding period for 1919. The Pratrova district appears to have been the main producer, leading with 166,000 tons. Damboritza produced 27,000 tons, Buzen 10,500, and Bacan 10,600. Strikes interfered with production. A five years' concession was granted by the Ministry of Industry and Commerce in June to a private Rumanian company, the Industria Rumana de Petrol, for the distribution of oil products.

From estimates and forecasts made before the end of 1920 it is expected that the average production of oil during the year will amount to 2,200 tons per day. This is still far from the pre-war production, as the average yield in 1913 was 5,237 tons per day, or about 500 wagons, as compared to the present output of 275 wagons. The year's production was in fact less than that of either 1918 or 1919, and the quantity of oil and its byproducts available for export was low.

In general, however, the Rumanian mining industry has been fairly active. The demand for concessions was heavy during the year, and grants were given mainly for the exploitation of petroleum, ozokerite, and asphalt in new localities. The liquidation of mineral lands owned before the war by German and Hungarian companies was in progress, along with their conversion into Rumanian concerns. During the year mica deposits were explored in the district of Mehedintz, and about fifteen carloads shipped in the summer. Work on the copper deposits of the Oltenic region, where mining dates back to the Roman period, was suspended, and production confined to the extraction of pyrites for the manufacture of sulphuric acid.

In Bulgaria operations were confined chiefly to coal. The country does not produce sufficient coal for home needs, nor is the coal high grade. Coal mining is still in a backward stage. Practically no oil was produced, as most of the oil companies operating in the country are awaiting confirmation by the Hellenic government of their titles to oil lands in Thrace.

In Turkey, by which Asia Minor is henceforth implied, mining operations have been confined almost exclusively to coal. In view of the urgent need of fuel during the war, attempts made to increase production succeeded, but since the armistice many of the mines which were worked during the period of hostilities have been abandoned.

Apart from coal, very few ores were mined. Production in the important chrome ore deposits of the Smyrna region, which formerly reached 10,000 tons, has fallen off considerably. The mines of the Borax Consolidated, a British company, were returned to their owners by the Turkish government, and work was resumed, although production is low when compared with pre-war records, the deficiency being ascribed mainly to labor shortage.

In the course of 1920 Italian engineers undertook extensive mining operations in the Georgian Republic, and it was announced in October that the coal of the Iquarceli Basin, stated to contain over 200,000,000 tons, was to be worked by an Italian company to supply the Italian market. In the Armenian region, although no production was obtained during 1920, interesting surveys of the mineral situation were made, which show that the region is rich in minerals and the industry awaits the re-establishment of order as well as the introduction of capital and transportation facilities. Copper was extracted on a small scale at the Lori mines, in the district of Bortchalo, and sent to the near-by refineries of Allaverdi, Schamluk, Schagale, Scar, and Manes. Before the war these refineries yielded about 4,200 tons of red and electrolytic copper per year. In the Langhezur and Goward region it is estimated that about 722,000 tons of copper ore was ready for shipment to the smelters at Siounik at the end of 1920. In the Olti district the coal reserves are estimated at 226,000,000 tons and those of rock salt near Nakhitchevan at 47,000,000 tons.

The oil situation in the Near East is one that deserves close attention on the part of American oil interests. In general, it may be stated that the opening up of fresh supplies has fallen far below the ever-growing demands of the many great industries which depend on oil. The changing situation due to the constantly increasing use of oil was observable in Egypt during 1920. At Port Said and Suez the number of ships in transit fitted with combustion engines is rapidly growing, together with a corresponding decrease of those using bunker coal. The question of fuel shortage was an important one during 1920 in Egypt, and caused the Anglo-Egyptian Oilfields Co. to carry on exploration work at various sites. Production was kept up at the oil wells at Gemsah and Hasgada, on the Egyptian coast of the Red Sea.

In Mesopotamia, the Anglo-Persian Oil Corporation of London, which is refining oil at Mohammerat, in Persia, had obtained certain rights from the Turks which have been recognized by the present British authorities. Little work appears to have been done in Mesopotamia. An oil refinery is in construction on the Tigris, ten miles north of Bagdad, and it is reported that crude oil will be brought there from the Persian fields to be refined for the Bagdad market.

Gold Mines of India

By W. A. Doman

London Correspondent *Engineering and Mining Journal*

OLD AGE is beginning to tell upon the Kolar mines. As they become deepened, and additional capital is needed, results are less favorable. For years past, gold production has been on a declining scale, and in the eleven months of 1920 for which figures are available the output is only 409,413 oz. In 1919, the yield was 461,171 oz., and there seems little probability now of the difference being made up. The producing mines are the Mysore, Ooregum, Nundydroog, Champion Reef, Balaghat, and North Anantapur. Mysore is the premier producer, but even here a decrease is noticeable.

Twelve months ago Mysore recovered over 15,000 oz.; in November, 1919, the total was only 12,249 oz. In December, 1919, these mines received an addition to their output by the closer clean-up that is practiced. The total production in January, 1920, was 39,073 oz. It was 4,751 oz. less in November. The general decline can best be shown by pointing out that, in 1916, the output of gold was 541,077 oz.; in 1917, 520,362 oz.; and in 1918, 485,236 oz.

The companies were severely handicapped by the method of selling, for the premium which was available for the mines of the Rand did not operate to the advantage of those of India. During 1920 the Indian government made a new arrangement, and now has the option of purchasing gold at the London market price calculated at the current rate of exchange. Any portion not so taken may be disposed of by the producers as they may choose.

With the declining fortunes of the Kolar field, though it will continue to produce for some years, three of the leading companies have formed the Indian Mines Development Syndicate to prospect mineral concessions elsewhere in India and in Burma. At the end of 1919, the Mysore doubled its capital of £305,000 for the deeper development of the mine, and the program is now being carried out, though only Ribblesdale's section is showing well. The Ooregum also had to spend money for extra development, about £40,000 for deepening the vertical shaft and £30,000 for equipment. These funds were on hand.

The Nundydroog was less fortunate, and was under the necessity of reconstructing to provide a sum of £170,000. The liability of the new 10s. shares was the heavy one of 6s. As the Balaghat, to the north, and the Ooregum, to the south, have shown better, there is the hope that Nundydroog will continue to yield profitable ore. The Anantapur field has proved a disappointment, and neither the Anantapur nor the North Anantapur has given encouragement.

On the Jibutil, where developments were suspended some months ago, prospecting is to be resumed. The Hutti Gold Mines is wound up. The dividend list is poor this year. The Champion Reef has disappeared, and the others have paid as follows: Mysore, 1s. 9d. per share; Nundydroog, 1s. 6d.; Ooregum, 2s. 3d.; Balaghat Preference, 10 per cent. The total is under £220,000.

At Rakha Hills, the only place where copper is produced in India, the Cape Copper and the Cordoba Copper companies are working. The latter had over £70,000 available, and the former has made a public debenture issue of £120,000.

China and Japan

By Thomas T. Read

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THE mining industry of Japan suffered from the financial crisis which so severely affected the whole country, beginning with the second quarter of 1920. The iron and steel industry, which had been expanded by the war more than any other, naturally was most severely influenced, but the situation of nearly all metallurgical enterprises was serious. The government works at Wakamatsu revised its program so that its output for 1920 will probably not exceed 300,000 tons, instead of 400,000 tons, as first projected.

The plans for building a steel plant at An-shan-chang, in Manchuria, have apparently been cancelled, and the relatively small blast furnaces already constructed are operating only at reduced capacity. The Toyo Seitetsu Kaisha (Oriental Steel Co.), which was reported by the British commercial attaché as having taken about 300,000 tons of iron ore from near Wuhu, on the Yangtze, in 1919, has greatly curtailed its operations. The Mitsubishi Iron Mining Co., near Chinnapo, in Korea, and the Pen-hsi-hu Iron Co., at the place of the same name in Manchuria, continue to operate, but no figures are available as to the present rate of output. It was proposed by the four principal Japanese steamship companies to advance freight rates on iron and steel products 20 to 50 per cent, in order to help protect the domestic enterprises from the effects of foreign competition, but the competition for cargoes on the Pacific rendered this impracticable. The new blast furnaces at Tayeh of the Hun-Yeh-Ping Coal & Iron Co. (a Japanese-controlled Chinese company) are nearing completion, and it is hoped to have them in operation early in 1921. Meanwhile, the old plant at Hanyang continues in operation. The Yangtze Engineering Works blew in its 100-ton blast furnace on June 26, 1920. This is a purely Chinese company, which has grown rapidly and seems to have been managed with much greater skill than has characterized other Oriental iron and steel enterprises. Reports that the Lung-Yen Mining Co., which controls the Lungkan and Yentungshan iron deposits, near Hsuanhuafu, is constructing a blast furnace near Peking are premature, the project not having advanced beyond the planning stage. It has been definitely stated and as definitely denied that this enterprise is also Japanese controlled.

The demand for coal in the Far East continues to grow. Operating costs have greatly increased, and as production in Japan, which has chiefly supplied the coast markets, does not increase with equal rapidity, prices have sharply advanced of recent years. The Kailan Mining Administration has greatly increased its output, and even sent one cargo of coal to Europe. The coal trade in the interior of North China has been hampered by a shortage of equipment to move coal. The Kailan Mining Administration is considering a plan to build a blast-furnace plant near its mine, as its coal steamers returning from Shanghai will bring back iron ore from deposits along the lower Yangtse as return cargo.

The event of 1920 in metal mining in China was the announcement of the formation of the Yunnan Ming Hsing Mining Co., which is a joint company formed by the New York Orient Mines Co. and the government of Yunnan. According to a statement by H. K. Tong, in the Chinese press, the company is to have a capital of $1,000,000, gold, at the beginning, but this amount may be increased without limit. Of the five directors of the company, three are to be Americans, and there will be one director-general, who will check all expenditures. The Chinese partners will not bear any expense for preliminary investigation. This company is now engaged in reopening an old lead-zinc-silver mine near Tengyueh, which offers a good deal of promise. At the request of the government of Yunnan, H. Foster Bain made a study of the tin and copper resources of Yunnan and reported on them to the government.

The Shuikousham lead-zinc-silver mine has been examined by W. H. Wiley and Jules Labarthe for another American firm, and the possibility of constructing a zinc smelter is being considered. Much interest has been displayed in Chinese mineral deposits by various American firms, but none of the other investigators has proceeded as yet to the point at which public announcement in regard to them has been made. J. Morgan Clements carried on investigations of the mineral deposits of China for the Bureau of Foreign and Domestic Commerce throughout 1920, and furnished to the Bureau a number of reports that have been made available to firms that are likely to be interested. A significant feature is the interest shown in the non-metallic mineral deposits of China, both asbestos and magnesite having attracted considerable attention in the year under review.

Metallurgy of Copper

By E. P. Mathewson

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ALTHOUGH nothing startling was discovered in copper metallurgy in 1920, many interesting improvements were made. The most important was the development of the application of pulverized coal to both blast and reverberatory furnaces. Several different plants have equipped blast furnaces to operate with pulverized coal. It is generally conceded that about 30 per cent of the coke on the charge can be replaced by an equal weight of pulverized coal. The blast furnaces of the new Cerro de Pasco smelter now under construction at Oroya, Peru, are designed to burn pulverized coal, the first large blast-furnace plant to be so equipped.

One plant in the Southwest has put in a large installation for the use of pulverized coal for reverberatory copper smelting, omitting the complicated drying and separating apparatus. After the coal is pulverized it is drawn directly to a fan under suction and thence to the furnace under fan pressure. The furnace has been operating about two months, and reports are very favorable. Most metallurgists would rather not attempt to put in a large installation of this character, owing to the great variation of moisture in the coal in most localities, hence an irregular supply of fuel to the furnace. The coal used at the installation referred to is remarkably free from moisture. Of course, many small furnaces are equipped in this way; in fact, the first application of pulverized coal to reverberatory copper furnaces was made in this manner. This was at the Highland Boy plant, at Murray, Utah.

At the Copper Queen reduction works a nine-hearth roaster, of the McDougall type, has been developed, and is said to be a success.

At Chrome, N. J., where nodulizing has been practiced for some years, an improvement has been made in passing the nodulized product between rolls which flatten out the nodules, making a product which is well suited for blast-furnace charge.

Hydro-metallurgy of copper has received a great deal of attention, and many modifications of old processes have been studied. One of the most important of these is the process to be adopted by the Andes Copper Co., of using liquid sulphur dioxide as the precipitant of the copper from the leach solution. This process is being developed in the Anaconda research laboratory under the direction of Fred Laist, general manager. This is the process that was called to the attention of the metallurgical world by Dr. George D. Van Arsdale. At Ajo, Ariz., some improvements have been made in the handling of cement copper from rejected electrolyte. The cement copper is dissolved in agitation tanks in a portion of the electrolyte containing approximately 0.5 per cent ferric sulphate. This reduces the ferric sulphate to the ferrous state. The solution is added to the purified electrolyte from the sulphur-dioxide towers, and then the combined solutions are returned to the electrolytic tanks.

W. E. Greenawalt has taken out a number of patents for his electrolytic process for the deposition of copper. In this, the chief features are that the ferric sulphate is never allowed to exceed one-quarter of 1 per cent in the electrolyte, and when the electrolyte is to be rejected, owing to excess of impurities, the copper is precipitated out by hydrogen sulphide. This semi-fluid precipitate is pumped to those tanks which are most acid and there re-dissolved, at the same time reducing the ferric sulphate in the electrolyte to the ferrous state.

The enormous installation of Cottrell apparatus at Anaconda was put in good working order during 1920, and results are said to be gratifying. Many other installations of Cottrell apparatus have been noted recently. Some interesting discoveries have been made regarding the theory of electrical precipitation.

In the concentration of copper ore, flotation held the center of the stage. The litigation instigated by Minerals Separation against the so-called infringers has gone merrily on; and Minerals Separation has itself been the subject of investigation through the efforts of the Federal Trade Commission and the American Mining Congress. A great many new flotation machines have been put on the market, but it cannot be said that much was added to the knowledge of flotation during the year, and the true physical explanation of the phenomena is still rather obscure. So many investigators are working on the problem that it would not be surprising to have many discoveries recorded in the near future. The Minerals Separation people have allowed one of their chief engineers in London, Mr. Sulman, to publish a long paper on flotation. This paper has met with a great deal of criticism, both favorable and unfavorable. However, the gold medal and premium of forty guineas founded by the Consolidated Rand Goldfields of South Africa, Ltd., has been awarded to the author.

Flotation reagents other than oils are being investigated thoroughly. Not only is the attempt being made to obtain a substitute for flotation oil, but efforts are being made to accomplish selective flotation by means of various reagents, with results that look promising. The discovery of selective flotation reagents that will finally solve the complex sulphide ore problem may be hopefully expected.

Considerable experimentation has been undertaken in this country, Canada, and Mexico in the sintering of flotation concentrate to prepare the material for subsequent blast-furnace treatment. This development is being closely watched by metallurgists, particularly those interested in semi-pyritic smelting. It has been found that the sulphur can be retained in the sintered product or can be driven out at will. It has also been found that the sintered product is well suited for the blast-furnace charge. In the early experiments, the concentrate was put through a fine screen before sintering. The fine screening was a mistake; the most approved screen now is of one-inch mesh.

Copper smelting, like many other industries, has developed to the point where the byproducts produced often show more profit than the principal product. Much of this development was caused by the fact that the agitation regarding smelter smoke has forced the smelting companies to take means to abate the nuisance.

Baghouses and the Cottrell electrical precipitation apparatus have been introduced, resulting in the accumulation, in the form of flue dust in the various smelters, of enormous quantities of rare metals and metallic compounds for which a use must be found. Formerly anything that did not produce silver, gold or copper was allowed to go out of the stack in the form of fumes. Now, this material is largely retained, and at some of the plants it has been a nuisance, as there was no bleeder provided to get rid of the surplus of the various subsidiary metals and compounds.

Some smelters are so situated as to be able to dispose of even their sulphur gases. For example, the Tennessee Copper Co. turns practically all of its sulphur into sulphuric acid, and this is used in the fertilizer industry. Some plants have gone extensively into the manufacture of liquid sulphur dioxide, for which there is an excellent market with the pulp mills and for the manufacture of concentrated sulphuric acid by the contact process. Among the byproducts now being recovered and placed on sale by the prominent smelting companies may be mentioned sulphuric acid, liquid sulphur dioxide, gold, silver, lead, zinc, zinc oxide, zinc dust, test lead, blue vitriol, litharge, cadmium, bismuth, thallium, selenium and its compounds, tellurium, arsenic, fungicides, insecticides, phosphate fertilizers, aluminum and aluminum compounds, antimony, lithopone, platinum, palladium, iridium, nickel and nickel sulphate, fire brick and common brick.

It would thus appear that the copper-smelting industry is passing through a stage of development that compares with the development of the packing industry. Soon everything in the ore will be saved and put to some valuable use. Slag from the smelters has been utilized for many years in certain localities for ballast for railroads, for the building of highways in concrete mixing, particularly; for foundation work, and in other useful applications. Waste heat is now recovered from all reverberatory furnace installations, and in a few instances is recovered from slag in the form of low-pressure steam. An ingenious recovery of heat from slag is noted at the Tacoma Smelting Co.'s plant, where the slag pots are used for heating certain buildings, it being only necessary to change the slag pots at intervals of many hours. This particular installation should be copied in other plants to cut down the consumption of coal.

In the matter of apparatus for the concentration of ores, vibratory screens seem to have come to the front in a remarkable way. This apparatus seems to be in a fair way to displace the trommel and other less efficient screening devices.

Labor conditions make it imperative that increasing attention be given to the use of mechanical appliances calling for the services of skilled labor in substitution for common labor.

Lead Smelting

By Jules Labarthe
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ADVANCEMENT in the process of lead smelting and refining during 1920 was confined principally to the introduction of labor-saving devices for the purpose of mechanically handling the ores, fluxes, and byproducts. Improved crushing and sampling facilities have also been installed at most plants to reduce manual labor.

The use of pulverized coal on the lead blast furnace is one notable achievement in smelting to be recorded, and although only partly successful so far, there is every indication of its ultimate success and great economic value. Conditions incidental to lead blast-furnace smelting have not permitted the use of coal to so large an extent as in copper work, but its use has been successful to a point of replacing approximately one-third of the fuel needed for smelting. This development, in itself, would result in great economy at points where coke is high in price and bituminous coal available at a reasonable cost. The use of coal has resulted in a falling off in the tonnage smelted, but this may be compensated for by the relative cost of the cheaper fuel in replacing coke. The metallurgists of the United States Smelting & Refining Co., Midvale, Utah, deserve great credit for their work in this connection.

Pulverized coal has now been successfully used in the following departments of lead smelting and refining: Steam boilers, drying furnaces, roasting furnaces, blast furnaces, drossing kettles, softening furnaces, desilverizing kettles, refining furnaces, merchant kettles and furnaces, retorts, cupels, silver-melting furnaces, and assay furnaces. At two Western plants, pulverized coal has replaced oil as fuel for ignition of the charge on Dwight & Lloyd sintering apparatus. This development has resulted in a saving in the cost of fuel and also more perfect ignition of the charge. The coal requirements are approximately six pounds per ton of charge.

A number of improvements in the Dwight & Lloyd grate bars have been made. At the Bunker Hill smelter, a more substantial design of the Trail grate has been developed. This grate is so designed that the air spaces are maintained at a uniform width of opening at all times. This is accompanied by spacing devices which hold the stationary grate rigid and at the same time allow movement in the central member of the grate to keep the openings clean and free from slagged charge. This improvement prevents the sifting of an undue amount of fines into the wind box and at the same time allows a maximum oxidization of the charge and a more equal distribution of air.

At Midvale, another change has been made in the Trail grate, wherein the central member of the grate is made convex on top. This feature tends to deflect the coarse particles of the charge to the sides and over the openings, thus allowing a better circulation of air through the charge and also preventing fine particles from reaching the grate openings and filtering through into the wind box.

The use of the Cottrell fume-precipitating apparatus has become quite general in Western lead smelters. At some plants, the installation is used for collecting dust and fume contained in roaster gases only, whereas at other plants, blast-furnace gases as well as roaster gases are passed through the treater. In some installations where mixed gases are treated, their basic character has caused difficulty in obtaining good clearance or results approaching perfect precipitation. This has been largely overcome by humidifying the gases by means of water sprays introduced in the flue at a point before the gases enter the treater. The precipitated fume, in most operations, can be ignited in the treater in the same manner as baghouse fume, and this sintered material is then in good condition for smelting in the blast furnace.

An interesting installation of the vacuum system of handling flue dust and baghouse fume has been developed at the Selby smelter, in San Francisco. With this equipment it is possible to clean the baghouse compartments much more quickly and thoroughly and at the same time prevent a dusty and unhealthy atmosphere, which was a bad feature of this work when performed by the old method with shovel and wheelbarrow. This apparatus consists of flexible suction pipe, which can reach various parts of the baghouse basement. The fume is collected in a cyclone collector by means of a connection to a high vacuum exhauster. The fume from the collector is mixed in a pug mill into a thick mud and smelted direct in the blast furnace.

At the Bunker Hill smelter, a circular merchant furnace has been installed. This furnace replaces four fifty-ton merchant kettles. The furnace is fired by pulverized coal, and is much more economical, requiring less fuel, and it produces less dross than the kettles. The temperature of the lead can also be kept more constant.

Metallurgy of Gold and Silver

By P. A. Robbins and Henry Hanson
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NO REVIEW of the progress in gold and silver metallurgy in 1920 would be complete without paying tribute to the work of John Stewart MacArthur, who died on March 16, 1920. The immediate and spectacular expansion of the electrical industry following the invention of the rotating magnetic field has scarcely been more wonderful than has been the result of MacArthur's invention of the cyanide process.

Looking back over thirty years of progress in the art of extracting precious metals from their ores, two phases of metallurgical endeavor are discernible. The first phase shows a somewhat stubborn avoidance of the use of the cyanide process coupled with attempts to improve upon MacArthur's invention. The second phase is marked by a world-wide acceptance of the process as originated by the inventor, the efforts of metallurgists being now directed toward the application of preliminary treatments which will make their ores more amenable to cyanidation, rather than endeavoring to devise processes which avoid cyanidation.

The psychological reason for this change in attitude would seem to be due in some measure to the coming of a younger generation of metallurgists, who, without experience or beliefs in other processes, could accept, without questioning, the cyanide process as being generally the most efficient system of extraction yet developed. Any reluctance upon the part of an older generation to abandon processes to which they had become wedded was a very natural and commendable attitude of caution. MacArthur's carefully designed process has remained unchanged, and only in improved mechanical details and in an ever-widening application of the process to refractory gold and silver ores has progress been made.

A discussion before the London Institution of Mining and Metallurgy, concerning the possible use of haloid cyanides, revealed no innovations. The only haloid compound which has been put to commercial use is bromo-cyanogen, which, however, is not a solvent for gold unless in the presence of an alkaline cyanide. The consensus of opinion is that the bromide merely acts as an oxidizing agent, a conclusion which seems to receive strong support from the fact that roasting and aëration have in most cases supplanted the use of bromo-cyanogen.

Although the process is still used in West Australia, it is to be noted that one of the largest mines in Kalgoorlie, which had previously used bromo-cyanogen, was compelled during the war to resort to ordinary alkaline cyanide treatment, no supplies of bromine salts being obtainable. This company will not return to the use of bromine, owing to the success of the present treatment.

Cyanide containing 36 per cent equivalent of the free cyanogen in standard sodium cyanide has been used in some American and Canadian mills as a means of reducing costs. The Tonopah Extension reports satisfactory results after seven months' exclusive use of the low-grade product. No fouling of solution is noted, and an advantage is claimed in that the low-grade salt possesses a high alkalinity, which assists in neutralizing the acidity of the ore, thus saving lime. Acetylene gas and sometimes ammonia are liberated when dissolving the low-grade cyanide, and hence it is advisable that good ventilation be maintained over the dissolving tank.

The impetus given to the production of low-grade cyanide at Niagara Falls has led to marked improvements in methods of manufacture and increases in the free cyanogen content of the product. The manufacturers of standard sodium and potassium cyanide are no doubt able to meet the competition of lower-grade substitutes, but competition in not only the precious-metal mills but also in the art of steel hardening and in the killing of scale on plants and trees may be expected to lead to an adjustment in prices of benefit to all consumers.

The low-grade cyanide is now manufactured from cyanamid, which latter has its principal use in the fertilizer industry, being one of the cheapest sources of combined nitrogen known, and thus offering an admirable material for transformation into cyanide.

At the Connemara mine (gold) in Rhodesia, it is claimed that heating the ore previous to cyaniding has raised the extraction from 68 to 86 per cent. The heating is referred to as "baking," as distinguished from roasting, the heating not being carried to a point where a roast is obtained. The process is stated to drive off water of crystallization from hydrated oxides of iron, thus making the ore more amenable to cyanidation.

The application of flotation to the recovery of slime concentrates at the Belmont Shawmut mill (California) is to be noted. The company was operating a gravity concentration plant producing a $60 concentrate, which was shipped to a smelter for treatment at a net cost of $16 per ton of concentrate. The plant was remodeled to treat the concentrate locally at a gross cost of $4 per ton, of which $1 is operating cost, and $3 is in discarded tailings. Four hundred tons of ore are treated per day, producing eighteen tons of sand concentrate from shaking tables and about thirteen tons of slime concentrate from flotation. The tailings from gravity concentration are classified, the coarse material being reground and the whole fed to an oil flotation plant consisting of two series of four cells each, followed by one cleaner cell. Froth from the last three pairs of cells goes to a cleaning cell, which discharges its tailings back into the head of the slime treatment circuit, while its froth joins the froth from the first pair of cells, the mixture flowing to a gravity concentrating table which makes three products; namely, two tons of $60 granular product, which goes to the roasting plant; two tons of $2.50 talcose middlings, which go to waste, and nine tons of $25 slimes, which go to cyanide treatment. The granular product from the slime treatment joins the concentrates from the main sand concentrating mill, and the mixture is roasted. The charge contains 30 per cent sulphur, whereas the calcine contains 4.3 per cent. The roasted sand concentrate is cooled and mixed with the raw, wet slime concentrate, the mixture being dewatered and cyanided. Sodium sulphide is vital to the success of the flotation, and is added at the cleaner cell to flocculate the sulphide particles and deflocculate the gangue. It is stated that cyaniding the raw concentrate gives an extraction of only 60 per cent, whereas roasting the granular concentrate, mixing with raw slime concentrate, and then cyaniding gives an extraction of from 91 to 94 per cent.

Satisfactory results are reported at the Shattuck Arizona mill (Bisbee, Ariz.) from the application of flotation to the concentration of silver-lead carbonate ores. The mill has a capacity of 400 to 500 tons per day. After coarse concentration on tables the ore is ground fine in ball and tube mills, then classified in cones, the overflow from the cones (containing 90 per cent minus 200) going to flotation, while the spigot discharge from the cones goes to tables. The slime overflow (all through 100 mesh) is thickened and sulphidized by a weak solution of sodium sulphide, after which it is agitated and then treated in eight oil flotation machines arranged in four series of two cells each. The froth from the first cell in each series is collected in a thickener, from which the thickened product passes to a filter, which discharges into storage bins ready for shipment to local smelters. The froth from the second cells is returned to the agitator which feeds the flotation system, and the tailings from the second series of cells go to waste.

The McIntyre-Porcupine mines (Ontario) are reported to have decided upon a flotation method for eliminating graphitic material which occurs in certain orebodies, causing losses of gold by reprecipitation.

Few new plants have been constructed during the year, although several enlargements of existing plants have been reported.

Although no marked improvements in milling apparatus have been noted, there is an increasing use of electrically vibrated screens, and a number of innovations in flotation apparatus have made their appearance.

Much earnest research work has been done during the year in the roasting and volatilization of refractory precious-metal ores, but experimenters have yet to report satisfactory commercial results.

In the Cobalt district of Ontario flotation continues to aid in the recovery of silver. Progress is exemplified by a comparison of the process at the Coniagas mill in 1914 with that in 1920. In 1914 the practice was straight concentration; 60 stamps, crushing to 14 mesh, treated 180 tons of 20-oz. ore daily, the product being classified and treated on sand, slime, and canvas tables, from all of which the tailings went to waste with an average silver content of from 5 to 6 oz. In 1920 60 stamps crushing to 3 mesh treat 300 tons of 10-oz. ore daily, the product being treated on tables and then reground in tube mills to 100 mesh, after which it is treated in flotation machines, the tailings from which carry one ounce per ton. Flotation concentrates are, by means of a cleaner cell, raised from 150 oz. per ton to 450.

It is rumored that Alaska Juneau has made good progress in improving the company's milling practice by rejecting a considerable portion of the low-grade rock sent to the mill.

There has been some discussion upon, and some experimental work has been carried on with, the electrical precipitation of cyanide solutions, but no improvements of commercial value seem to have developed. From Canada and Mexico reports have come of the continued success and economy of the Crowe vacuum zinc-dust precipitation process, and a number of new installations have been made.

Recent Trends in Ore Dressing

By ALFRED JAMES*

Consulting Mining Engineer, London, England

WHEN the cyanide process for treating refractory ores was introduced, the Grusonwerk mill was found to be the best ball mill. It was unapproachable as a dry granulator—not slimer—and it has surprised me that in America millmen should have been content to run a shortened tube mill, with various modifications in the way of baffles and discharge, instead of first adopting, as normal standard for comparison, the Grusonwerk mill, with its peripheral screening and the cascading of balls by successive drops.

In western Australia, Messrs. Bewick Moreing, who contributed so materially to the success of Kalgoorlie practice, introduced at Oroya Brownhill—or at least I first noted the practice at that mine—a system of screening, on shaking-sieve feeders, all the rock fed to the ball mills used for dry crushing. This screening materially increased the output by preventing the choking of the mill with material already sufficiently fine.

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*A part of Mr. James' "Annual Christmas Letter." [illegible] of the remainder of the letter was published in Engineering and Mining Journal for Jan. 15, 1921.

At the outset two tons per hp.-day of hard West Australian ore was crushed, with these mills, from breaker size, 2½-in. cubes, to 46 per cent through 200 holes per square inch (14 mesh). At Hannan's Star (where the tube mill was first introduced into gold mining) this output was increased, possibly by preliminary screening, to 2½ tons per hp.-day using 30- and 40-mesh screens. By the adoption of preliminary screening to divert from the feed all the ore already sufficiently fine, the South Kalgurli definitely increased its output to 100 tons per day from each of the No. 5 mills taking 36 hp. or nearly three tons per hp.-day.

Wear of balls in these Grusonwerk mills amounted to 0.5 lb. per ton crushed; liners lasted eight months. In the test described by C. T. Van Winkle (*Trans. A. I. M. E.*, Vol. LIX, p. 231) the consumption of balls by the Marcy mill is given at 1.7 lb. per ton crushed. Hines (*idem.* p. 261) shows a consumption of 1.5 lb. for chrome steel and 2.8 lb. for cast composition balls per ton of ore crushed through 48 mesh. The discrepancy is not so great as at first appears. The Grusonwerk ball mill was found to be unequaled as a *dry* granulator on ores not too tough, but the abrasion of iron was so great when wet crushing that millmen, the world over, preferred to use gravity stamps for this purpose. With these, abraded iron amounted to only 0.57 lb. per ton crushed (0.4 lb. for shoe and 0.17 lb. for die).

It is customary for some to refer to stamps as out of date. Their position has been obscured by the remarkable friability of some of the huge copper deposits, whence come reports of high outputs from ball and rod mills. It seems to have been left to private enterprise and energy to restore sanity by the publication of a series of tests on the varying hardness of ores (see Lennox, p. 1,262, *Bull.* 140, A. I. M. E.). Up to the outbreak of war, for ore of the hardness of that found on the Witwatersrand, the Nissen stamp was considered to be the most effective appliance known, for crushing from 2-in. cubes down to, say, 3 or 4 mesh perior to tube milling. On this work it was proved to have an efficiency about 15 per cent greater than that of the ordinary Californian stamp. That so little is heard of the Nissen stamp nowadays is perhaps owing to the absence of "paternal care," either with regard to advertisement in the press or in the fostering care of the inventor.

Weigall and Mitchell-Roberts, in their valuable article on their work at Suan (*Min. & Sci. Press*, Dec. 13, 1917, p. 847) show a crushing capacity with their stamps which I work out to be at the rate of 2½ tons per hp.-day crushed for tube milling.

Professor Truscott suggests the duty of stamps on 2-in. cubes of average (South African) hardness to be

100 lb. per hp.-hour to 30 to 40 mesh
200 lb. per hp.-hour to 12 to 16 mesh
400 lb. per hp.-hour to 3 to 4 mesh

with a consumption of 1 lb. of steel (used or thrown out) per ton of ore crushed fine, and a less consumption for coarser crushing.

It will be seen that Professor Truscott's figures on stamps (wet crushing) approximate for power closely to those given by me for Grusonwerk mills (dry crushing).

In comparisons of ball mills and stamps on the same tough ore, wet-crushed, it is not infrequently found that stamps require less power per ton output and that they have a less abrasion of iron or steel. Doubtless ball-mill specialists will develop a ball of greater endurance, but some of the consumptions, over 2 lb. of metal in balls alone per ton milled, have caused me regret.

The effect of fresh, finely abraded iron on cyanide work has been more than once mentioned. I have viewed with concern the apparent apathy of millmen as to the vitiation of their ore charges by this material. On the other hand, the adoption of special wear-resisting metal should materially lessen the vitiation of ore charges in this way.

SLIMING

The adoption of peripheral discharge in the Marcy ball mills is a reversion to the original tube-mill practice. Davidsen, the inventor of tube mills, invariably equipped his mills with peripheral discharge, either by direct outlet or by scoop, until the Africans made the mistake—I am afraid for patent rather than for technical reasons—of insisting on trunnion-level discharge. With the expiry of the Davidsen patents, more enlightened views prevailed, and peripheral discharge once more came into its own.

The tube mill remains the accepted standard appliance for wet or dry comminution. I note with regret the tendency to an increased cost of tube milling. Cannot some means be devised of effecting a material reduction? A cost of over 35c. (or 2/-) per ton tube milled is not an encouraging introduction to the beneficiation of huge dumps of low-grade tailings such as those existing in India. I have lessened costs by the adoption of roller bearings, but my experience is that the heaviest operating costs occur when the outlet screen is of large dimensions (peripheral discharge) and mine rock of large diameter displaces pebbles or balls. Whether the increased cost is more than counterbalanced by the profit resulting from the additional mine rock thus crushed is of course a question to be determined by the user, but the cost certainly is somewhat alarming. Lowest costs are associated with the use of rounded pebbles, or balls and light liners.

Pans, as fine slimers, seem to have definitely fallen out of the running. Formerly there was the pans vs. tube mills controversy from western Australia, and after tube mills had definitely proved their superiority the matter was regarded as settled until Mr. Söhnlein's articles in the *Engineering and Mining Journal*, Sept. 27, 1913, once more raised the question by showing the remarkably high duty from the pans in his mill, resulting from a series of experiments to improve efficiency and output. I have this year taken up the matter direct with Mr. Söhnlein and asked him how time had dealt with his remarkable results. His reply is instructive:

"I fear that grinding pans are not so satisfactory on an unroasted charge of ore as they were formerly on roasted material at Machacamarca. Also, with the high price of iron I fear that they cannot compete with tube mills; therefore I fear that the grinding pan is not longer a machine to be reckoned with. Further, I found that it needs rather a good class of labor to keep the pans running right; unskilled people are very apt not to let the dies low enough on the shoes, and the result is an enormous amount of oversize from the classifier, which will finally choke the pan. For all these reasons I am not as much in favor of the pan as I used to be, and have always used tube or ball mills during the last years in installations which were erected or operated under my charge."

Thus ends a skillful effort, and millmen should be as indebted to Mr. Söhnlein for his frankness as they were for his initiative and public spirit.

At the moment an enterprising attempt is being made by Hugh Rose at Fresnillo to slime ore from 1½ in. maximum down to 75 per cent minus 200 mesh in one operation in Marcy rod mills working in closed circuit with a Dorr classifier. The nature of the ore at Fresnillo may assist the experiment, but previous experience with rod mills has not been of an encouraging nature.

Agitation is not swirling; it is the perfect descent of each solid particle separately through, and not with, the liquid. Grothe showed mathematically, as well as by ocular demonstration in a glass model, how the heaviest and coarsest material obtained most agitation—it descended vertically through the column of solution at a greater rate than the lighter and finer matter even in a 1:1 thickened pulp ready for filtration without decantation. What more perfect agitation could be devised than this continuous settlement of particles—ever separating with reference to each other and yet without classification—through the solvent column! What finer record than that of E. H. Johnson's four agitators at the East Rand, continuously agitating year after year, for twelve horsepower, no less than 1,800 solid tons a day, with a 97 per cent extraction!

I have recently had, or seen in the public press, reports from three different parts of the world of agitators failing through the ore settling hard on the bottom of the tank and caking there. The Pachuca tank still stands supreme, and attention has of late been forcibly directed, in the absence of these agitators, to the necessity for thorough aëration of solutions prior to, or during, solvent action.

The increased price of silver has resulted in the profitable treatment of accumulations of old "fills," dumps, and tailings. These usually require the employment of oxidizers. First principles cannot be overlooked in a devotion to mechanical efficiencies. Hamilton, in his recently published handbook, refers to the advantages gained from a simple testing of sump solutions and the resulting addition of alkali. Crowe's work emphasizes the benefit of aëration to prevent precipitation—in the solution vats. The fragments and logs of wood recovered from the "fills" makes the warning all the more serious. In early work on some ores rich in silver the amount of silver absorbed in, and recovered by burning from, the surface of wooden vat staves was astonishing. The condition of the fragments of wood now clogging up mill screens or plates makes them much more absorbent of silver than are vat staves. This wood must be avoided. A washing apparatus can be so designed that all the wood shall be floated off before the ore enters the mill; and this should be done. A report by a well-known metallurgist on the treatment of the ores of a Mexican silver mine states that reprecipitation on these old "fills" is so serious as to make impossible their treatment with the ordinary ore. Washing as above, plus an oxidizer, should overcome this difficulty.

It is not out of place here to refer to Embury's method of handling pulp in transit from agitators to filters. Simply and smoothly working, it is extremely attractive. The automatic regulation is superior to the many attempts I have noted to obtain similar flexibility with diaphragm pumps. The industry is surely entitled, by reason of its need, to a paper from Mr. Embury on this subject.

Ferro-Alloys

BY ROBERT J. ANDERSON

THE unsettled conditions that prevailed in the ferro-alloy and metallurgical ore industries in 1919 continued in general through 1920, although it must be admitted that these industries are better off than they were a year ago. The steel industry was upset at several times during the year by labor troubles and transportation difficulties, and any factors that govern steel output are immediately reflected in the ferro-alloy industry. Owing to the inability of British ferromanganese makers to obtain supplies of Indian ore, there was a threatened shortage of ferromanganese in the United States, and several electric-furnace makers here found it profitable to re-enter the field. The export demand for Continental Europe was fair, but the unsettled political and financial conditions abroad acted as a deterrent to much business. This refers especially to ferromanganese and spiegeleisen. At the same time, heavy offerings of foreign ferrochromium and ferrotungsten were made here at stiff price concessions.

One of the most important metallurgical developments of 1920 was the introduction of the Soderberg self-baking electrode at the plant of the Southern Manganese Corporation, Anniston, Ala. The possibility of the use of oxygen-enriched air in the blast-furnace production of some of the ferro-alloys also received further attention in 1920. The carbon reduction of ferrovanadium is a metallurgical development that has been brought to commercial success.

Ferromanganese and Spiegeleisen—Owing to the scarcity of foreign ores and the inability of English makers to supply ferromanganese, the domestic mining of metallurgical manganese ore was stimulated in 1920.

The domestic ferromanganese industry was considerably revived in 1920, and the inability of the British makers to supply the American market was the most important contributing factor in this situation. The domestic output of ferromanganese in 1920 was about 280,000 tons, as compared with 179,029 tons in 1919. The spiegeleisen production was about 116,000 tons in 1920, as against 65,391 tons in 1919. Prices for 78@82 per cent ferromanganese fluctuated widely during the year, the range being from $130 per ton in January to $225 per ton in July. Prices declined in the second half. In England the situation as to ferromanganese supplies was quite desperate at times, but the threatened shortage in the United States had disappeared by September. The reappearance of the electric-furnace alloy is noteworthy; five plants were operating in June, as against none in January. Prices for spiegeleisen increased from \$38@\$40 per ton for 18@22 per cent alloy in January to \$75@\$85 in August, where they remained during the remainder of the year. The export demand for spiegeleisen was active.

Ferrosilicon—Owing to shutdowns at the plants of blast-furnace ferrosilicon makers, because of coke scarcity, there was a shortage of bessemer ferrosilicons throughout 1920, and high prices were obtained for these alloys. Large quantities of the 12@15 per cent electric-furnace product were offered, however, at prices lower than those for bessemer ferrosilicons. Domestic electric-furnace ferrosilicon, 12@15 per cent grade, sold at \$65, furnace; the 50 per cent grade was overproduced, but the prices were held at \$80@\$90. The 75 per cent alloy sold at \$150@\$200 per ton. Bessemer ferrosilicons, 9, 10, 11, and 12 per cent grades, brought \$56.50, \$59.50, \$62.50, and \$66.10 per ton, f.o.b. New Straitsville, Ohio, until July, when a series of increases set in to \$66, \$69.50, \$72.80, and \$76.10, respectively. Imports of all grades of ferrosilicon in 1920 were about 16,000 tons, as against 10,445 tons in 1919. Foreign competition for the domestic market in 1920 was strong, but the demand was better than in 1919. Owing to the shortage of pig iron in some districts, some foundries made iron in the cupola by smelting a mixture of scrap steel and ferrosilicon with coke.

Ferrochromium.—Ferrochromium was steady but low throughout 1920; and consumption and demand were low. There were heavy offerings of foreign alloys at price concessions, particularly by French makers. Ferrochromium, 6@8 per cent C grade, sold at 19@22c. per lb. of contained Cr, whereas the 4@6 per cent C grade brought 20@24c. The cancellation of alloy-steel orders, owing to the collapse in the automotive industry, was a contributing factor in the dull ferrochromium markets. Stainless steel, the iron alloy containing about 14 per cent chromium, has continued to attract much attention. This steel was prominent in the British cutlery trade prior to the war, but it is now being employed for many construction purposes where an anti-corrosive alloy is needed. Low-carbon ferrochromium is desired for the manufacture of stainless steel.

Ferrotungsten—The production of both metallic tungsten and ferrotungsten was small. Prices for metallic tungsten and ferrotungsten were lower in 1920 than in 1919, owing to the decline in demand and the dumping of foreign ferrotungsten. The demand for high-speed steel was light. British ferrotungsten was offered as low as 50c. per lb. of contained W, and although the domestic 70@80 per cent alloy brought \$1.25@\$1.40 during the opening months of 1920, it did not get below 75@90c. There is small possibility of tungsten losing its pre-eminence in the manufacture of high-speed steel through the use of molybdenum as a substitute, despite the many rumors circulated recently.

Ferrovanadium—The heavy demand for ferrovanadium continued through 1920, and supplies were scarce. Numerous improvements were effected by the Vanadium Corporation of America at its Peruvian properties, and the operations there were considerably enlarged. Owing to the discovery of additional large ore deposits, it is estimated that this company can now supply ore almost indefinitely at the present rate of consumption.

The ferrovanadium situation in England was acute during 1920, owing to the heavy decline in exports from the United States, but many domestic tool-steel makers were pinched for supplies also. Ferrovanadium sold for \$5.50@\$8.50 per lb. of contained V, depending upon the percentage of silicon present; spot resale alloy in brokers' hands brought up to \$14.

In the metallurgy of ferrovanadium, the successful solution of the carbon-reduction process in the electric furnace is especially noteworthy. This process, which has been in the formative stages for some years, has been put into commercial operation. Evidently, the bulk of the future output of the alloy will be made by this method, and it should result in lower production costs. The possibility that vanadium, in the form of cupro-vanadium or alumino-vanadium, will find considerable application in non-ferrous metallurgy in the next few years is not to be overlooked.

Ferromolybdenum—Ferromolybdenum sold at \$3@\$3.50 per lb. of contained Mo in the early months of 1920, but the price later declined to \$2@2.50. A gradual and wider use of molybdenum steels is looked for, and many of the motor companies are experimenting with these steels. A so-called all-molybdenum-steel motor car is announced.

Ferrotitanium, Ferro-Uranium, and Ferrozirconium—Further experiments have been made by some steel companies with a view to using titanium as an alloying element in steels, and it is reported that noteworthy results have been obtained with titanium steels for use as armor plate and in ordnance. Details are lacking. Ilmenite sold at 1¼@2c. per lb. for 52 per cent TiO_2 in 1920, and rutile brought 10@25c. per lb. for 95 per cent material. Ferrocarbontitanium sold at \$200@\$250 per ton, and the aluminothermic alloy was higher in price. Metallurgical developments of note in ferro-uranium and ferrozirconium were at a standstill in 1920.

Uranium oxide sold in 1920 at \$2.75@\$3 per lb. for 96 per cent material, whereas carnotite ore, minimum 2 per cent U_3O_8, brought \$2.75@\$3 per lb. of contained U_3O_8. Ferro-uranium, 35@50 per cent U, sold at \$7 per lb.

The use of ferrozirconium in the metallurgy of cast iron has been investigated recently by Moldenke. He states that the alloy is useful as a deoxidizer in cast iron and that an addition of 0.10 per cent results in increased strength and deflection. Some complex alloys high in zirconium for use as high-speed cutting tools have been developed recently by Cooper. A 20 per cent ferro-zirconium has been employed in England, in steel metallurgy, as a substitute for ferrotitanium.

Minor and Complex Ferro-Alloys.—Nothing of striking importance occurred in the minor and complex ferro-alloys in 1920, although considerable experimental work is going on. Ferro-aluminum is receiving some attention again, and the 10@20 per cent alloy has been used in Germany for the deoxidation of steel in the last few years. Little is heard of boron steels and ferroboron. Further work on the use of cerium in steel is in progress, and the possibility of using the native mineral fluocerite as a means for introducing cerium into steel, rather than employing ferrocerium or misch metal, is suggested by the recent experiments of Cammen. Metallic cobalt is still employed in some of the good grades of high-speed tool steels, and considerable cobalt now goes into the manufacture of the stellite alloys. A new complex deoxidizer, viz., a uranium-magnesium-aluminum alloy, has been employed commercially for the deoxidation of chromium steels. Both silicomanganese and calcium silicide were employed considerably in 1920, especially abroad, owing to the shortage of ferromanganese.

Mining Stocks in 1920

Stock	Exch	High	Low	Last	Sales
COPPER					
Adventure C..	Boston..	1¾ Feb. 27	*40 Aug. 10	*60	4,640
Ahmeek	Boston	77 Jan. 3	40½ Dec. 29	45	11,372
Alaska-B. C....	N. Y. Curb.	2⅛ Apr	⅛ Dec.	[illegible]	1,486,000
Allouez	Boston	42 Jan. 7	15 Dec. 23	18	6,944
Anaconda	N. Y.	66½ Apr. 6	30 Dec. 21	[illegible]	1,381 300
Ariz. Com'l	Boston	15¾ Jan. 5	5¼ Dec. 2	[illegible]	55,437
Big Ledge	N. Y. Curb	¾ June	1/16 Nov.		1,195,900
Bingham Mines	Boston	10⅞ Apr. 27	6½ Mar. 18	[illegible]	26,265
Calumet & Ariz	Boston.	69 Jan.	39¾ Dec.	[illegible]	56,421
Calumet & Hecla	Boston	409 Jan. 3	200 Dec. 11	250	8,397
Canada Copper.	N. Y. Curb	1⅞ Mar.	*11 Dec.	*15	233,700
Centennial	Boston	16½ Jan. 5	6½ Dec. 21	6½	2,403
Cerro de Pasco	N. Y.	61¾ Jan. 3	24¼ Dec. 29	26½	72,130
Chief Consol	Boston Crb	5⅝ Jan.	1¾ Aug.	2	
Chile Copper	N. Y.	21⅞ Jan. 3	7¾ Nov. 30	9¾	[illegible]
Chino	N. Y.	[illegible] Jan. 3	16⅞ Dec. 21	19¾	488 580
Columbus Rexall	Salt Lake..	*40½ July	*31 Dec.	*32½	
Con. Ariz	N. Y. Curb	1 13/16 Feb.	*1 Dec.	[illegible]	165,850
Con. Copper M.	N. Y. Curb	5⅜ Jan.	1 Dec.	1½	106,725
Copper Range	Boston	48⅞ Jan. 5	25 Dec. 21	26¾	63,913
Crystal Cop. (N)	Boston Crb	*74 Feb.	*21 Jan.	*36	
Davis-Daly	Boston	14¼ Jan. 5	4⅞ Dec. 22	5¼	131,668
East Butte	Boston	16 Jan. 3	7¼ Dec. 30	8	72,936
First Nat'l	Boston Crb	1 3/16 Jan.	*50 Dec.	*65	
Franklin	Boston	5¼ Apr. 7	*50 Aug. 11	2½	29,537
Gadsden Copper	N. Y. Curb	3 Jan.	*20 Dec.	*25	39,250
Granby Consol.	N. Y.	55½ Jan. 5	15 Dec. 21	17¾	36,056
Greene-Cananea	N. Y.	38½ Jan. 3	15 Dec. 22	19	71,663
Hancock Consol.	Boston	6¼ Mar. 31	2 Dec. 29	2	6,137
Houghton	Boston Crb	*80 Apr.	*30 Dec.	*35	
Howe Sound	N. Y. Curb	4⅞ Feb.	2¼ Dec.	2⅝	48,650
Inspiration Con.	N. Y.	61⅞ Apr. 8	28 Dec. 21	31½	685,465
Iron Cap	Boston Crb	*14 Jan.	* 6 Nov.	* 6½	
Isle Royale	Boston	38 Jan. 3	15 Dec. 29	16½	27,553
Kennecott	N. Y.	33½ Apr. 7	14¾ Dec. 22	17¼	839,200
Keweenaw	Boston	2½ Jan.	1¼ Dec.	1¼	9,975
Lake Copper	Boston	4¼ Apr.	1½ Dec.	1½	12,676
La Salle	Boston	3⅜ Jan.	1¼ Dec.	1¼	10,055
Magma Chief	N. Y. Curb	½ Jan.	*17 Sept.	¼	192,000
Magma Copper	N. Y. Curb	39½ Apr.	15⅛ Dec.	15⅞	35,260
Majestic	Boston Crb	*22 Jan.	* 7 Oct.	* 8	
Mason Valley	Boston	3 Jan. 21	*90 Dec. 21	*90	9,466
Mass Consol.	Boston	5¼ Jan. 3	1¾ Dec. 20	1¾	13,551
Mayflower-O.C.	Boston	11¾ Jan. 2	3½ Dec. 23	3¾	46,813
Miami	N. Y.	26 Jan. 5	14⅛ Dec. 22	15½	163,735
Michigan	Boston	7½ Jan. 2	1¾ Dec. 15	2¼	17,377
Mohawk	Boston	72 Mar. 27	40½ Dec. 30	43½	18,900
Mother Lode (N)	N. Y. Curb	6¼ May	4½ Mar.	5¾	138,250
Nevada Con.	N. Y.	17½ Jan. 5	8 Nov. 18	9¾	211,500
New Arcadian	Boston.	5½ Jan.	2½ Feb.	2½	11,569
New Baltic	Boston Crb	4 Jan.	3 Jan.	3	
New Cornelia	Boston	24 Jan. 5	12½ Nov. 20	13¾	46,389
Nixon Nev.	N. Y. Curb	*23 Jan.	* 5 Aug.	* 5	
North Butte	Boston	21½ Apr. 20	8 Dec. 30	8¼	196,422
North Lake	Boston	*80 Jan. 27	*25 Oct. 14	*40	3,205
Ohio Copper	N. Y. Curb	[illegible] Mar	⅛ Sept.	[illegible]	
Ojibway	Boston	2⅝ Jan. 26	1 Dec. 17	1¼	5,478
Old Dominion	Boston	37½ Jan. 5	15 Dec. 22	15⅛	22,821
Osceola	Boston	58 Jan. 3	20½ Dec. 29	22½	9,111
Phelps-Dodge	Open Mar.	†230 Apr.	†150 Nov.		
Quincy	Boston	65 Jan. 3	34½ Dec. 21	35	9,187
Ray Con.	N. Y.	22¾ Jan. 5	10 Nov. 18	11½	349,695
Ray Hercules	Boston Crb	2½ Jan.	*50 Oct. 2	*50	
St. Mary's M.L	Boston	58 Jan. 5	25¾ Dec. 21	28	13,860
Seneca Copper	Boston	23 Nov. 11	12½ May 24	16¾	59,212
Shannon	Boston	2 Jan. 7	*50 Dec. 28	*75	27,105
Shattuck, Ariz.	N. Y.	13 Jan. 17	4 Dec. 30	4½	54,000
South Lake	Boston	2⅜ Jan.	1 Dec.	1	4,919
South Utah	Boston	*25 Jan.	1 Dec.	* 4	26,289
Superior Copper	Boston	6 Jan. 7	2¾ Dec. 30	3¼	9,369
Superior & Bost	Boston	6¼ Jan. 29	1 Dec. 21	[illegible]	[illegible]
Tenn. C. & C.	N. Y.	13¼ Mar. 31	6¾ Dec. 28		354,275
Tuolumne	Boston	1¾ Jan. 10	*33 Dec. 2	[illegible]	77,792
United Verde Ex	Boston Crb	*43 Jan.	*18 Nov.	[illegible]	
Utah Consol.	Boston	9¾ Feb. 20	2½ Dec. 29	3	44,558
Utah Copper	N. Y.	80¼ Jan. 3	44½ Dec. 21	[illegible]	552,800
Utah M. & T.	Boston	3⅞ Jan. 5	*42 Nov. 18	[illegible]	143,994
Victoria	Boston	3½ Jan. 8	1 Dec. 3	[illegible]	7,175
Winona	Boston	2 Jan. 7	*25 Sept. 9	[illegible]	24,278
Wolverine	Boston	23 Jan. 10	8 Dec. 28	[illegible]	9,084
LEAD					
Hecla Mining	N. Y. Curb	5 1/16 Jan.	2 Jan.	[illegible]	
St. Joseph Lead	N. Y.	17¼ Apr. 12	10 Dec. [illegible]	[illegible]	94,620
Stewart	Boston Crb	*20 Feb.	* 6 Dec. [illegible]	[illegible]	
Utah Apex	Boston	4 Oct. 21	1⅛ Aug. 7	3	[illegible]
ZINC					
Am. Z. L. & S.	N. Y.	21⅛ Jan. 10	5½ Dec. [illegible]	[illegible]	[illegible]
Am. Z. L. & S. pf.	N. Y.	59½ Jan. 9	25½ [illegible]	[illegible]	20,400
Butte C. & Z.	N. Y.	11½ Jan. 9	3½ [illegible]	[illegible]	[illegible]
Butte & Superior	N. Y.	29½ Jan. 12	8 [illegible]	[illegible]	[illegible]
Con. Interst. Cal.	N. Y.	20⅛ Jan. 3	4¾ [illegible]	[illegible]	[illegible]
New Jersey Z.	N. Y. Curb	300 Apr.	127 [illegible]	[illegible]	[illegible]
[illegible]	N. Y. Curb	* 7 Jan.	*1 Dec.	[illegible]	[illegible]
Yellow Pine	Los Angeles	1 25 Apr.	0 35 [illegible]	[illegible]	

* Cents per share. † Bid or asked.

Stock	Exch.	High	Low	Last	Sales
GOLD					
Alaska Gold	N. Y.	2⅝ Mar. 24	⅝ Dec. 22	[illegible]	181,500
Alaska Juneau	N. Y.	3 Mar. 31	¾ Dec. 21	1	241,300
Carson Hill	N. Y. Curb	*40 Jan.	*19 Feb.	*22¾	64,215
Cresson Con. G.	N. Y. Curb	2½ Jan.	¾ Sept.	1¼	102,900
Dome Ex.	Toronto	*50 Oct.	*18 May	*41	
Dome Mines	N. Y.	13 Jan. 3	9⅞ May 19	10¼	89,200
Golden Cycle	Colo. Sprgs	*186 May	*65 June	*73	...
Goldfield Con.	N. Y. Curb	*15 Jan.	* 4 Dec.	* 5	1,065,625
Hollinger Con.	Toronto	7.00 Feb.	5.15 May		
Homestake	N. Y.	71 Jan.	45 Oct. 21	50	9,154
Kirkland Lake	Toronto	*81 Jan.	*36 Dec.	*39	
Lake Shore	Toronto	1.25 July	1.00 Dec.	1 05	
McIntyre-Porcu.	Toronto	2.15 Mar.	1.76 Dec.	1.79	....
Porcupine Crown	Toronto	*31½ Apr.	*15 Dec.	*17	
Portland	Colo. Sprgs.	*60 May	*55 June	*60	
Reorgan. Booth.	N. Y. Curb	* 7 Jan.	* 2 Dec.	* 3	796,310
Silver Pick	N. Y. Curb	*30 Mar	* 2 Jan.	* 4	710,610
Teck Hughes	Toronto	*19 Jan.	* 5 Dec.	*10	
Tom Reed	Los Angeles	2 00 Mar.	0.90 July	1.22	
United Eastern	N. Y. Curb	4½ Jan.	2 Dec.	2 3/16	357,290
Vindicator Con.	Colo. Sprgs.	*20 May	*17 June	*18	...
West Dome Con.	Toronto	*10¾ Mar.	* 4 Dec.	* 8	
White Caps Min.	N. Y. Curb	*20 Apr.	* 3 Dec.	* 4½	6,741,950
Yukon Gold	Boston Crb.	1¾ Feb.	*50 Dec.	*50	......
SILVER					
Arizona Silver	Boston Crb	8½ Jan.	*10 Aug.	*18	
Beaver Con.	Toronto	*67 Jan.	*25¾ Dec.	*25¾	
Coniagas	Toronto	3.25 Mar.	2.00 Dec.	2 00	
Crown Reserve	Toronto	*43 Feb.	*15 Dec.	*16	
Kerr Lake	Boston	5 Mar. 24	2½ Dec. 31	2⅝	20,572
La Rose	Toronto	*48 Apr.	*22 Dec.	*22	....
McKinley-Dar.	Toronto	*65 Jan.	*20 Dec.	*24	....
Mining Corp.	Toronto	2 00 Apr.	0 85 Dec.	1 00	...
Nipissing	N. Y. Curb	12¾ Jan.	7 Dec.	7⅝	162,200
Ontario Silver	N. Y.	9⅞ Apr. 6	3½ Nov. 19	4½	103,120
Ophir Silver	N. Y. Curb	1⅛ Feb.	½ May	1	134,250
Peterson Lake	Toronto	*22 Jan.	* 9 Dec.	* 9	
Temiskaming	Toronto	*47 Apr.	*24 Dec.	*25	
Trethewey	Toronto	*48½ Feb.	*13½ Dec.	*15¾	
GOLD AND SILVER					
Atlanta	N. Y. Curb	*5½ Mar	*½ Dec.	*1½	921,400
Bost. & Mont.	Boston	*94 Apr.	*23 Sept	*44	
Cashboy	N. Y. Curb	*12 Mar.	*3½ Dec.	*3½	1,079,470
El Salvador	N. Y. Curb	3⅛ Mar.	⅛ Dec.	1/16	459,000
Jim Butler	N. Y. Curb	*27 Jan.	*10 Aug.	*17	750,590
Jumbo Exten.	N. Y. Curb	*13 Sept.	*4 July	*4½	768,150
Louisiana Con.	N. Y. Curb	¾ Jan.	⅛ Dec.	⅛	506,280
MacNamara M.	N. Y. Curb	*97 Jan.	1/16 May	1/16	1,980,600
N.Y.Hond Ros.	Open Mar.	†15½ Apr	*9 Dec		
Tonopah-Belm't	N. Y. Curb	3½ Jan.	1 1/16 Aug.	[illegible]	203,834
Tonopah-Divide	N. Y. Curb	4⅞ Jan	15/16 Aug.	1⅛	1,252,280
Tonopah Ex.	N. Y. Curb	2 11/16 Jan.	1 1/16 June	1⅞	214,564
Tonopah Mining	N. Y. Curb	3⅜ Jan.	1 July	1⅜	309,540
West End Con.	N. Y. Curb	2 1/16 Jan.	¾ Dec.	1	524,345
SILVER-LEAD					
Caledonia Min.	N. Y. Curb	*42 Jan.	*15 Oct	*16	849,170
Consol. M. & S.	Montreal	32½ Jan.	15¾ Nov	18	
Daly Mining	Salt Lake	4 25 Mar	2 00 Dec	2 00	
Daly-West	Boston	4¼ Mar 3	3½ Dec 21	3½	[illegible]
Eagle & Bl. Bell	Boston Crb	2¼ Apr	2 May	2½	
Electric Point	Spokane	*45 Apr	* 4 Dec	* 5	
Fed. M. & S.	N. Y.	16½ Mar 30	5 Dec 17	7½	14,557
Fed. M. & S. pf.	N. Y.	44¾ May 14	21½ Dec 21	22	51,872
Florence Silver	Spokane	*50 May	*10 Dec	*14	
Grand Central	Salt Lake	*47	*37½ Aug	*37½	
Iron Blossom	N. Y. Curb	[illegible] Feb	*16 Dec	*16	84,315
Judge M. & S.	Salt Lake	5 50 Jan.	2 92 Dec.	2 92½	
Marsh Mines	N. Y. Curb	*32 Jan.	* 6 Dec	* 8	762,267
Prince Consol.	N. Y. Curb	[illegible] Jan.	[illegible] Nov	¼	[illegible]
Rambler-Cariboo	Spokane	*19 May	*5 Dec	* 7½	
Rex Con.	N. Y. Curb	*12 Jan.	* 3½ Dec	* 4	671,700
South Hecla	Salt Lake	1 30 Mar	*60 Dec	*65	
[illegible]	N. Y. Curb	[illegible] Jan	⅛ Nov.	[illegible]	156,620
Tamarack-Custer	Spokane	2 75 May	1 25 Dec.	[illegible]	
Tintic Standard	Salt Lake	7 15 Mar.	2 52½ Sept	[illegible]	
Wilbert Mining	N. Y. Curb	*12 Mar.	*[illegible] Dec	* 2	803,545
NICKEL-COPPER					
Internat'l Nickel	N. Y.	26½ Jan. 7	11⅛ Dec. 21	[illegible]	[illegible]
Internat'l N. pf.	N. Y.	88 Feb. 5	75 Dec. 30	78½	[illegible]
QUICKSILVER					
New Idria	Boston	7½ Jan. 8	*35 Dec. 27	[illegible]	[illegible]
TUNGSTEN					
Mojave Tungsten	Boston Crb	*20 Jan.	[illegible]	[illegible]	
VANADIUM					
Vanadium Corp.	N. Y.	97 Apr. [illegible]	[illegible]	[illegible]	[illegible]
ASBESTOS					
Asbestos Corp.	Montreal	103 [illegible]	[illegible]	[illegible]	
Asbestos Corp. pf.	Montreal	108 [illegible]	[illegible]		
MINING, SMELTING, AND REFINING					
Am. S. & R.	N. Y.	72 Jan. 3	[illegible]	[illegible]	[illegible]
Am. S. & R. pf.	N. Y.	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	N. Y.	[illegible] Mar. 30	[illegible]	[illegible]	[illegible]
[illegible]	N. Y.	[illegible] Jan. 3	[illegible]	[illegible]	[illegible]
[illegible] pf	Boston	48 Mar.	40 Dec.	[illegible]	24,898

Acknowledgment

The stock prices of the *Engineering and Mining Journal* during 1920 and in this Annual Review [illegible] of quotations as published [illegible] of the Boston Curb Exchange, and [illegible] Toronto mining market furnished by [illegible] New York [illegible] Prices [illegible] from [illegible] Butte [illegible] Los Angeles [illegible] by J. E. [illegible] New York City [illegible]

Mining Dividends

DIVIDENDS OF MINING AND METALLURGICAL COMPANIES IN THE UNITED STATES, 1919 AND 1920

Company Name	Situation	Shares Issued	Par Value	Dividends Paid				Total to Date	Latest	
				1919		1920				
				Per Share	Total	Per Share	Total		Date	Amount
Ahmeek, c.	Mich.	200,000	$25	$3 00	$600,000	$1 50	$300,000	$12,150,000	Sept. '20	$0 50
Allouez, c.	Mich.	100,000	25	1 00	100,000	.		2,850,000	Mar. '19	1 00
Am. Sm. & Ref.	U. S.-Mex	609,980	100	4 00	2,439,920	4 00	2,439,920	45,855,598	Dec. '20	1 00
Am. Sm. & Ref., pfd	U. S.-Mex.	500,000	100	7 00	3,500,000	7 00	3,500,000	72,296,386	Dec. '20	1 75
Am. Smelters, pf. A	U. S.	97,381	100	6 00	584,288	6 00	584,288	14,134,238	Oct. '20	1 50
Am. Smelters, pf., B	U. S.	31,884	100	5 00	165,334	5 00	165,334	18,018,981	Oct. '20	1.25
Am. Zinc, Lead & Sm., pfd	U. S.	80,540	25	6 00	483,240	6 00	483,240	2,188,401	Nov. '20	1 50
Anaconda, c., s. z.	Mont.	2,331,250	50	4 50	10,490,625	4 00	10,490,625	175,938,750	Nov. '20	1 00
Argonaut Consol., g	Cal.	200,000	5	.20	40,000	10	10,000	1,940,000	Mar. '20	.05
Arizona Binghamton, c.	Ariz.	2,000,000	1	10	200,000	.		200,000	Jan. '19	.10
Arizona Copper, pf. ( )	Ariz.			..	119,221	...		2,605,949	Nov. '19	....
Arizona Copper	Ariz.	1,519,896	5 sh	2/6	£170,998	9 d	£56,996 2/0	£4,637,894	May '20	9 d.
Arizona Silver Mines	Nev.	450,000	$7	$0 03	$13,500	$0 12	$54,000	$67,500	Apr. '20	$0.03
Barnes-King Dev., g	Mont.	400,000	5	.30	120,000	15	60,000	440,000	Aug. '20	.05
Bingham Mines, c	Utah	150,000	10	75	112,500			675,000	Sept. '19	.25
Bunker Hill & Sullivan, l. s.	Ida.	327,000	10	3.50	1,144,500	$6.00	1,962,000	25,275,000	Dec. '20	.50
Caledonia Mining, l.s	Ida.	2,605,000	1	12	312,600	07	182,350	4,256,206	Oct. '20	.01
Calumet & Arizona, c.	Ariz.	642,521	10	3 00	1,927,560	4 00	2,570,080	45,630,263	Dec. '20	1 00
Calumet & Hecla, c	Mich.	100,000	25	10 00	1,000,000	5 00	500,000	152,250,000	June '20	5 00
Camp Bird, pfd., g. s	Col.	649,625	£1	7%	£45,473.75	7%	£45,473 75	......	July '20	8⅜d.
Cardiff, l.g	Utah	500,000	$1	$0 15	$75,000	15	$75,000	875,000	Dec. '20	.15
Central Eureka, g.	Cal.	392,616	1	03	11,778	.10	39,261 60	977,363 38	Feb. '20	05
Champion, c	Mich.	100,000	25	12 80	1,280,000	...		25,250,261	Dec. '19	6 40
Chief Consolidated, s. g. l.	Utah	884,232	1	32	283,954	40	353,689 20	1,869,514 20	Nov. '20	10
Chino Copper	N. M.	869,980	5	3 00	2,609,940	1.12½	978,728	29,991,709 50	Sept. '20	37½
Columbus Rexall, l. s.	Utah	586,342	1	02½	14,659			14,659	Jan. '19	.02½
Con. Interstate Callahan, z.	Ida.	323,303	10	..	....	2 00	755,606	7,721,688 25	Dec. '20	.50
Copper Range, c.	Mich.	395,000	25	2.50	986,015 50	1 50	592,500	26,999,219 50	Sept. '20	.50
Cresson Consol., g	Col.	1,220,000	1	1.20	1,464,000	.20	244,000	8,979,162	June '20	.10
Daly, s. l. g.	Utah	150,000	20	.65	97,500	.30	30,000	3,142,500	July '20	.10
Daly West, s. l.	Utah	250,000	20	..	......	90	225,000	6,868,000	Dec. '20	.25
Davis Daly, c.s	Mont.	600 000	10	.50	300,000	.25	150,000	900,000	Mar. '20	.25
Dragon Con., s. c. l. g. i.	Utah	1,875,000	1	....	....	.02	37,500	206,250	Apr. '20	.01
Eagle & Blue Bell, l. s.	Utah	893,146	1	$0.10	89,316	.35(b)	312,606	1,663,012	Dec. '20	(b) .25
East Butte, c.	Mont.	421,849	10	.50	210,366	....	.	1,687,396	Dec. '19	.50
Eastern Talc	Vt.	69,696	10	...	27,837	...	55,646 40	180,802	Nov. '20	.04
Electric Point, l.	Wash.	793,750	1	.06	47,625	21	166,687 50	468,312.50	Oct. '20	.15
Elko Prince, g. s.	Nev.	1,108,566	1	.07½	83,142	...	....	360,284	Sept. '19	.03½
Fairview Round Mountain, g.	Nev.	963,471	1	.14	134,666	..	.....	153,715	Nov. '19	.02
Federal M. & Sm., pfd	Ida.	120,000	100	3 75	449,479	6 00	720,000	15,933,837	Dec. '20	1.75
First Natl. Copper,	Cal.	600,000	5	.15	90,000	....	....	660,000	Feb. '19	.15
Gemini, g.s.	Utah	5,000	100	.....	....	6 00	30,000	2,490,000	Aug. '20	6 00
Golden Cycle, g.	Col.	1,500,000	1	.36	540,000	.12	180,000	9,438,500	Dec. '20	.02
Goldfield Consol., g.	Nev.	3,559,148	10	05	117,958	...	....	29,177,790	Dec. '19	.05
Grand Central, g.	Utah	500,000	1	.06	30,000	.03	15,000	1,825,250	June '20	.03
Hecla Mining, l.s.	Ida.	1,000,000	0 25	60	600,000	65	650,000	8,655,000	Dec. '20	.15
Homestake, g.	S. D.	251,160	100	4.50	1,130,220	....	......	....	Sept. '19	.50
Inspiration Consol., c.	Ariz.	1,181,967	20	6 50	7,682,787	5.00	5,909,836	38,983,704	Oct. '20	1.00
Internat. Nickel,	U. S.-Can.	1,673,384	25	.50	836,692	....	.	53,113,676 20	Mar. '19	.50
Internat. Nickel, pfd.	U. S.-Can	89,126	100	6.00	534,756	6.00	534,756	8,021,225.99	Nov. '20	1.50
Iowa, g. s. l.	Col.	1,666,667	1	.00½	8,333	....	.. .	378,499	Oct. '19	.00½
Iron Blossom, s. l. g.	Utah	1,000,000	0 10	.07½	75,000	.05	50,000	3,300,000	Apr. '20	.02½
Iron Cap Copper,	Ariz.	142,106	10	50	72,942	.25	35,526	996,090	Sept. '20	.25
Isle Royale Copper,	Mich.	150,000	25	1.00	150,000	....	....	2,025,000	Sept. '19	.50
Judge Min. & Sm. s. l.	Utah	480,000	1	.12½	60,000	.37½	180,000	2,550,000	Sept. '20	.12½
Kennecott Copper,	Alaska	2,787,050	...	2.00	5,574,120	2.00	5,574,120	53,502,344	Dec. '20	.50
Liberty Bell, g.	Col.	133,560	5	.05	66,778	....	....	2,660,959	Sept. '19	.02
Magma Copper	Ariz.	240,000	5	.50	120,000	....	....	1,704,000	Jan. '19	.50
Miami Copper	Ariz.	747,114	5	2.50	1,867,785	2.00	1,494,228	21,957,057	Nov. '20	.50
Mohawk, c.	Mich.	100,000	25	5.00	500,000	5.50	550,000	9,675,000	Nov. '20	1.00
Nevada Consol. Copper	Nev.	1,999,457	5	1 50	2,999,188	75	1,499,592.75	46,768,626 50	Sept. '20	.25
Nevada Packard, g.	Nev.	1,164,492	1	02	23,290		....	110,627	Apr. '19	.02
Nevada Wonder, g.	Nev.	1,408,240	1	.05	70,423	.	....	1,549,005	May '19	.05
New Cornelia Copper	Ariz.	1,800,000	5	...	....	50	900,000	1,350,000	Aug. '20	.25
New Idria, q.	Cal.	100,000	5	.25	25,000		...	2,705,000	Jan. '19	.25
New Jersey Zinc	U. S.	420,000	100	20 00	7,000,000	12 00	4,760,000	(Not reported)	Nov. '20	4.00
North Star, g.	Cal.	250,000	10	40	100,000		....	5,537,040	June '19	.40
Ontario Silver	Utah	150,000	.	50	75,000		...	15,187,500	Jan. '19	.50
Oroville Dredging, g.	Cal.	686,538	£1	2 sh.	329,540	1/6	£51,490,135	£429,036	Sept. '20	9d.
Osceola Consol., c.	Mich.	96,150	$25	$3 00	288,450	$1.00	$96,150	$1,856,375	June '20	$0.50
Phelps Dodge Corp.	U. S.	450,000	100	15 50	6,975,000	10 00	4,500,000	96,071,000	Oct. '20	2 50
Plymouth Consol., g.	Cal.	240,000	£1	2 sh	117,040	.		700,240	July '19	1 sh.
Portland Gold	Col.	3,000,000	$1	$0 08	240,000	.06½	195,000	11,692,080	Oct. '20	$0 01½
Quincy Mining	Mich.	110,000	25	4 00	440,000	1 00	110,000	27,002,500	Mar. '20	1.00
Ray Consol., c.	Ariz.	1,577,179	10	2 00	3,154,356	1 00	1,577,179	30,412,619	Dec. '20	.25
Reorg. Booth, g.	Nev.	1,000,000	1	05	50,000	...	. .	400,000	May '19	.05
St. Joseph Lead	Mo.	1,409,466	10	1 05	1,550,414	2 00	2,818,932	25,912,962	Dec. '20	.50
Shattuck Arizona, c.	Ariz.	350,000	10	1 25	437,500	25	87,500	7,612,500	Jan. '20	.25
South Hecla	Ida.	263,000	1	15	39,450	...	......	78,888	Sept. '19	.15
Tamarack & Custer, l. s.	Ida.	1,776,288	1	03	53,288			515,118	Dec. '19	.03
Tintic Standard, l. s.	Utah	1,174,700	1	47	552,109	50	587,350	1,538,338	Dec. '20	.20
Tom Reed, g.	Ariz.	909,555	1	24	218,923	.		2,755,952	Dec. '19	.02
Tonopah Belmont, s. g.	Nev.	1,500,000	1	25	375,000	10	150,000	10,193,063	Oct. '20	.05
Tonopah Extension, g. s.	Nev.	1,282,801	1	30	384,840	15	192,420	2,553,820	Oct. '20	.05
Tonopah Mining, g. s.	Nev.	1,000,000	1	30	300,000	05	50,000	14,925,000	Oct. '20	.05
United Eastern, g.	Ariz.	1,363,000	$1	$0 66	$899,580	$0 72	$981,370	$3,134,910	Oct. '20	$0 15
U. S. Sm., Ref. & Min.	U. S.-Mex.	351,115	50	5 25	1,843,354	6 00	2,106,693	15,140,222	Oct. '20	1 50
U. S. Sm., Ref. Min., pfd.	U. S.-Mex.	486,350	50	3 50	1,702,225	3 50	1,702,225	24,851,267	Oct. '20	87½
United Verde, c.	Ariz.	300,000		9 00	2,700,000	6 00	1,800,000		Dec. '20	1 50
United Verde Ext., c.	Ariz.	1,050,000	0 50	2 25	2,362,500	2 00	2,120,000	11,150,000	Nov. '20	50
Utah Apex, c.	Utah	528,200	5			25	132,050	1,254,475	Nov. '20	25
Utah Copper	Utah	1,624,490	10	6 00	9,746,940	6 00	9,746,940	111,509,663	Dec. '20	6 00

a Two classes. *b* Include returned capital.

DIVIDENDS OF MINING AND METALLURGICAL COMPANIES IN THE UNITED STATES, 1919 AND 1920

Company Name	Situation	Shares Issued	Par Value	Dividends Paid 1919 Per Share	1919 Total	1920 Per Share	1920 Total	Total to Date	Latest Date	Latest Amount
Vanadium Corp	Col and Peru	373,334			.....	4 50	1,680,003	1,680,003	Oct '20	1.50
Vindicator-Consol., g.	Col.	1,500,000	1	.04	60,000	.01	15,000	3,847,500	Jan '20	.01
Wellington, g.	Col.	1,000,000	1	.10	100,000		....	1,950,000	Jan '19	.10
West End Consol., s	Nev.	1,788,486	1	.10	178,850			1,251,940	Dec '19	.05
Wolverine, c	Mich	60,000	25	2.50	150,000	.50	30,000	10,350,000	Jan '20	.50
Yellow Pine, z. l.s.	Nev.	1,000,000	1	[illegible]	150,000	.06	60,000	2,596,008	June '20	.03

CANADIAN, MEXICAN, SOUTH AND CENTRAL AMERICAN MINING COMPANIES

Company Name	Situation	Shares Issued	Par Value	1919 Per Share	1919 Total	1920 Per Share	1920 Total	Total to Date	Latest Date	Latest Amount
Alvarado, g. s.	Mex.	350,000	$20			$1 50	$52,500	$52,500	Oct '20	$0 50
Amparo, g. s.	Mex.	2,000,000	1	$0 18	$360,000	.20	400,000	3,712,176	Nov '20	.05
Asbestos Corporation	Que.	30,000	100	3 75	112,500	11 25	337,500	450,000	Oct '20	1 50
Asbestos Corp'n, pfd.	Que.	40,000	100	4 50	180,000	13 00	520,000	1,000,000	Oct '20	1 75
Beaver Cons., s.	Ont.	2,000,000	1			.03	60,000	710,000	May '20	.03
Belmont Surf Inlet, g.	B. C.	2,500,000	1	.10	250,000	.20	500,000	750,000	Oct '20	.05
Cerro de Pasco, c	Peru	898,229	.	4 00	3,592,909	4 00	3,592,916	18,255,312	Dec '20	1 00
Coniagas, s.	Ont.	800,000	5	.50	400,000	.62½	500,000	10,140,000	Nov '20	.12½
Consol. M. & S. Canada	B. C.	419,098	25	2 50	1,047,744	2 50	1,053,370	7,093,896	Oct '20	.62½
Dome Mines, s.	Ont.	400,000	10	.	....	1 00	400,000	1,900,000	Oct '20	.25
El Oro M. & R. R., g. s.	Mex.	1,147,500	£1	1 sh.	£57,375	1 sh.	£57,375	£2,013,125	Nov '20	1 sh.
Florence Silver	B. C.	1,100,000	$1	$0 03	$35,300			$35,300	Apr '19	$0 01½
Frontino & Bolivia, g	Colombia	140,000	£1			2 sh.	£14,000		July '20	1 sh.
Frontino & Bolivia, pfd.	Colombia	23,390	£8½			5	£10,000		July '20	5
Granby Consol., s. l. c.	B. C.	150,00	$100	3 75	562,500	$1 25	$187,500	10,526,885	May '20	$1 25
Green Cananea, c	Mex.	500,000	100	1 50	750,000	1 00	500,000	17,097,165	Nov '20	.50
Hedley Gold	B. C.	240,000	10	.20	48,000			2,459,520	Jan '19	.10
Hollinger Consol., g.	Ont.	4,920,000	5	.35	1,722,000	.40	1,968,000	13,[illegible]4,000	Dec '20	.05
Howe Sound, c.	B. C.	1,984,150	1	.20	396,832	.20	396,832	1,081,288	Oct '20	.05
Kerr Lake	Ont.	600,000	4	1 50	900,000	.12½	75,000	8,985,000	Oct '20	.12½
Lake Shore, g.	Ont.	2,000,000	1	.05	100,000	.04	80,000	280,000	Oct '20	.02
Lucky Tiger-Comb., g.	Mex.	715,337	10	1 62	1,158,346	1 85	1,323,373	7,469,573	Dec '20	.15
McIntyre Porcupine, s	Ont.	3,640,283	1	.10	364,028	.15	546,042	1,994,654	Sept. '20	.05
McK.-Dar.-Sav., s	Ont.	2,247,692	1	.12	269,724	.12	269,724	5,955,395	Oct. '20	.03
Mexico Mines of El Oro, g. s.	Mex.	180,000	£1	18 s.	£162,000	4 s.	£36,000		June '20	4 s.
Min. Corp. of Can., s	Ont.	1,600,050	$5	$0 37½	$622,518	$0 37½	$622,518	5,499,275	Sept. '20	$0 [illegible]
N. Y. & Hond. Ros., s. g.	C. A.	200,000	10	2 00	400,000	2 00	400,000	5,790,000	Oct '20	.50
Nipissing Mines, s	Ont.	1,200,000	5	1 50	1,800,000	1 50	1,800,000	22,140,000	Oct '20	[illegible]
Ouro Preto Gold, pfd	Brazil	27,161	£1			1 sh.	£1,358		Aug '20	1 s.
Pato Mines, g	Colombia	100,000	£1	10 s.	£50,000	14 sh.	£70,000	£120,000	Oct. '20	4 6
Rambler-Cariboo, s	B. C.	1,750,000	$1	$0 01	$17,500	.	.	$440,000	Feb [illegible]	$0 [illegible]
St. John del Rey, g	Brazil	600,000	£1			1 12	£8,500		[illegible] '20	[illegible]
St. John del Rey, pfd	Brazil	100,000	£1			2 sh.	£10,000		[illegible] '20	1 s.
Santa Gertrudis, g. s.	Mex.	1,500,000	£1	2 s.	£150,000	2 sh.	£150,000	£1,011,450	[illegible] '20	1 s.
Temiskaming, s	Ont.	2,500,000	$1			$0 04	$100,000	$2,159,156	[illegible] '20	$0 04
Trethewey, s	Ont.	1,000,000	1	$0 05	$50,000	. .		1,211,998	[illegible] '19	[illegible]

HOLDING COMPANIES

Company Name	Situation	Shares Issued	Par Value	1919 Per Share	1919 Total	1920 Per Share	1920 Total	Total to Date	Latest Date	Latest Amount
California Exploration		231,617	$2 40	$0 24	$56,278		.	$1[illegible]6,973	[illegible] '19	[illegible]
Exploration Co.	Mex.	750,000	10 sh.	[illegible]	£28,125			$1,845,000	[illegible] '19	[illegible]
General Development	U. S.	120,000	$25			1 00	120,000	4,[illegible]	Aug '20	$1 [illegible]
St. Mary's Min. Land	Mich.	160,000	25	$4 00	$640,000	2 00	320,000	12,[illegible]	June '20	[illegible]
White Knob C. & D., pfd	Cal.	200,000	10	[illegible]	40,000	.05	10,000	360,000	Feb '20	[illegible]
Yukon-Alaska Trust		203,433		[illegible]	813,732	1 00	203,433	3,254,928	Sept '20	1 00

Bonds on New York Stock Exchange

	1919 High	1919 Low	1920 High	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1920 [illegible] Dollars
Alaska Gold M., 6% conv., [illegible] Series A	[illegible]	[illegible]	[illegible]	[illegible]	12	[illegible]	[illegible]	[illegible]	[illegible]
Alaska Gold M., 6% conv., 26, Series B	34	12	20½	[illegible]	12	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] 1947	93	84	86½	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] 1926	[illegible]	[illegible]	97½	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] 1943	92	84½	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] 1936	89½	80	86½	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] 1931	97	89	93	May 4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] 1923	128	101	108½	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] 1932	[illegible]	82½	86	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] 1948	92	83	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] 28	98½	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] conv. 6s, [illegible]	98	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7

	1919 High	1919 Low	1920 High	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Illinois Steel deb. 4½s, 1940	86½	82½	84	Jan 2	72½	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Steel, 1st mtg., 5s, [illegible]	98½	91	93½	[illegible] 7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Steel, 1st conv. 5s, 1923	98½	94	97½	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	107	86	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] 1952	99½	92	93½	[illegible] 7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] 1940	96	92							
[illegible] 1951	93	87	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	96	91	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] conv., [illegible]	107½	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	101½	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	101	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] 1st g. 5s, [illegible]	87½	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

THE MARKET REPORT

Daily Prices of Metals

Jan.	Copper, N. Y. net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
13	12.75	33.50	38.00@38.25	4.75@5.10	4.80	5.50@5.55
14	12.75	32.00	37.00@37.25	4.75@5.10	4.80@5.00	5.50@5.55
15	12.75	32.00	37.00@37.25	4.75@5.10	4.80@5.00	5.50
17	12.75	31.00	35.75@36.00	4.75@5.10	4.80@5.00	5.50
18	12.75	30.00	34.75@35.00	4.75@5.00	4.70@5.00	5.45@5.50
19	12.75	30.00	34.75@35.00	4.75@5.00	4.80	5.45

*These prices correspond to the following quotations for copper, "delivered": 13c. for the week

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Jan.	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
13	73⅜	73⅝	81½	205	211	23¼	23⅝	26	26¾
14	73	72¾	81	200	204½	23½	24	24⅝	26
15	...								
17	72	71¾	80	191	196	23¼	23¼	24½	25¼
18	70¾	70⅝	79	186½	185½	22⅞	23¼	24	25¼
19	70¼	70⅜	79	181½	187	22⅞	23¼	24¼	25¼

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Jan.	Sterling Exchange	Silver New York, Domestic Origin	Silver New York, Foreign Origin	Silver London	Jan.	Sterling Exchange	Silver New York, Domestic Origin	Silver New York Foreign Origin	Silver London
13	372	99½	65⅞	39⅞	17	373¼	99½	66⅛	39⅞
14	373½	99½	66¾	40	18	375½	99½	66⅛	39¼
15	372	99½	67¼	40¾	19	374	99½	65½	39½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, Jan. 19, 1921

The metal markets show no change of importance over last week, although a lull in buying seems to have set in since Monday. Consumer demand is, in general, confined to deliveries within one month, although inquiries for later deliveries are beginning to come in somewhat greater volume. Sellers, however, are indifferent and prefer to take chances of an improvement in prices in the future.

Import costs, it must be remembered, could not necessarily be figured on London price plus freight to this country, for direct [illegible] from the Orient in many cases represent considerable [illegible] and freight. Freight rates from this country to France, Holland and Germany are now from $4 to $5 per ton and from Baltimore to Havre even lower rates have been quoted. To Spain, Italy and Denmark the rate is $13@$15 and to England the conference rate of $13 still applies, though it has been raised to $15 on ingot bars. From Europe to this country freights are in many cases lower. Transpacific rates are about $11.25 per ton.

Copper

Sales continue in satisfactory volume considering prevailing general business conditions; at least they did up to Saturday. Since then business has been scanty. Export demand has decreased over that of two or three weeks ago, but is still in fair volume. Prices have held steady with all interests asking about the same figure, which is the same as we mentioned last week, viz, 13c. delivered for January, and ⅛c. additional for each month beyond. The wire mills have been the chief buyers.

Lead

The A. S. & R. official price continues at 4.75c. New York and St. Louis.

Lead has continued active, although orders for large tonnages have not been in evidence. Demand for spot metal has almost entirely disappeared, but it has apparently been obtainable from one of the principal producers at all times for 4.75c. New York. Most of the business has been done for February and March delivery on a basis of 4.95@5.10c. New York, and much of this was done on Thursday, Friday and Saturday. In the last three days demand has fallen away somewhat, which has caused a slight lowering of prices. April and May lead continues at a premium of about ⅛c., but producers in general are not interested in these sales. It would seem probable that lead will continue at present prices for some weeks, as the relation of supply and demand does not indicate a decline; on the other hand comparatively large stocks in Spain and Italy, and also supplies in Belgium, Germany and England, would probably be thrown on this market if the price were only slightly higher. There would also be a possibility of Australian lead coming to this country.

Zinc

The market continues very restricted at prices below cost of production. Curtailments are still going on and it is likely that the Bartlesville smelters will shut down entirely on the first of February. Many consumers in Ohio and Pennsylvania will soon be using imported zinc, contracts for which have already been made. With European lead reaching this country, the price in New York is no higher than in St. Louis for future delivery. The market for high-grade is almost non-existent, but it can be obtained for 7@7¼c.

Tin

Demand is still poor, the price decline, originating in London, serving to scare off buyers rather than interesting them. The price range is so irregular that consumers do not care to provide for future needs, even though they know the price is low. A little electrolytic has been sold at prices which represent slight consessions over Straits. It is rumored that the Straits government has reduced the fixed price to an equivalent of £230, but we have been unable to confirm this.

Straits tin for future delivery: Jan. 13th, 38.50@38.75c.; 14th, 37.50@

37.75c.; 15th, 37.50@37.75c.; 17th, 36.50@36.75.; 18th, 35.75@36.25c.; 19th, 35.75@36.25c.

Arrivals of tin, in long tons: Jan. 11th, Australia, 100; 12th, Straits, 350; 14th, Straits, 25; China, 10; 17th, Singapore, 175.

Silver

The Indian bazaars have been buyers again during the last week, and it would appear that the chief inquiry in the market now is from this source rather than from China. The market has been dull of late, probably owing to the absence of speculative operations which had until recently been in evidence.

Mexican Dollars—Jan. 13th, 50; 14th, 50¾; 15th, 51½; 17th, 50¾; 18th, 50¾; 19th, 50.

Gold

Gold in London: Jan. 13th, 110s. 6d.; 14th, 109s. 8d.; 17th, 109s. 9d.; 18th, 108s. 9d.; 19th, 109s. 5d.

General stock of money in the United States, Jan. 1: Gold coin (including bullion in Treasury), $2,784,834,427; standard silver dollars, $269,746,326; subsidiary silver, $270,536,268; United States notes, $346,681,016; Federal Reserve notes, $3,735,719,345; Federal Reserve Bank notes, $242,164,400; National Bank notes, $723,277,222; total, $8,372,959,004. The gold coin has increased about $23,000,000 but the Federal Reserve notes are about $72,000,000 over the preceding month.

Foreign Exchange

Foreign money in general has been steady during the last week, with sterling in rather better demand. On Tuesday, Jan. 18th, francs were 6.21c.; lire, 3.50c.; and marks, 1.54c. New York funds in Montreal, 14¼ per cent premium.

Other Metals

Aluminum—List prices of 28.3@28.5c. are purely nominal.

Antimony — Chinese and Japanese brands, 5@5¼c.; market quiet. W.C.C. brand, 6¼@6½c. per lb. Cookson's "C" grade, shipment from England, 9⅝c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony[1] (200 mesh), 7@7¼c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 7c.

Bismuth—$2.40 per lb., 500-lb. lots, and $2.42 per lb., 100 lb. lots.

Cadmium—Nominal, $1.40 per lb., in 1,000 lb. lots.

Cobalt—Metal, $5 per lb.; black oxide, $3.40 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $325 per oz.

Magnesium — Crude, 99 per cent, $1.[illegible] per lb. f.o.b. Philadelphia.

Molybdenum Metal in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Ingot, 43c.; shot, 43c.; electrolytic, 45c., f.o.b. Bayonne, N. J.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $70@$80 per troy oz.

Palladium—$70@$75 per oz.

Platinum—Firm at $70@$75 per oz.

Quicksilver—Nominally $50 per 75-lb. flask. San Francisco wires $50.

[1]**Rhodium**—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 55@60c. per unit, New York. Practically no change on California chrome ore since August; 40@50 per cent can be bought at 50@60c. per unit, f.o.b. cars, California. One party has offered 800 tons of 40@45 per cent at 55c., and has been able to dispose of only 150 tons.

[1]**Manganese Ore**—38@40c. per unit, seaport; chemical ore (MnO_2) $60 per gross ton, lump; $75@80 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

[1]**Tantalum Ore**—Guaranteed minimum 60 per cent tantalic acid, 40c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¾@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

[1]**Tungsten Ore**—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3.25@$3.50, New York.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

Zirkite—According to conditions, $70@[illegible] per ton, carload lots. Pure white oxide, [illegible] per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Jan. 15.—Zinc blende, per ton, high, $[illegible]; basis 60 per cent zinc, premium, [illegible]; Prime Western, $[illegible]; fines and slimes, [illegible]; calamine, [illegible]. Average settling price, all grades of blende, $[illegible].

Lead, high, $52.50; basis 80 per cent lead, $50. Average settling price, all grades of lead, $47.90 per ton.

Shipments for the week: Blende, 7,371; lead, 891 tons. Value, all ores the week, $279,460.

Production and purchases of zinc are now near balancing, with the demand around 7,000 to 8,000 tons per week. Some of the mines operating are devoting attention to lead production and are producing very little blende. The lead market improved this week, advancing to $50 basis. Ten inches of snow Thursday handicapped hauling, yet the shipment was 1,100 over the preceding week.

Platteville, Wis., Jan. 15.—Blende, basis 60 per cent zinc, a base price of $32 was offered for high-grade blende, but producers refused to sell at this price. Shipments for the week: Zinc ore, 255; lead, 250 tons. Shipments for the year: Zinc ore, 651; lead, 360. Shipped during the week to separating plants, 878 tons blende.

Non-Metallic Minerals

Asbestos—Crude, No. 1 $2,000@$3,500; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, $23; ground (white), $45; ground (off color) $30@$32 per net ton, less than carload lots, f.o.b. New York. Crude, first grade, $10 per ton, f.o.b. cars, Missouri; floated, $28 per ton in bbls.; $26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis.

Chalk—English, extra light, 5@5½c.; light, 5@6c.; dense, 4½@5c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$12; washed, $12@$15; powdered, $18@$22; bags extra, per net ton, f.o.b. mines, Georgia; crude, $8@$12; ground, $15@$40, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $25@$35; powdered, $30@$35, f.o.b. New York.

Feldspar—Crude, $8@[illegible] per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. [illegible] $[illegible]@$23 per ton, [illegible]

Fluorspar—[illegible] 85 per cent calcium fluoride and not over 6 per cent silica, [illegible] per ton, f.o.b. Illinois [illegible] f.o.b. Kentucky; ground suitable for acid, chemical or enameling purposes, $60; lump, $15, f.o.b. Tonuco, N. M. In Canada 85 per cent calcium fluoride sells for $20 per ton, f.o.b. Madoc; output limited. Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines.

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[1] Furnished by Foote Mineral Co., Phila., Pa.

Fuller's Earth—$16 per ton, carload lots, f.o.b. New York.

Graphite—The 90 per cent crucible grade is held in Alabama for 9c. per lb. and 85 per cent grade, 7@9c. Lubricating grade commanding the best price is a fine flake, passing a 100@120 mesh, and running higher than 96 per cent carbon. Linotype machines use a flake passing 90 mesh and standing on a 120 screen, with 90 per cent carbon, retailing at 75c. to $1 per lb. and selling to jobbers at 11@40c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Dolomite, 1@2 man size, $1.60@$1.65; 2@8 in., $1.55@$1.65 per net ton, f.o.b. Plymouth Meeting, Pa.; fluxing, $1.65@$1.75 per net ton, f.o.b. Howellville, Pa.

Magnesite, Calcined — High - grade caustic calcined, lump form, $35@$40 per ton, carload lots, f.o.b. California points. In Chicago district, $57.70; Atlantic seaboard, $61@$63.

Dead - Burned — $38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 50c.; No. 5, $1.20; No. 4, $2@$3; No. 3, $3.25@$3.50; No. 2, $5.50@$7; No. 1, $8. Clear block: No. 6, 55c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $10; extra large, $25; all f.o.b. New York; ground, $60 per ton, in car lots, Philadelphia. Domestic, uncut, f.o.b. Franklin, N. C., as follows: Scrap, $45@$50 per ton; punch, 10c. per lb.; circle, 15@25c.; 1½ x 2 in., 75c.; 2 x 2 in., $1.15; 2 x 3 in., $1.65; 3 x 3 in., $2.10; 3 x 4 in., $2.50; 3 x 5 in., $2.75; 3 x 6 in., $3.75; ground 165 mesh, $150 @$170 per ton; ground roofing mica, $60; mica washers, 75c.@$2 per lb.; 1¼-in. disks, No. 1, $1.40 per lb.; No. 2, $1.25. Lower prices are obtainable on certain sizes of domestic. Cut No. 1 stove, clear and slightly stained, 1½ x 2, $2; 4 x 5, $10; 8 x 10, $30.

[1]**Monazite**—Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $13; 75 per cent, $11.50; [illegible]@74 per cent, $11; 70 per cent, $8.35; 68 per cent, $7.85; 68@66 per cent, $7.60. Finely ground Tennessee rock sells for $8.50 per net ton for 13 per cent phosphorus content, agricultural application; for acid-making, 14 per cent, $9; both prices f.o.b. Centerville, Tenn.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 16½c.; Spanish lump, 14@16c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Sand (Glass)—Dry glass sand, $4 per net ton, f.o.b. cars Mapleton, Pa. Sand, f.o.b. Ottawa, Ill., is $3 per ton; $2.50 on annual contracts. Sand at Klondike, Gray Summit and Pacific, all in Missouri, is $2.50 on contract; some outside sales have been made at $4. St. Louis, open market, at $3.50; contract price on large quantities, $2.50; on small quantities, $3.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $12@$22 per ton; roofing grades, $9.50@$15; rubber grades, $12@$18; all f.o.b. Vermont. California talc, $20@$45, talcum powder grade. Southern talc, powdered, carload lots, $12@$15 per ton; less than carload, $25, f.o.b. cars; freight to New York $5.25 per ton, carload lots; less than carload lots, $9.25. Imported, $40 @$50; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 10¾@11c. per lb.; sulphide, powdered, 15@15½c. per lb. in carload lots.

Sodium Nitrate—$2.85@$3 per cwt. ex vessel, Atlantic ports. Market quiet.

Sodium Sulphate—For 95 per cent material, $22 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract.

Potassium Sulphate—Domestic, $220 @$230 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrocarbontitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 16@17c. per lb. of chromium contained; 4 to 6 per cent carbon, 17@18c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $105@$110, f.o.b. seaboard bases; resale, $115; English, $110, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $50.50, f.o.b. furnace.

[1]**Ferromolybdenum**—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $55@$60; 50 per cent, $78@$80; 75 per cent, $140@$145.

[1]**Ferrotungsten**—Domestic, 70 to 80 per cent W, 55@60c. per lb. of contained tungsten, f.o.b. works. Foreign, 60c.

Ferro-uranium—35 to 50 per cent U, $7 per lb. of U contained, f.o.b. works.

[1]**Ferrovanadium**—Basis 30 to 40 per cent, $5.75@$6.75 per lb. of V contained, according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York list price, 21¼c. per lb.; wire, 15¾.

Lead Sheets—Full lead sheets, 8½c.; cut lead sheets, 8¾c. in quantity, mill lots.

Nickel Silver—33½c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets, 19¾c.; sheathing, 19¾c.; rods, ⅝ to 3 in., 16¾c.

Zinc Sheets—$11.50 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr_2O_3, $50@$55 per net ton, and $60 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $80 per net ton, shipping point; arches, keys, wedges, $85; splits, soaps, $100.

Fire Brick—First quality, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $45@ $50.

Magnesite Brick — 9-in. straights, $100 per net ton; 9-in. arches, wedges and keys, $105; soaps and splits, $120.

Silica Brick—9-in., per 1,000: Chicago district, $65@$70; Birmingham, Ala., $56@$61; Mount Union, Pa., $50 @$60.

Iron Trade Review

Pittsburgh, Jan. 18, 1921

The steel market continues stagnant, as to open market transactions. There is a moderate amount of buying from the Steel Corporation, by regular customers, but even such business is at a slower pace than in December. The independents are booking some business, but not much.

Pig Iron—A half dozen sales or more of foundry iron in lots of a few hundred tons each have been made at $31.50, Valley basis, or $1.50 under the previous nominal quotation. The Standard Sanitary Manufacturing Co. took at least 1,000 tons, for January-February shipment. Bessemer and basic have been altogether inactive. The market is now $31.50 for foundry, bessemer and malleable remaining at $32, and basic at $30, all f.o.b. Valley furnaces.

Semi-finished Steel—Prices are practically nominal at mill quotations of $43.50 for billets and $47 for sheet bars.

Charcoal and Coke

Charcoal—Willow, 7c. per lb. in bbls., hardwood, 5¼c. per lb., in 250-lb. bbls. Barrel charge is 35c. additional.

Connellsville—Furnace, $6.25@$7; foundry, $5@$5.50.

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

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Volume 111 New York, January 29, 1921 *Number* 5

Mining Concessions in Russia

A CORRECT appraisal of conditions in Russia and Siberia under the sway of the Soviet government is of importance to American mining men, many of whom have interests in those countries, and many others of whom would be willing to invest capital in the development of Russia's mines if they could count on anything like a fair deal and stable conditions.

For a long while the news from Soviet Russia was confused and contradictory. For the last six months, however, we have not been lacking in absolute and harmonious testimonials as to the desperate industrial and social conditions which have descended upon that unhappy country. We published some months ago the abstract of a confidential letter sent out secretly by an American in Petrograd, giving details of the appallingly swift disintegration of the symbols of prosperity and civilization. Also, we had testimony from the American Bolshevists who were deported to Russia, and there found disillusionment. Still later British socialists, or semi-socialists, like Russell and Wells, visited Russia and returned with the same story, although the latter has ruined his reputation as a thinker, after pointing out the utter industrial collapse and the abandonment of all communistic and socialistic ideals, by concluding that Russia needs some despot and that Lenine is the best in sight.

It is, however, with renewed interest that we read the summary of Russian conditions as seen by Germany, and as related by a German, our correspondent in Berlin, and published in another column. The letter is doubly interesting, in that it reflects not only Russian conditions, but the correct German appraisal of them, as transmitted from a committee of German radical leaders who recently visited Russia at the invitation of the Bolshevist government, and have returned with the verdict that the country is hopelessly ruined.

Railroads in Russia are nearly extinct, and becoming still worse. Over 80 per cent of existing engines are out of repair, and general conditions are so bad that even those passenger trains which can run can attain the speed of only four to nine miles per hour. Productivity in the still existing industrial works has shrunk unbelievably. "One works manager," says our correspondent, "states that the output per man and working day equals the output of one and one half hours of the pre-war standard." The number of industrial workers is steadily diminishing, the workers going to work in the country, where there is food, or becoming administrative officials, "of whom there exists now one for every six heads of the population!"

It is to the recognition of their utter failure by the Bolshevist leaders that our correspondent ascribes the recent decision to give concessions to foreign capital. It appears that the concession recently allotted to Washington B. Vanderlip is only one of many which the Soviet government is now willing, in its last extremity, to give. Our correspondent, however, states that "the opinion of Continental business men is so far highly unfavorable toward the scheme. Foreign capitalists and business men lured into embarking in the scheme are believed to take a heavy risk, as the Soviet government are hardly able to observe their guarantee, even if they are willing to do so."

Recent news indicates that Lenine and Trotzky are having difficulty in explaining how their latest move to invite capitalists into Russia harmonizes with their crusade for the abolishment of capital; and they are explaining it as a clever political move. Political it doubtless is, but not so clever as desperate. It seems hardly credible that the existing regime should endure in Russia much longer. In the meantime, American mining men should not stake a penny on Bolshevist promises of concessions. As the Bolshevists have repudiated all the pledges and obligations of Russia, so inevitably will the succeeding government or governments hold worthless and invalid any acts of the Bolshevists. The pledges of the Czar's government will eventually have a far better rating.

Opportunities for Copper

IN A PREVIOUS ISSUE we spoke about extending the uses of copper as one means of disposing of the large surplus stocks and suggested an investigation of the price of copper products. If a fair price can be maintained, many promising avenues of expansion can be conceived.

Where are the copper kettles of our grandmothers' kitchens? We remember hearing that they were hard to keep clean, but possibly modern varieties of household fuel would eliminate any trouble caused by setting a kettle in a smoky wood fire. They would be more resistant than aluminum to alkaline substances, and would conduct heat readily.

For roofing, copper is said to be equaled by no other metal from a structural standpoint. It is light and durable; it weathers to a most artistic green color, as witness the roof of the Cathedral of St. John the Divine here in New York. Several other New York buildings, in the construction of which the best was demanded, also have copper roofs, notably the Schwab and Carnegie homes, some of the Columbia University buildings, and several large office buildings.

Copper screens on a house will last a lifetime. An iron screen will rust out, and before we know it the early summer fly will be admitted, whose progeny we are told amounts to several billions by fall. Or ingress will be made possible for the low lived female mosquito with her (we quote Webster) long and [illegible] proboscis.

A copper hot water tank in the kitchen engenders a pride which makes us even willing to admit visitors to those sacred precincts, and also obviates the curse of rusty water in the bath tub and wash bowls. These living in mining camps or smelter towns where the water is slightly acidulated know particularly well what this means.

Copper steels should also be thoroughly investigated. Small percentages of copper added to steel have been shown to assist greatly in lengthening its life. The manufacture of copper steel we understand has been confined largely to sheet metal, but the life of these sheets has been found to be 300 to 500 per cent longer than sheets of ordinary steel exposed to atmospheric corrosion. With the vast tonnage of steel used for roofing, the subject merits early and thorough investigation on the part of the copper interests.

A possible use of copper which we have just noticed is for binding. Most magazines are fastened together with steel staples. We see, however, that *The Review* of the American Chamber of Commerce in France is secured with copper staples. Is there any advantage?

A little investigational work and advertising of the red metal should accomplish wonders. Suppose the copper interests forget about the "Surplus Stock" bogey for awhile and do some constructive thinking on widening the outlet for their product.

Buying Versus Thrift

TWO separate campaigns are now being prosecuted in the country—a campaign to buy, and a campaign to save and invest. Each of these is offered as the cause for business depression, as the remedy for unemployment, as the means for the replenishment of that liquid capital which has become scarce, and as the swiftest means toward renewed industrial prosperity.

The two campaigns are certainly opposite. The S. B. S., Start Buying Something, slogan is put out by an association composed of representatives of retailers and wholesalers. They believe that the citizen who finds himself with a hundred dollars today should buy himself a new overcoat, a hat, a shirt, and a pair of shoes—and he can do all that if he is a sharp shopper. The other campaign, carried on by bankers, says "Stop: do not spend your money; your old overcoat will do for the winter, and you can have your shoes half-soled again; put your money in the bank; or buy a Liberty bond; or, better yet, put your money into industrial bonds or securities."

Superficially, either call seems logical, and worthy; but one must be better, and the other worse. There can be no question which it is: the relative value of thrift versus free spending has been too often tested out on a national as well as a personal side. Thrift is the great gospel, as Franklin preached and the French nation has demonstrated. Thrift provides a reserve of power, and enables sane planning and easy adjustments. It moderates the inflation of prosperity, and digs down into its stocking to tide over the stagnation of adversity. It is a wonderful stabilizer for good. Again, the practice of thrift carries with it satisfaction for those who clamor "Start Buying Something." The thrifty have at all times something to spend for necessities and a trifle more. The reputation of the Jewish people for thrift and for liberal spending goes hand in hand, and is typical. The hand-to-mouth earner and spender, on the other hand, spends his all in times of easy money, and has nothing for even some of the necessities in hard times; and so is an economic unbalancer and nuisance. So much for the relative merits of ant and cricket.

It would have been far more opportune if this thrift campaign had been launched during the time of easy money. But then the producers of goods had no need for a buying campaign; and the bankers and great industrial organizations themselves were largely in the vast army of crickets. Witness the vast plants and inventories created in those flush days, to provide for future business, by concerns which now have closed down.

Editorial Selection

ONE of the duties of an editor is to pass upon contributions for publication, to accept the best and to decline the others. This is understood and approved by his readers. There is one class of contributors, however, who have special privilege, and the power of passing through closed doors—namely, the contributors who write letters criticising the editor. There is a feeling, based upon sound sentiment, that fair play demands the publication of such letters. It does: but is there not a reasonable limit? Suppose we receive, as we did this morning, a letter out of which we can make neither head nor tail, except that active exception is taken to a certain editorial and that the author considers us pro-British. May we not decline to inflict the unintelligible piece of writing on our patient readers? Some time ago we received a letter which was not only unnecessarily abusive but was full of statements that were incorrect: it was from the kind of person and was the sort of letter that one does not argue with. It did not occur to us that the writer could desire to have such a letter published; and the tone was so discourteous that we thought it best to make no personal reply. The letter was then sent by the writer to a contemporary for publication, who published it with the remark that it was at a loss to know why we had not published it—the inference apparently being that publication of anything is obligatory if it contains abuse of the editor.

We do think that fair play and sportsmanship demand that the attacking contributor be given a little more than an even chance at publicity, as compared with the editor; but it is nevertheless necessary to establish a dead line somewhere, and while allowing greater latitude in controversial literature of this kind than in any other department of the *Journal*, to require that writers of letters much make themselves intelligible and, if possible, intelligent, as well as peppy. Otherwise, we shall sometimes be unable to publish their letters, not because we are not glad of their criticism, but because our literary judgment controls, and our readers should not be offered just plain shavings for their meal.

Cheap Copper Hard on Yavapai County

NOT only the mining companies of doubtful standing and of stock-market sponsorship but some of the old reliables are having hard sledding to keep out of the poorhouse during these strenuous times. Our observation is prompted by the recent announcement that the Consolidated Arizona Smelting Co. at Humboldt has gone into the hands of a receiver; not new hands, however, for Mr. Colvocoresses, the highly esteemed general manager of the company, is to have the new title.

This company was organized in 1906, passed into bankruptcy soon after, and was sold for $200,000 and the assumption of mortgages aggregating $600,000. Its record at that time was very unsavory. Those interested in it included Thomas W. Lawson and Charles W. Morse. In more recent years, however, it has been soundly managed and intelligently operated, so that its present difficulties are by no means caused by the factors so much in evidence in the earlier days. Copper had to go to 30c. before this company paid its first dividend in 1917, and payments were suspended at the close of the war, after paying a total of 30c. per share. However, considerable money was applied toward modernizing the plant, the smelter being now in excellent condition.

The Consolidated Arizona Smelting Co. is what may be termed a high-cost producer. Its own ores do not furnish a desirable smelting mixture and, owing to their hardness, are difficult to mill. With copper below 20c., as it seems likely to be for some time, the custom business will be small. The outlook for 1921 is not encouraging.

It is unfortunate that the mining district about Prescott cannot enjoy more prosperous conditions. More than a mile high, and wooded, the climate and country are much more attractive than the hot desert lands in the southern part of the state. The country is rich in prospects but poor in real mines.

Lenine Calls Vanderlip a Jackal

FURTHER illuminating remarks by Lenine concerning the famous concession to Washington B. Vanderlip are contained in recent dispatches. Lenine is having a hard time explaining to the Communist party. The Bolshevik Premier, in a speech which is published in full in the *Pravda*, the official organ of the Bolshevik party, said that one of the objects of Soviet foreign policy is to sow still greater discord among the Allies.

"This discord has increased considerably," he added, "as a result of the project for the conclusion of a trade agreement with a group of American capitalist jackals of the most savage kind, headed by a multimillionaire who plans to round up about him a group of other multimillionaires." He observed that the Vanderlip concessions were capable of rousing discord between the United States on one side and France and England on the other. He was apparently under the impression that Vanderlip represented American capital in general, and that, therefore, American capital would be able to force the Washington Government into trade relations with Russia, or even a recognition of the Soviet government.

Ah, foxy Lenineski!

Fuel Oil and Industrial Development in California

IN AN address presented some time since to the Commonwealth Club of San Francisco, D. M. Folsom discussed in an illuminating way the fuel-oil situation in relation to industrial development. He pointed out the inability of the California petroleum industry to meet the ever increasing demand for fuel oil. Out of 100 units of oil production, he stated that 75 units were available for fuel oil, whereas the rate of consumption approximated 85 units. Mr. Folsom said:

"This is no artificial shortage which confronts the community. It is actual and immediate. There is more drilling in the state than ever before. Every possible effort is being made, both to maintain production and to find new fields. There is only a limited area in California which has even a possibility for oil, and each month sees some portion of that area tested and condemned by the failure of wildcat wells. We have been forced to draw heavily on our resources for our current needs. We cannot continue to burn more oil than we produce. There is only one answer to this situation—someone who is burning oil today will have to use another source of energy tomorrow."

Priority restrictions are, in Mr. Folsom's judgment, impracticable, although they have operated to the extent of compelling oil users such as copper-smelting plants operating reverberatories to install coal-dust firing in place of oil. Mr. Folsom offered two remedial solutions: One was the substitution of internal-combustion engines for steam plants. He stated that in such a plant one barrel of oil would do the work of three in a steam-power plant of equivalent capacity. The other was the further development of hydro-electric power. Continuing, he said that we have been too anxious to get our power cheaply and that fuel oil has been so cheap that we have not realized its value.

California has had cheap power both from fuel oil and from hydro-electric plants. The situation as presented by Mr. Folsom is of interest to the mining industry of the Western States, in that it indicates that power costs may be expected to increase rather than diminish in the future. Under date of Jan. 1, 1920, there was a total of 942,000 hp. in hydro-electric plants in California, and for the year 1920 the new construction approximated 243,000 hp. Hydro-electric development is estimated to cost $200 per kw. for dams, ditches, pipe lines, waterwheels, transformers, and line switches. Power lines and distribution costs add another $200 per kw. A steam plant of first-class construction for central power distribution costs $200 per kw., not including transmission line distribution. A Diesel engine plant will probably cost not far from $175 to $200 per kw. The construction of such plants is predicated on a comparatively stable market for the power produced. This fact and the relatively large capital investment required mean that delivered power is going to be high as compared with power costs when hydro-electric power companies had surplus power and were anxious to market it. Industrial competition for power operates like demand for any other commodity.

Hitherto the mining industry had the alternative of either developing its own hydro-electric plant where conditions were favorable or installing a steam plant with crude oil as a fuel. Many reverberatory copper smelting units found in fuel oil a cheap source of power, but the increased cost of this fuel and its scarcity will put some of these smelting plants to the necessity of finding new fuels. Some small mining plants operating semi-Diesel units and distillate engines are finding difficulty in getting supplies of gas oil and the lighter oils that they have been accustomed to use. They are paying higher prices and cannot secure time contracts, without which their power costs will be uncertain and dependent solely upon market conditions.

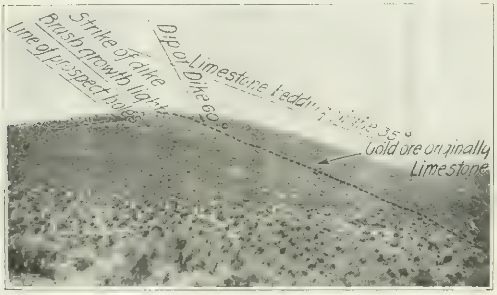
For the mine so situated that it can be served by existing central power plants, higher power charges can best be met by a more efficient use of power. This would necessarily entail a thorough study of the power utilization scheme at a given plant. The elimination of unnecessary motors, the substitution of proper size for oversize motors, and the use of counterbalanced hoisting wherever practicable are some of the things that can be done. The mine outside of the electrical power areas and situated where fuel costs are high represents a difficult problem, and there appears to be no escape from high power costs.

WHAT OTHERS THINK

Botany Applied to Mining

An article by F. M. Wichman on "Botany Applied to Mining" in the *Engineering and Mining Journal* of Dec. 11 attracted my attention.

I am forwarding a photograph (see accompanying cut) which I have marked to show a line of distinct division, as between the vegetation that exists in the different rocks as mentioned. I had taken this view a few years ago, just after the discovery of the mines of the Buffalo Valley Mines Co., sixteen miles south of Valmy, Nev., a station on the line of the Southern Pacific R.R. At that time the country was in its virgin state. The photograph barely shows a few shallow cuts on the surface defining the outline of an aplite dike. On either side of this dike, the brush will be observed to grow much more abundantly. The prospecting that was done at the time proved the mineral-bearing ground to be confined, almost to the point of precision, to the territory outlined by the ground bearing the heavier growth of the native brush *(artemesia)*, the common sagebrush of the desert region of Nevada.


Strike of dike
Brush growth light
Line of prospect holes
Dip of Limestone bedding plane 35°
Dike 60°
Gold ore originally Limestone

At the extreme top portion of the hill, the dike is covered by a part of the ore-bearing rock, an altered limestone. The irregular dotted line marks this. All of that portion of the hill from the dotted line to the surface, and pitching into the valley, is a highly metamorphosed limestone, which had received the gold-bearing solutions emanating from the dike and become altered therefrom, in greater part, into a low-grade siliceous gold-bearing ore. When the dike had intruded itself into the sedimentaries, which are very thick apparently, it was doubtless thrown out of its course in ascending to the surface, and deflected, by the various bedding planes forming the several series of sedimentary rocks, to some extent.

A small portion of the particular strata of limestone forming the orebody was thus separated from the main body, a small segment of which is shown on the opposite side of the dike, where it is also noted that the growth of brush is quite heavy as compared with that along the strike of the dike. The dike has eroded at a somewhat faster rate than the adjacent harder silicified limestone, which possibly may account for the brush not being able to fix itself so firmly as in the limestone altered area. This occurred in spite of the fact that the dike contained more plant food than the sedimentary rock, and, altered as it was to a silicified hard rock, was of a softer consistency, as the dike rock at the extreme surface was somewhat decomposed.

The brush along the strike of the dike and on top thereof was somewhat smaller as well as being less dense than elsewhere, giving the impression that, although it seemed to thrive well, its life was cut rather short because of the decomposing of the dike. Likewise, it would also appear that the scattering seeds of the brush would find it difficult to secure root in the ground, due to the work of the decomposition of the rock of the dike, and only succeeded now and then in the most favorable spots along the dike. It need hardly be pointed out that this is of much importance to the miner in determining, in advance of development, the course and extent of his mineral deposit. JOHN T. REID.

Lovelock, Nev.

The Interpretation of Geology

Many thanks for your editorial, in the Jan. 8 issue of *Engineering and Mining Journal*, entitled "The Interpretation of Geology." Don't let the matter drop with the writing of this one editorial; keep hammering at it until the idea is driven home.

It is a mistake to suppose that people in general are not interested in scientific truth; it is equally a mistake to suppose them incapable of understanding. It is the greatest mistake of all to assume that they are not entitled to everything that can be in any way made plain to them. And it is most unfortunate that the passing on of the truth is, in largest measure, left to clever writers who know, for the most part, only by hearsay.

It is hardly too much to say that there is no such thing as a "popular" book on geology. Such a book must be very readable; not exhaustive, but scrupulously in accord with the best geologic opinion. Controversial matters would be out of place in such a work.

Some of the simple truths about the rocks should certainly be taught in school as early as possible. Your statement that geology is not taught below the colleges is hardly accurate, as fairly good elementary courses are given in many of the high schools of the country.

The trouble with our high school and college freshman courses in geology, and also in other sciences, seems to be that they are not given for the right purpose. Such courses are commonly given with the object either of enabling students to pass examinations or of preparing them to undertake more advanced work in the same subjects. The chief aim of all our elementary science work should be to get as many of our young people as possible to take a live and intelligent interest in their natural surroundings.

Shaler, "Uncle Nat" of blessed memory, saw this more clearly than any other teacher with whom I have had the fortune, good or bad, to come in contact. Would that there were more like him today!

Augusta, Me. FREEMAN F. BURR

Exercising the Right of the Gold Miner

In a letter "In Opposition to the McFadden Bill," printed in your issue of Dec. 25, W. de L. Benedict goes out of his way to refer to certain resolutions which I presented to the recent Gold Conference in Denver; and which I subsequently withdrew, at the urgent request of the secretary of the American Mining Congress, who feared that their adoption at this time might tend to endanger the passage of the McFadden Bill.

Mr. Benedict writes: "It is to be regretted that persons like the foregoing 'proposer' do not take the trouble to study the subject sufficiently to inform themselves correctly regarding present conditions, before advocating measures for relief."

Perhaps, if I were disposed to emulate Mr. Benedict in a mere matter of manners, I might express regret that persons like himself should not take the trouble to read a few lines further before rushing into print. I presume that few of your readers will require my assurance that I am aware (perhaps quite as completely aware as is Mr. Benedict) that the law provides for the free coinage of gold, and that when we deposit gold bullion at the mint we are entitled to demand gold coin in exchange for it, and to use this gold coin for such payments as we have occasion to make.

The point which Mr. Benedict overlooks is that we are not doing it now, and that the gold is not being coined. When a very large producer of gold, like the Portland mine, recently asked through its banker for a minute percentage of its own product in the form of gold coin to distribute among its employees at Christmas, it was unable to obtain it. When we deposit gold bullion in the mint, we actually receive, not gold coin, but an order on the national Treasury, which is ultimately paid in the form of Federal Reserve Bank notes. The actual gold is refined, cast into bars, and either used as a basis for currency or sold to the jewelry trade in exchange for the gold certificates which the rest of us are unable to get hold of. While, therefore, free coinage of gold is theoretically in existence, it is not being practiced at this time. My proposal was, essentially, that producers should exercise their rights of having their gold coined and placed into circulation.

Precisely what effect it would have if domestic gold producers did take steps to place the gold produced by their mines into circulation as coin, and how long it would stay in circulation before finding its way back to the banks, are points which are open to question, and on which Mr. Benedict's opinion might be helpful. I think myself that it would require a campaign of education, even in the West, to keep gold in circulation to the same extent as in pre-war times, and also that a considerable percentage would not return to the banks. The main difficulty in carrying out these proposals is the financial domination of the Reserve Banks, and the pressure that they would exercise on any producers who had the temerity to use their undoubted rights. It is possible that, without the co-operation of the local banks, the gold would drift back to the Reserve Banks in a short time. It would, however, seem that the very fact that the Reserve Banks place such obstacles in the way of lending gold to the people who produce it indicates that the disposable surplus of our gold reserve is very small, and that withdrawal for circulation by the actual producers of the domestic production, even if effective for only a brief period, might compel reconsideration of what, in the opinion of many of us, is a short-sighted and dangerous policy, which must inevitably fail in the end, bringing evils to our financial stability which may be of the utmost gravity.

In the same letter Mr. Benedict quotes from the report of the Strauss Committee, appointed just after the armistice, to consider the gold situation. It is now nearly two years since the committee reported, and the course of events has already disproved the assumptions on which its report was based. The committee made a bad guess in respect of the length of time that would be necessary before prices could return to a normal basis, and quite overlooked the fact that, after such a lapse of time, gold producers would not be in a position to "respond automatically to normal stimuli" (as they expressed it) in time to be of service.

It does not seem to be generally realized, by those who uphold the gold standard, that gold production, not merely in the United States but all over the world, is rapidly falling to a level which will with difficulty sustain it; and that it will be impossible within a reasonable time to stimulate production, however great the need, after the individual mines from which it is to be derived have closed down. The maintenance of a healthy gold-mining industry should be regarded as a necessary safeguard to the maintenance of the gold standard: or perhaps as a cheap form of insurance against conditions which may disturb it. GEORGE E. COLLINS.

Denver, Col.

Quoting Mr. Clemens on the Apex Law

I have been greatly interested in the various letters, editorials, and articles that have appeared from time to time in the *Engineering and Mining Journal* in connection with the apex law problems that have for so long vexed the minds and disturbed the dreams of our friends in the mining industry in certain of the Western states.

Viewing the matter from this safe distance, and having no immediate interest in the outcome, I am irresistibly demanded of Mark Twain's remark to the effect that the opinions of wise men are worth exactly as much as the opinions of fools, and no more; for the simple reason that for every wise man's opinion on a given subject there is another wise man's opinion exactly to the contrary; and for every fool's opinion there may be found the opposite opinion of another fool. When equals are substracted from equals, the remainders are equal. Q. E. D.

All of which goes to show the fallacy of a system which permits the employment of experts, either wise men or fools, to testify on both sides of a case.

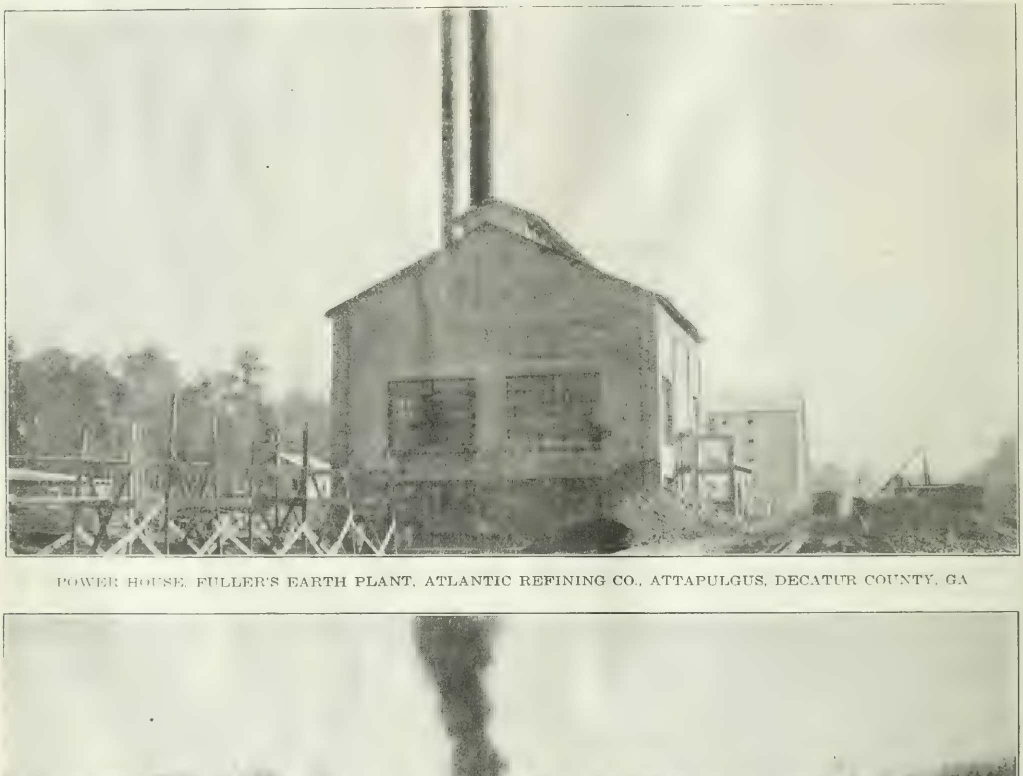
Augusta, Me. FREEMAN F. BURR

Repairing Ladles at Garfield

I note in *Engineering and Mining Journal* of Dec. 25, 1920, a description of the method used at the plant of the British American Nickel Corporation for patching holes in steel ladles by means of thermit welding. Similar work has been done at the Garfield Smelting Co.'s plant in repairing spouts on converter ladles, etc. In all such repairs the repair piece or insert was a steel casting instead of a forging. A large number of ladles have been put into serviceable condition at moderate cost. [illegible] L. STEWART.

Salt Lake City.

Mining Fuller's Earth in Georgia



POWER HOUSE, FULLER'S EARTH PLANT, ATLANTIC REFINING CO., ATTAPULGUS, DECATUR COUNTY, GA

STEAM SHOVEL MINING FULLER'S EARTH, ATLANTIC REFINING CO., ATTAPULGUS, DECATUR COUNTY, GA

Fuller's earth is employed chiefly in the refining of petroleum and vegetable oils, in which operation it is used as a decolorizing, clarifying, and bleaching agent. The industry has grown rapidly, and whereas ten years ago about 32,000 tons were produced annually in the United States production last year is estimated at about three times this rate. At the same time that domestic production has grown, the imports of fuller's earth have declined, indicating that increasing reliance is being placed upon domestic supplies. Florida has first place as a producing state, followed by Georgia and Texas. The two illustrations show the large establishment which a Georgia producer has built for the preparation of fuller's earth, and a common method of mining with steam shovel.

The Non-Metallic Mineral Industries Of the United States*

Comparatively Little Attention Paid to These Important Resources, Which Generally Require Intelligent Engineering Guidance and the Introduction of Efficient Methods of Mining, Milling, and Marketing

By Raymond B. Ladoo†

Written for Engineering and Mining Journal

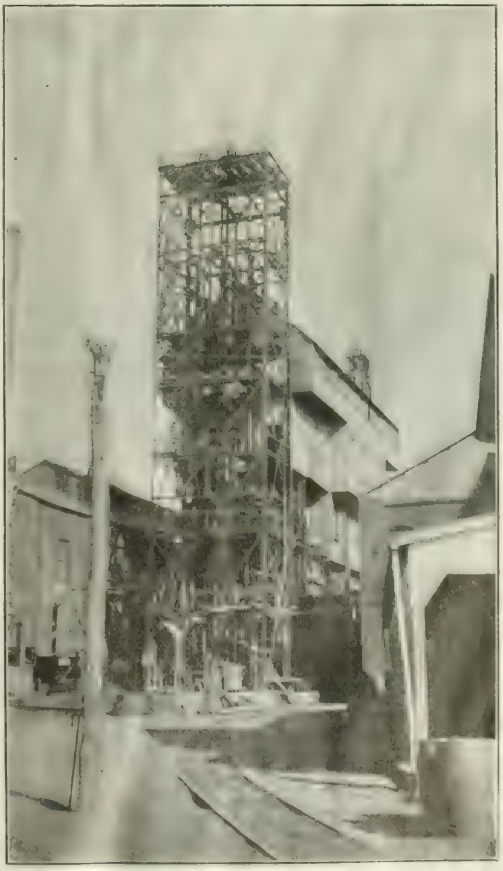
LACK of coherence and united effort in the inorganic non-metallic mineral industries, as compared with the methods adopted in the mining of the metals, coal, and petroleum, has allowed this important group of minerals to remain in comparative obscurity. During the war attention was temporarily drawn to certain essential minerals, formerly imported in large quantities, such as graphite and magnesite, but the relative importance of the whole group has not been generally appreciated.

Producers of most of the non-metallic minerals and mineral products have not considered themselves part of the mining industry. On the other hand, few mining engineers have any real knowledge of this field. Mining schools and colleges pay little or no attention to the non-metallics. But their mining and treatment are as truly a part of real mining and metallurgy as the mining and the subsequent treatment of copper, lead and zinc.

"Metallurgy" of Non-Metallics

The manufacture of lime from limestone, of cement from limestone and clay, of glass from glass sand, involves the use of many machines and processes common to metallurgy and really constitutes the "metallurgy" of the non-metallics. The mining of fluorspar or limestone underground may follow the same methods as the mining of copper or coal; the open-pit mining of phosphate rock or clay is closely comparable to the open-pit mining of iron; the dredging of sand and gravel for road making or building purposes is almost identical with the dredging of gold-bearing sand and gravel. The washing and sizing of sand and gravel on a large scale constitutes an "ore"-dressing problem of magnitude. Some of the mills used in producing crushed stone for the building industry have a larger capacity in tons per day than any except a few ore-dressing plants. Indeed, in the mining of bauxite the mining of the metallics and the non-metallics meet and merge, for bauxite may be used as an ore of aluminum or as an abrasive or refractory. But despite this very close connection there is available very little literature dealing with the engineering, technical, and commercial phases of the non-metallics, exceedingly few mining engineers are conversant with the problems in this field, and great wastes and inefficiencies are to be noted in the operation of mines and mills. Of course this does not apply to all phases of all the non-metallics, for in certain industries mechanical and chemical control is excellent; but there are many mills which are very good mechanically and very poor metallurgically.

Though there is probably a larger proportion of small companies in the non-metallic mineral industries than in the metallic mineral industries, many large and important companies are engaged in operations in this field. But even the large companies often use as poor mining and milling methods as the smaller operations. Some very large companies have found from experience that "practical" managers do not pay. Often management of this type can show good results for several years, but ultimately engineering management is necessary and the rehabilitation of the property may be very expensive.



HEADFRAME AND PART OF MILL, ROSICLARE LEAD & FLUORSPAR MINING CO., ROSICLARE, ILL.

Some idea of the importance of this group of minerals may be obtained by a consideration of the number of products included and the annual value of such products. The most important non-metallic minerals and mineral products are as follows:

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*Published by permission of the Director of the U. S. Bureau of Mines.

†Mineral Technologist, U. S. Bureau of Mines.

Abrasive materials
Asbestos
Asphalt
Barytes, strontium, and lithium minerals
Bauxite
Cement materials
Chalk
Clay and clay products
Dolomite
Feldspar
Fluorspar
Fuller's earth
Glass sand and glass
Graphite
Gypsum
Lime
Magnesite
Mica
Mineral pigments
Phosphate rock
Potash salts
Salts and salines
Sand and gravel
Sand-lime brick
Silica
Slate
Sodium salts
Stone
Talc and soapstone

The number of minerals actually used is much greater than would appear from the above tabulation, for mineral pigments include ocher, umber, sienna, mortar colors, and metallic paints. Stone includes marble, granite, sandstone, limestone, and other building stones. The annual value of the above products produced or imported for consumption into the United States now lies somewhere between $800,000,000 and $850,000,000. Another tabulation in round numbers for the year 1916, in which are not included all of the inorganic non-metallics given in the above list, is given below:

GYPSUM QUARRY NEAR MOUND HORSE, NEV

ANNUAL PRODUCTION OF U. S. IN 1916

Inorganic non-metallics		$534,000,000
Organic non-metallics	$1,318,600,000	
Metals	1,661,400,000	2,980,000,000
Total		$3,514,000,000

From this it appears that the value of the non-metallics was about 15.2 per cent of the total, the fuels 37.5 per cent and the metals 47.3 per cent; or the ratio of importance was as 1.0 to 2.5 to 3.1. Expressed as totals, the ratio of value of the non-metallics to the value of all other mineral products is as 1.0 is to 5.6. This, of course, is only an approximate figure, but it serves to show the relative importance of this group. If non-metallic mineral products, such as glass from glass sand, were included in the above tabulation, which gives values of the metals and not the ores, the non-metallics would represent a far greater sum.

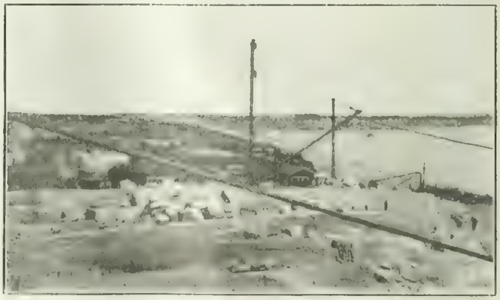
Assuming that the ratio of 1 to 5.6 is fair, it would be only reasonable to expect that mining literature should be found in a comparable ratio, that our mining schools should devote a reasonable part of their attention to the non-metallics, and that consulting engineers familiar with this field should be fairly plentiful; but none of these reasonable expectations coincide with actual conditions. As a matter of fact, the literature of the non-metallics is very meager and is mostly geological rather than technological. The ratio as evidenced by literature would seem to be nearer 1 to 50 than 1 to 5.6. A brief examination of a few volumes of the Transactions of the American Institute of Mining and Metallurgical Engineers gave ample evidence of the fact that the ratio of 1 to 50 is conservative.

QUARRYING TRIPOLI NEAR SENECA, MO

As a result of the lack of engineering knowledge and absence of the application of the best methods of business, the mining of the non-metallics has often been wasteful, inefficient, uneconomical, and unsafe. In many operations the cream has been skimmed from the country's deposits, leaving them in a condition which will make further recovery expensive or impossible. Already, the country's apparent reserves of some minerals, which were considered inexhaustible a few years ago, are so low as to cause concern.

Another illustration of the importance of the non-metallics which may be of significance to metal-mining engineers is the fact that the annual value of inorganic non-metallic mineral products (exclusive of coal, oil and gas) of the State of Pennsylvania alone in 1917 was greater than the total value of *all* mineral products, including petroleum, from such old mining states as Utah, Missouri, Colorado, Texas, Nevada and Idaho.

The non-metallic minerals are of as great importance in our daily life as are the metals, for they form the basis of our chemical and building industries and they include the raw materials used in the construction of our pavements and highways, docks, breakwaters, dams, bridges, and other structures relating to land and water transportation. In fact, few of our metals could be produced without non-metallic mineral refractories or electrodes.



GRANITE QUARRY, CROTCH ISLAND, MAINE

Agriculture is dependent for fertilizers upon phosphate rock, lime, gypsum, potash, nitrates and other non-metallic minerals and mineral products.

DISTRIBUTION OF PRODUCTION AND CONSUMPTION

Mining men hold a rather general impression that the most important producing states in the non-metallic field are the old Southern States of Georgia, Florida, Tennessee, the Carolinas, Kentucky and others, but the actual facts show quite a different situation. The chart (Fig. 1), plotted from totals recalculated from figures published by the U. S. Geological Survey, shows the actual distribution of production for the first thirty-eight states. From this chart it will be noted that the first ten states include none of the Southern States and that Vermont and Massachusetts stand ahead of Alabama and the Carolinas. As clay products, such as brick and tile, chinaware and porcelain, are included in the totals in Fig. 1, and the propriety of such inclusion for this purpose might be questioned, a second chart (Fig. 2) has been prepared omitting both clay and clay products. Though this omission flattens the curve somewhat at its upper end, and causes a few readjustments, the order in the main is relatively little changed.

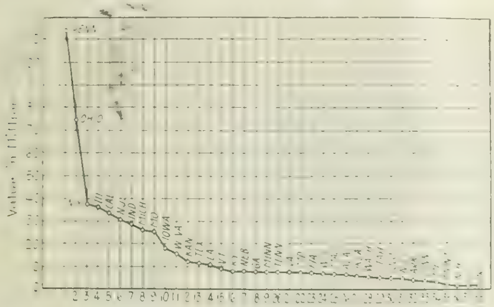


FIG. 1. VALUE OF INORGANIC NON-METALLIC MINERAL PRODUCTION OF U. S. IN 1917

Another fact well illustrated by these charts is that there are many states not ordinarily considered mining states which are really of considerable importance in the mining industry. Many of them have no mining laws, and inadequate attention to safety in mines, quarries and mills is often noted.

Though there are probably large deposits of non-metallic minerals in many of the Western States, production from this section of the country has not been large. This is due to several causes. One is that some of the materials in this group, such as sand and gravel, low-grade clays, and cement materials, have a small unit value and a wide distribution, so that [illegible] is localized and corresponds roughly to the distribution of large centers of population. A second [illegible] is that Western prospectors are not as familiar with barytes, asbestos, talc, and fluorspar as they are with the metallic ores. No romantic glamour [illegible] the discovery of an asbestos deposit as in the discovery of a gold or silver deposit. All the non-metallics are often thought of as low grade. Ground talc [illegible] per ton and gravel fluorspar at $25 per ton [illegible] to be scorned. As the population of the Western States increases and manufacturing industries [illegible] the non-metallics will become better known and production in the West is sure to increase.

The industries which consume the non-metallic minerals may also be divided into two groups. As has been previously shown, such low-priced materials as sand and gravel and brick clay must be used close to their source, and consumption is largely in proportion to population. Such materials as lime, cement, and gypsum may have a wider range of sale, and they merge into the second group in which are minerals so relatively scarce that centers of consumption bear little relation to centers of production. For example, mica is mined, in the United States, chiefly in North Carolina, but most of it is used in the large cities of the northeastern part of the country, where electrical equipment, gas lamp chimneys, wall paper, and lubricants are made. As most of the higher-grade non-metallics are used in the chemical and manufacturing industries, the centers of consumption naturally lie in the large manufacturing cities east of the Mississippi and north of Virginia.

The geographical relations which exist between producing and consuming centers of some non-metallics result in some interesting situations which are not found in the metals. For example, talc is used largely as a filler in paper in competition with English clay. Competition is possible both on the basis of price and on that of results obtained. It so happens that the country's largest talc deposits are in the states of Vermont and New York, and within a comparatively short distance of some of the largest paper mills in the country. If these deposits were in Colorado instead of in the East, talc probably could not compete with English clay, and the talc production of the United States would be but a small fraction of its present size. The fact that some of the largest domestic manufacturing centers lie comparatively close to the Atlantic seaboard makes many of the country's non-metallic minerals particularly susceptible to completion with imported materials. Thus, without a protective tariff it is claimed that barytes from Georgia cannot compete in eastern markets with barytes imported from Europe, but as a part of the barytes mined in Missouri is not dependent upon eastern markets, Missouri producers are not as interested in a tariff. Before the war, domestic fluorspar mined in Illinois and Kentucky could not compete with imported spar east of Pittsburgh. The whole question of the relation between producing and consuming centers and the part which imports play is one which has not received sufficient attention by either producers or consumers.

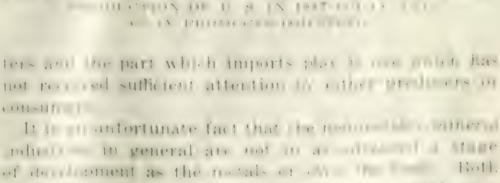


FIG. 2. VALUE OF INORGANIC NON-METALLIC MINERAL PRODUCTION OF U. S. IN 1917, [illegible]

It is an unfortunate fact that the non-metallic mineral industries in general are not in as advanced a stage of development as the metals or even the fuels. Both of the latter groups of industries have emerged, to a large extent, from the disorganized, inefficient stage which is now occupied by many of the non-metallics.

The large companies or syndicates which control most of the metal mines of the country are highly organized, provided with ample capital, and realize the economy of employing efficient technical talent and using efficient methods and machines. But in the non-metallic field the engineer is continually astonished at the lack of even elementary knowledge of technical and business principles exhibited by fairly large producers. One company interested in several different non-metallics and operating several mines and mills has never employed a geologist, a surveyor, a mining engineer or a chemist. Another large company operating four or five mines and as many mills, representing a large capital investment, had never, until a few months ago, had a mine map made, and had not heard of a flow sheet of a mill.

DAISY MINE HEADFRAME, ROSICLARE LEAD & FLUORSPAR MINING CO., ROSICLARE, ILL.

Many of the non-metallics are distributed largely by jobbers, and this situation has a bad effect on both producers and consumers. In such cases producers receive little for their products, and, as they usually are not familiar with the consuming industries, they cannot prepare their materials most advantageously for the intended use. This often results in haphazard mining, skimming the cream, and leaving the lower-grade material in such a condition that later recovery is difficult and expensive. In some operations this lower-grade material could be used advantageously by the consuming industries; in others the high- and low-grade ore could be mined together and a marketable grade made by concentration; in still other cases the low-grade material could be stockpiled, separately from the waste, to be later concentrated when market conditions warranted.

An example of another result of the lack of close contact between producer and consumer is afforded by the following incident: A manufacturer of enameled kitchenware formerly used imported clay, but during the war his supplies were cut off and he was forced to use domestic clay. After many tests one clay was found which was superior to the imported clay, and an order was placed. On receipt of the shipment part of the clay corresponded to the sample and part was entirely unsuitable, but, as no other clay was available, it was necessary to place subsequent orders for the same material; but shipments continued to be very ununiform, causing much loss and annoyance. Eventually it was discovered that the good clay occurred as a separate and distinct bed which could be mined and shipped separately. When the producer fully understood the consumer's requirements shipments of high-grade, uniform material resulted. This example is typical of conditions in the high-grade clay industry.

Crude feldspar now sells for $7.50 to $14 per ton (average probably about $9) and ground feldspar for $17 to $30 per ton. Much of the feldspar from North Carolina is produced by farmers and shipped in crude form to companies which grind and market it. Only high-grade spar will stand high freight charges, and the lower-grade spar is put on the waste dump. There can be little profit in selling crude spar at $8 or $9 per ton; but, after adding the cost of grinding and freight, the present sale price should allow an exceedingly liberal profit. The miner who has no mill is thus at a great disadvantage and can hardly be blamed for saving only the best and most easily obtained material. This situation is gradually being remedied by the erection of grinding mills at or near the mines by companies which are also mine owners.

Another phase of the non-metallics is that of milling. Milling or concentration in the metallics is usually done to free an ore from its impurities and produce a concentrate which is later smelted or treated to yield a finished product. In the non-metallics, milling alone often must produce a finished product. In other words, the chemical properties of the non-metallics are often unaltered from the mine to the finished product. In metallic ore concentration differences in specific gravity may be used to effect separations; but in the non-metallics many valuable minerals have specific gravities very close to those of the impurities. Thus, talc, calcite, quartz, and feldspar differ little in specific gravity. It would seem reasonable to suppose that special types of machines would have been evolved for the non-metallics. This is true to a certain extent, but too little attention has been given this subject, and too often machines used in metallic ore dressing have to be used, though inefficiently, for the non-metallics. Probably the most common process used in the non-metallics that is not largely used in the metallics is dry grinding and air separation. In the milling of asbestos special fiberizing machinery is used. In the milling of fluorspar at a mine in Canada the property of mineral decrepitation is utilized. Fluorspar mixed with gangue is gently heated to the point at which it decrepitates or flies apart. The gangue minerals at this temperature are unaffected, and a separation is made by screening.

IMPORTS AND EXPORTS NOT OF MUCH GENERAL INFLUENCE

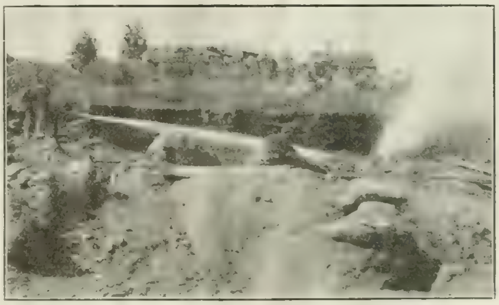
Generally speaking, the non-metallics with a low unit value are not affected by imports or exports except near large Atlantic ports. At Atlantic ports imported low-grade material often comes in from European ports as ballast and competes successfully with domestic products. An interesting example of this was afforded a year or so ago when imported sand and gravel could be bought in New York City cheaper than domestic. A short distance away from the coast, railway freight costs became so great that competition of this nature is impossible.

Before the war, European production costs and water freights were so low that many domestic non-metallic products could not compete with imported material in the Eastern States. Where the chief centers of consumption of such materials were in the East, domestic products had difficulty in competing. Examples of this condition were barytes and barium compounds, fluorspar, magnesite, and high-grade talc. During the war imports of all of these products were cut off, and domestic production increased greatly. Since the war, imports in all cases have not yet returned to their pre-war status, but domestic freights have increased and water freights are decreasing. Domestic producers of several non-metallics feel that unless a protective tariff is imposed they will not be able eventually to compete with imported material.

Another class of non-metallics comprises that in which are such minerals as asbestos and high-grade lump crystalline graphite. These minerals the United States does not possess either in sufficient abundance or of sufficient quality to satisfy the needs of the country, and they must be imported regardless of cost or of tariff. Domestic substitutes may be developed for some of these minerals, but the country's industries will probably always have to import large quantities of some materials, for example spinning fiber asbestos.

Many non-metallic minerals are now being mined in Canada and shipped into the United States, and Canadian production of many materials can be largely expanded. But imports from Canada must be considered on a different basis from imports from Europe, Africa, Asia, or South America. Labor costs in Canada are about the same as in this country, business conditions are similar, and most material must be shipped by land freight at rates about the same as in the United States. Thus, exclusive of a tariff, competition is on an equal footing; engineering ability and business sagacity are the deciding factors. Furthermore, many deposits in Canada are being worked by capital from the United States, and almost the entire output is shipped to this country. The United States even exports to Canada some non-metallic minerals and mineral products which are or could be produced in Canada.

Our hold on Canadian trade, and the possibility of competition both with Canada and with other countries, aside from tariff possibilities, rests upon our efficiency of production as measured by production costs, uniformity and high quality of products, and extension of markets and uses. More research work must be done, capital must be provided for consolidation of present enterprises and for larger-scale operations, and the need for engineering talent and business ability must be recognized. If our domestic resources cannot be utilized wisely, is it desirable to deplete our reserves by the exclusion of foreign products? Our present shortage of petroleum shows the folly of rapidly depleting our resources for immediate gain. Ultimately we may become dependent upon imports anyway.



HYDRAULIC STRIPPING OF BEDFORD LIMESTONE, BEDFORD, IND

METHODS OF MINING AND MILLING REQUIRE CAREFUL PLANNING

Methods of mining and milling some non-metallics closely resemble those used in metal mining, and in others methods wholly different are applied. In general, though, mining processes and those of recovery are not so carefully worked out and are not so efficient. For example, in one non-metallic mineral industry most of the ore is obtained by underground mining, but in only one or two mines is a real mining method used. In some of the other mines practically all the ore is taken in large development openings. In other operations the mines are merely irregular holes in the ground from which the best ore is removed as encountered.

The quarrying of limestone for cement manufacture, for lime, agricultural limestone and blast-furnace flux, and the quarrying of road materials, railroad ballast and concrete aggregate, often closely resemble the open-pit mining of copper or iron ore. But in the quarrying of building stones such as marble, limestone, sandstone, and granite special methods and machines are used which find no counterpart in metal mining. Here large blocks of stone must be removed from the ground intact, and most of the quarrying is done in the open, though actual underground mines are operated for dimension stone.

In marble and limestone quarrying channeling machines are used to cut out large blocks. In some marble quarries huge blocks are cut out by sawing with a moving wire fed with sharp sand as an abrasive. Granite is removed in blocks by taking advantage of joint planes, and wedging off great slabs with "plugs and feathers." Occasionally machines borrowed from other industries are used successfully. Thus, coal-cutting machines have been used in quarrying limestone for cement manufacture. The "milling" of these materials consists of sawing or splitting the large blocks to exact dimensions and the surfacing, grinding, tooling, turning or polishing of the blocks to give the desired finish.

The mining of sulphur by melting with water under pressure at the temperature of superheated steam, and pumping the molten brimstone to the surface, and the mining of salt by solution and pumping, find no counterpart in metal mining. But the recovery of sand and gravel by dredging and the mining of sand by hydraulicking and sluicing closely resemble methods of placer gold mining. The methods of mining and milling of fluorspar in some districts are almost identical with metal-mining processes, for shrinkage stoping is used and the mills employ picking belts, jigs, and Wilfley tables.

Many of the non-metallics find their principal uses in finely pulverized form. Thus barytes, cement, chalk (whiting), clay (chinaware and paper clay), feldspar, fluorspar (except gravel spar), fuller's earth, gypsum, limestone (agricultural and other), mineral pigments, mineral fillers, phosphate rock (raw), diatomaceous earth, tripoli, and talc are all marketed either wholly or in part in ground form. For this reason methods of dry grinding with fine screening or air separation and wet grinding with water classification are used in the milling of most non-metallic minerals. Air separation is probably the most useful process which has been developed in this field. At present air separation cannot be practiced economically to produce large tonnages of material finer than 200 mesh. For 300 to 350 mesh or finer wet grinding and water classification or water "flotation," as it is usually called, must be used; but aid separation methods are constantly being improved, and it is probable that finer sizes may eventually be separated economically.

In many instances no attention has been given to the proper proportioning of machine capacities in mills. For example, one talc mill had a very small jaw crusher, fed by hand, as its primary breaker. The capacity of the rest of the mill was several times the capacity of this crusher. Consequently, most of the mill was shut down over half the time waiting for crushed rock. Even in some large and well-constructed mills the efficient use of power, proper machine drives, and the best methods of transferring ore from one machine to another have seemingly received no attention. In some industrial centers such as New York City there are a number of small grinding plants which are run only intermittently. In these mills ores are ground to order in small lots, which necessarily often results in high costs and ununiform products.

Many plants have been noted in which expensive, efficient machinery has been installed, but the machine drives, general layouts, and methods of elevating and conveying have been so poor that the general efficiencies were very low. A gypsum plant was recently built by a company which had been very successful in the gypsum business. The latest types of labor-saving machinery were installed, and an effort was made to build a most modern mill. But the services of a trained engineer were not employed, and the co-ordinating details were poorly worked out, with the result that the plant was far from successful and many thousands of dollars were lost.

Probably the most important result of poor mining and milling practice is lack of a uniform, high quality of finished products. The consuming industries are partly to blame for this situation, because in many instances they have developed no standards and no series of uniform tests by which materials may be tested and compared. In fact, even the properties which materials must possess for some uses are unknown or are subject to wide divergence of opinion. Materials submitted are tried out under actual commercial conditions; if the finished product is satisfactory the material is considered suitable. But if the finished product is not good, due perhaps to the material under test and perhaps to other factors, the material is condemned. Thus the producer can often hardly be blamed for poor preparation of his products, as he has no means of testing. But certain tests may well be applied which are at least a rough check on uniformity. Finely pulverized material may be frequently tested for size by hand screening, but, unfortunately, even this simple test is often omitted. Chemical composition may be checked accurately by analysis, but few producers of the non-metallics maintain chemical laboratories.

Domestic materials are often condemned for lack of uniformity and imported materials used in preference. Unfortunately, it is or has been true that in many instances foreign producers have taken greater pains with their products and have maintained uniform high quality over long periods. This has been especially true in certain grades of clays and mineral pigments. American producers have been inclined to sacrifice quality and uniformity to quantity and speed in preparation.

To place the mining and milling of the non-metallics upon a sound, efficient basis, much research work must be done. First, simple accurate tests must be devised for the determination of all the important physical properties of the major non-metallics. Second, the properties which materials must possess to fit them for various uses must be determined in terms of standard tests. Third, specifications should be drawn up defining these properties, and these specifications should be the basis of purchase and sale of non-metallic mineral products. Only in this way can the efficient domestic producer protect himself from foreign competition and price cutting by irresponsible domestic producers; and only thus can the consumer be assured of a uniform and constant supply of high-grade material at a reasonable price. Coal, oil, and metals are purchased on the basis of analysis and standard tests, but many of our non-metallics are apparently bought on the basis of friendship, personal opinion, prejudice, or sheer luck.

Some of the non-metallic industries have made considerable progress in organization and in improvements in methods and practices within the last few years. The industries which have made the greatest progress are those which have efficient trade associations. Thus, the Portland Cement Association, the Gypsum Industries Association, and the National Lime Association have done and are doing very good work. But even in these industries there is great room for improvement. For example, the more general use of trained engineers (not surveyors alone) in the quarrying of limestone for cement manufacture would be very beneficial. In other industries progress has hardly started; but the realization that a great change is necessary and inevitable has begun to be generally felt. Efficient production on a small scale is becoming economically impossible. Large-scale production or the backing of a large amount of capital is becoming more and more necessary.

Present tendencies toward the development of more efficient operations are in several different directions, and it is difficult to see which will prevail or which is more desirable for the good of the industries. First, there is the tendency toward consolidation of many small companies into a few large corporations. This is well illustrated by the gypsum industry. Second, there is the tendency toward betterment of methods and business conditions of individual companies, both large and small, by co-operative effort through associations. This is illustrated by the lime industry acting through the National Lime Association. Third, there is a pronounced tendency for consuming industries to own their own sources of raw materials and operate their own mines. This is illustrated by the action of paper companies, both individually and co-operatively, in purchasing clay mines and limestone quarries; and by chemical companies which produce their own limestone and other raw materials. The Eastern Potash Corporation will require large quantities of lime in its processes, and is now installing at New Brunswick, N. J., a lime plant, capable of producing 1,000 tons of lime per day, which will be the largest lime plant in the world. Fourth, there is a tendency toward the formation of companies to produce a variety of non-metallic mineral products which are shipped in the crude and milled or prepared in centralized mills near centers of consumption. Several companies of this type are now operating, but they are not yet sufficiently large to justify drawing conclusions as to their ultimate influence.

METHOD OF FINISHING A GRINDSTONE, OHIO

At present it seems as though the third tendency is most pronounced, but it is questionable as to whether this method of progress will be most beneficial to the non-metallic mineral industries in general. The tendency for consuming industries to acquire their own sources of raw materials has become of importance only within the last few days. This has been due in large part to the fact that the production of many non-metallics has been unsteady and the supply unreliable, rather than to dissatisfaction as to price. In fact, many companies have turned to this means of insuring a steady supply rather reluctantly. It would seem reasonable to suppose that a large independent company could produce lime, for example, on a large scale more efficiently and cheaply than could a consuming company operating its own lime plant. This would undoubtedly be true if the independent companies utilized the best methods of mining and preparation. But in most instances the consumer-controlled properties have been equipped and operated more efficiently than the independent properties, because usually only large consuming companies can acquire mining properties, and they not only have plenty of capital but value engineering advice and efficient operation.

New uses for the non-metallics are constantly being found. In some industries search for such new applications is very active, and in others little attention has been given to this important work. In general, the development of new uses and markets is very desirable and should be extended, but it is a waste of time and energy to attempt to substitute one material for another unless such substitution results in a better or a cheaper product. It is also an unwise and shortsighted policy to seek new uses for a mineral product of which our supply is very limited and which is an absolute essential in industries now established. Thus, though an extension of the uses of lime or cement is justified and desirable, the desirability of actively seeking new uses for spinning fiber asbestos is at least questionable.

In order that the non-metallic minerals may be produced and utilized with greater efficiency, intelligence, and profit, much work must be done along several different lines. First, research must be undertaken to determine exact physical and chemical properties of non-metallic mineral materials for various uses, to devise simple and uniform methods of testing for these properties, and to set up specifications based upon such tests. Second, studies must be made of methods of mining, and of machines and processes for the preparation of the non-metallics, in order to produce uniform materials of standard grades at a reasonable cost and with a minimum of waste. Third, the importance of the non-metallics, the need for research and engineering work, the possibilities of expansion of markets through extending the use for materials now mined and through development of uses for materials not now utilized, and the attractiveness of the non-metallics as a field for investment, must be clearly and forcibly brought out through extensive educational publicity.

Publicity work will probably have both to precede and to supplement research and engineering studies, in order that capital may be made available and the industries convinced of the need for and the value of such research. As soon as it is recognized that the non-metallics offer as attractive and a more stable field for investment than the metallics, capital will be forthcoming and funds will be available for research and investigation, for efficient equipping and management of mines and mills, and for intelligent sales engineering. Above all, the need for adequate capitalization, sound management, and capable engineering in the mining, preparation and utilization of the non-metallics must be recognized.

GENERAL VIEW OF HOISTING AND MILLING PLANT, FAIRVIEW FLUORSPAR & LEAD CO.

The Mining and Milling of Fluorspar

In the Fairview, Illinois, District Fissure Veins Containing Fluorspar Are Mined Principally by the Shrinkage System—Owing to Flooding From High Water in the Ohio River, a System of Bulkheading Has Been Adopted That Facilitates Unwatering

BY J. M. BLAYNEY, JR.
President, Fairview Fluorspar & Lead Co.

Written for *Engineering and Mining Journal*

EIGHTY-FIVE PER CENT of the fluorspar production in the United States is sold in the form of washed gravel fluorspar, and is used as a flux in the manufacture of open-hearth steel. It is usually under ⅝ in. in size, and is generally sold on a basis of 85 per cent CaF_2 and 6 per cent silica (SiO_2). There is a high-grade produce generally known as "acid" fluorspar, sold either in lump form or pulverized, which is used in the manufacture of hydrofluoric acid, and is usually guaranteed to contain not less than 98 per cent CaF_2 and not over 1 per cent SiO_2. Another grade of ground fluorspar analyzing 92 per cent to 98 per cent CaF_2 and from 1 per cent to 4 per cent SiO_2 is used by the manufacturers of opalescent glass, sanitary and enameled ware.

Other metallurgical uses of fluorspar consist in the extraction of aluminum from bauxite ore, in smelting gold, silver and copper ores, in refining copper, in the electrolytic refining of antimony and lead, in the manufacture of ferro-alloys, in the electric furnace, and in the recovery of byproduct potash from portland cement kilns. Clear, flawless crystals of fluorspar are much in demand for use in lenses of optical instruments. Most of the fluorspar sold in the United States is purchased f.o.b. shipping point, and is marketed through established selling agencies, or through brokers.

ILLINOIS PRODUCES BULK OF DOMESTIC FLUORSPAR

More than 70 per cent of the total amount of fluorspar mined in the United States comes from Hardin County, in southern Illinois, near the Ohio River and about one hundred miles above the junction between the Ohio and Mississippi rivers. Nearly all of this is mined by two companies from the Fairview-Rosiclare vein and the Blue Diggings vein. These mines have direct railroad connection, the shipping point being Rosiview, Ill.

About 20 per cent of the domestic production comes from numerous scattered mines in Crittenden County, Ky., just across the Ohio River from Hardin County, Ill. These mines are all small in comparison with the operations on the Fairview-Rosiclare vein, and only two of them have a railroad connection. Most of the others are from three to fourteen miles from a railroad shipping point. The fluorspar produced and all mine supplies must be hauled over poor dirt roads, impassable during about five months of each year. The shipping points are Marion, Mexico, and Crayne, Ky. During the years 1914 to 1919 inclusive, the total domestic production amounted to 992,437 tons, of which, according to Government records, the Illinois-Kentucky field produced slightly over 89 per cent. During these same years, Colorado produced about 8 per cent, the small amount remaining being mined in the states of New Mexico, Arizona, New Hampshire, Utah, and Washington.

In the early days of the fluorspar industry in the United States, gravel fluorspar imported from England was a source of serious competition to domestic producers. The English supply was not mined, but was hand-picked from abandoned dumps of lead mines, principally in Derbyshire and Durham. As these dumps neared exhaustion, the supply from England declined, and imports fell steadily from 42,488 long tons in 1910, to 10,205 long tons in 1914, at which figure it approximately remained during the period from 1914 to 1919. In the first ten months of 1920, 19,834 long tons was imported. The English fluorspar is not guaranteed to analyze more than 70 per cent CaF_2, and runs very high in silica.

Fluorspar Deposits Occur Mainly in Fissure Veins

Nearly all of the fluorspar in the United States occurs in fissure veins. The largest deposit yet discovered, known as the "Fairview-Rosiclaire" vein, situated in Hardin County, Ill., occurs in a true fault fissure. The country rock forming the walls is limestone and sandstone, and the throw of the fault varies from 60 to 200 ft. The pitch of the vein approaches the vertical and is seldom less than 70 deg. from the horizontal. The strike is approximately north and south. The fluorspar occurs in lenticular masses in the vein, which pinches laterally and vertically. At some places in the vein the fluorspar outcrops on the surface; at other places it is some distance below the surface.

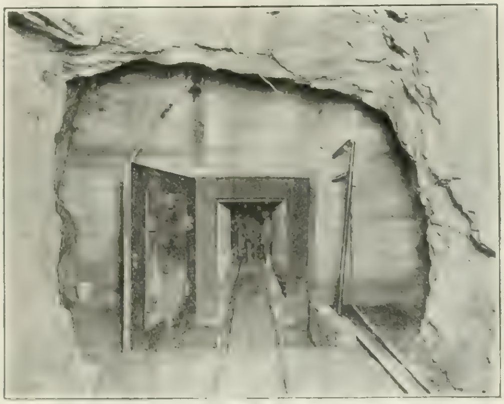
Usually, the gangue is calcite and what is known as "mill grit," which in its origin is sandstone and limestone (generally the latter) and carries a small per cent of lead and zinc. The widest shoots of the ore seldom exceed 30 ft. and the ore is usually not worked narrower than 2 ft., although it is sometimes advantageous to mine narrower streaks in the process of development work. The quality of the spar also varies largely, but apparently does not depend on the country rock forming the walls. Often high-grade spar is found between sandstone walls or between limestone walls, or where one wall is limestone and the other sandstone.

A selvage of rotten shale often occurs between the ore and the wall, and in several Kentucky mines this is 20 to 30 ft. thick; but generally on the Fairview-Rosiclare vein it is not more than a few inches in thickness. As a rule it may be stated that fluorspar decreases in quantity with depth, the fault either pinching or the vein matter being replaced by calcite. In several of the mines on the Fairview-Rosiclare and Blue Diggings veins this occurs between 400 and 500 ft. Some parts of these veins carry 30 ft. of calcite at a depth of 400 ft. and no fluorspar, and there are other places where fluorspar has been mined to a depth of 600 ft. and is still of good quality and width, although not so wide as the ore in the same body at higher levels.

Bulkheading Facilitates Unwatering

All of the producing mines on the Fairview Rosiclare vein are subject to flooding from high water in the Ohio River. The water enters the workings through underground fissures in the rock. Formerly it was the practice to sink the shafts on the vein. In such operations, when the mine flooded the shaft was also flooded, and underground pumps were useless for the purpose of unwatering, which had to be accomplished from the surface by means of a sinker pump, sometimes assisted by an air lift or bailing, a slow and expensive process and resulting in long interruptions to production.

The last two shafts sunk by the Fairview Fluorspar & Lead Co. are unique in the fluorspar district in that they were sunk some distance off the vein in the solid country rock, which is practically water-tight, and crosscuts were driven from the shaft to the vein. In the crosscuts, still in the country rock, heavy reinforced concrete bulkheads are built, and these are fitted with suitable heavy steel doors. The concrete bulkhead on the 500-ft. level at the Good Hope mine of the Fairview Fluorspar & Lead Co. is shown in an accompanying illustration. During the time that the mine is in operation the steel doors are kept open. Whenever the river reaches a point where the flooding of the mine is threatened, the steel doors are closed and only the shafts are kept clear of water.



CONCRETE BULKHEAD ON 500-FT. LEVEL OF GOOD HOPE MINE

The bulkheads are equipped with suitable water pipes and valves, so that when the river recedes these valves can be opened and the water permitted to flow to the station pumps, situated near the shaft. This system permits the use of heavy pumping equipment and greatly facilitates the unwatering of the mines. The Good Hope mine of the Fairview Fluorspar & Lead Co., which required six months to unwater by the old system, was recently unwatered in ten days by the new method. The pumping equipment on the 500-ft. level in the Good Hope mine is capable of handling between 3,500 and 4,000 gal. of water per minute, being equipped with three units, i.e., one 1,300-gal., 500-ft. lift Cameron centrifugal pump, which on actual test delivered 1,500 gal. per minute; one compound Worthington reciprocating pump, 1,300-gal. capacity, 500-ft. lift; and one compound Prescott pump, 1,000 gal. capacity, 500-ft. lift.

The Extension mine of the Fairview Fluorspar & Lead Co. on the same vein is operated through a shaft similarly situated and equipped, and has practically the same pumping capacity. No other mines in the Illinois-Kentucky fluorspar district are thus protected against long periods of interrupted production due to the flooding of the mines.

PUMPING STATION AT 500-FT. LEVEL OF GOOD HOPE MINE

All of the mines on the Fairview-Rosiclare vein pump from 600 to 1,200 gal. per minute. The frontispiece of this issue shows normal water entering at the face of the 500-ft. level in the Good Hope mine at the rate of 1,100 gal. per minute.

SHRINKAGE SYSTEM GENERALLY EMPLOYED

The shrinkage system of mining is followed by the Fairview Fluorspar & Lead Co. and by the Rosiclare Lead & Fluorspar Mining Co., although some underhand stoping is done. Levels are driven on the vein at intervals of 100 ft. in depth, and are usually carried about 14 ft. high when the drift is in fluorspar. Drifts driven through pinches in the vein are usually carried 6 to 8 ft. wide and 8 ft. high, but when driven in ore, the drift is carried the full width of the vein. The levels are then stulled over at a height of about 8 ft., and bins are placed between the stulls at approximately 10-ft. centers.

The stulls are poled over, leaving openings for the bins. The fluorspar is then broken and drawn through the bins into tram cars, generally mule or motor driven, and conveyed to the shaft, where the ore is dumped through a grizzly, which is made of railroad irons set at about six-inch openings, into a skip bin holding from ten to fifty tons. From the bin it is drawn into $1\frac{1}{2}$-ton skips and hoisted in balance to the surface bin. The shafts are three-compartment, 5 ft. x 16 ft. to 20 ft., two compartments carrying the skips and cages, the third compartment containing the ladderway, steam, air and water lines.

MILLING METHODS FOLLOW UNIFORM PRACTICE

The following method of milling is practiced by the Fairview Fluorspar & Lead Co. at Rosiview, Ill., a general view of the milling plant being shown in an accompanying illustration. The ore generally carries, as hoisted, from 10 to 30 per cent waste, and is passed over a washer of special design. A portion of this washer is perforated with round $\frac{3}{4}$-in. holes, the undersize from the washer passing directly to the rolls. The oversize is delivered to a picking belt about 50-ft. long, and 24 in. wide, which travels at a speed of 25 to 40 ft. per minute, the pickers standing on each side.

As the ore passes over the belt, waste, a certain amount of high-grade spar, and a type of closely disseminated lead and zinc ore are removed. The high-grade spar so removed is then either shipped in lump as acid spar, or pulverized through a Griffin mill and shipped in bags or barrels. The closely disseminated lead and zinc ore is removed for treatment in a separate mill. The ore remaining on the belt is discharged into a rock crusher, from which it passes through a set of rolls, thence through trommel screens and classifiers to the jigs. The jig product, in the form of gravel fluorspar, is delivered to a large, reinforced concrete bin, from which, after draining, it is loaded into railroad cars for shipment to the steel mills. The finer material from the classifiers and from the jigs (after reclassification) passes over concentrating tables, where further separation is made.

LEAD AND SILVER BYPRODUCTS

A lead concentrate analyzing from 75 to 80 per cent is also produced on the jigs and tables, and this lead concentrate, which at Fairview varies from 1 to 2 per cent of the crude ore hoisted, carries seven to eight ounces of silver per ton. The tailings from the jigs are allowed to accumulate on a tailing dump, and either sluiced out with water or rehandled with a locomotive crane. The limestone waste from the picking belt is delivered to a separate mill, where it is converted into agricultural limestone.

In the Kentucky district in Crittenden County, the orebodies are much narrower and shorter than those on the Fairview-Rosiclare and Blue Diggings veins in Hardin County, Ill., and the pinches are much longer. The largest producing mines in Kentucky are the Franklin mine, owned by the Fairview Fluorspar & Lead Co.; the Mary Belle mine, owned by the Kentucky Fluorspar Co.; and the Haffaw mine, owned by the Aluminum Ore Co. The first two are on the Franklin-Mary Belle vein, about ten miles southeast of the mines on the Fairview-Rosiclare vein in Hardin County, Ill. The Haffaw mine is on the Tabb vein near Mexico, Ky., and about ten miles south of the Franklin and Mary Belle mines. The Tabb vein is quite different from the three others above mentioned, and is apparently a series of faults, sometimes parallel and close together, at other times diverging and several hundred feet apart.

The surface rock, which is a flinty limestone and quartzite, seems to have weathered very much, and the orebodies have settled on themselves in places, making them wide, with most of the ore disintegrated to gravel size. The Haffaw mine on this vein has an orebody which at a depth of about 80 ft. is from 75 to 100 ft.

TRAMMING FLUORSPAR BY MOTOR

wide, and of good quality. Development work to date on the Tabb vein indicates that the orebodies do not extend as deep as on the veins described above, and often when solid formation is struck at the bottom of the gravel fluorspar chutes, the veins are small and filled with shale or calcite and contain no recoverable fluorspar.

Milling in the Kentucky district ranges from a crude log washer to a complete concentrating plant patterned after the larger mills in the Illinois field. Most of the mines are not large enough to justify independent mills. The only mines having complete milling plants are the Franklin, the Haffaw, and the Keystone (near Mexico, Ky.). The Kentucky Fluorspar Co. and the Roberts Fluorspar Co. have concentrating plants at Marion, Ky., to which the product of various mines is hauled and milled.

Alunite in South Central Texas

BY J. G. BRAUN

Written for *Engineering and Mining Journal*

ABOUT thirty miles southeasterly from San Antonio, Tex., in what appears to be a disintegrated "trachyte," irregular deposits of alunite occur. The mineral is in two forms. One is rather soft, white and somewhat stained by iron. Outwardly it resembles chalk, and has been used as such by the school children in the neighboring county schoolhouses for many years. This variety contains approximately 12 per cent silica and from a trace to 0.6 per cent of iron oxides; probably, also, basic sulphates of iron. The other is more compact (cannot be used on the blackboard like chalk), snow white, free from iron and contains only 2.5 per cent silica.

I know of three outcrops of the mineral. They are from six to twelve miles apart, and, judging from the way they occur, as well as from general surface appearances (numerous outcrops of the decomposed "trachyte"), there should be more of the mineral below the surface. I have named the area the "alunite district." The outcrop of the snow-white, high-grade variety covers approximately twenty acres and has the composition given in Table I.

TABLE I. RANGE IN COMPOSITION OF WHITE VARIETY OF ALUNITE

	Per Cent
Silica (SiO_2)	2.5 to 2.7
Water (H_2O)	14.0 to 13.6
Sulphuric anhydride (SO_3)	36.5 to 37.0
Alumina (Al_2O_3)	34.5 to 34.4
Potash (K_2O)	11.2 to 10.8
Soda (Na_2O)	0.2 to 0.6
Undetermined	1.1 to 0.9

The other variety has a similar composition, but contains 12 per cent silica, only 8.5 per cent potash, about 2 per cent soda and small quantities of iron. This variety can also be obtained by washing the decomposed "trachyte," through which it appears to be disseminated in the form of fine grains, apparently replacing the original feldspar of the rock. Wherever this replacement has occurred, the "trachyte" is of a light, whitish color.

In the examination of the mineral I have made laboratory tests on 100-gm. samples. The result of the first test was that the potash alum crystallized out while the aluminum sulphate remained in solution, which was later evaporated to its solidification point. The potash alum naturally contained the silica, which was removed by resolution and filtration. The recrystallized salt passed ordinary tests for purity. The aluminum sulphate was iron free, but that was due to the fact that I had used the high-grade mineral as well as c.p. sulphuric acid in the test.

The result of this second test is given in Table II.

TABLE II. APPROXIMATE ANALYSIS OF END PRODUCTS
No. 2 TEST

Loss on ignition (water and the greater part of the SO_3)	42.0
Water-soluble alkalies (about 95 per cent K_2SO_4)	19.2
Residual alumina, containing the 2.5 per cent silica (by diff.)	38.8

This experiment indicates a high recovery of the potassium sulphate contained in the mineral. The mineral was powdered to pass a 100-mesh screen previous to roasting, and subsequently treated with two washes of hot water. Tests to convert the residual alumina into ultramarine with cobalt proved successful with respect to color, but I did not go into further detail.

Apparently there is a large tonnage of the mineral in the district, but, owing to lack of time and of funds for purposes of investigation, I have been unable to arrive at a definite figure.

Dana states that the mineral occurs in fissures in trachyte and allied rocks. The district in which the alunite is found is altered and level. Excavations will have to be made before it can be determined as to whether the deposits are commercially workable or not. I am strongly inclined to believe that they are, but have no proof to that effect.

The Second-Foot of Water

"Second-foot," as defined by the U. S. Geological Survey, is an abbreviation for cubic foot per second and is the unit for measuring the rate of discharge of water flowing in a stream one foot wide and one foot deep at a rate of one foot per second. It is generally used as a fundamental unit in measurements of stream flow.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

An "acre-foot" is equivalent to 43,560 cu.ft. and is the quantity required to cover an acre to a depth of one foot. The term is commonly used in connection with the storage of water for irrigation.

A flow of one second-foot equals 7.48 United States gallons a second, 448.8 gal. a minute, or 646,317 gal. a day. As a California "miner's inch" equals 0.187 gal. a second, there are forty California miner's inches in one second-foot.

The Control of Bismuth

The production of bismuth and the market price of the metal have been strictly controlled for many years, according to the Imperial Mineral Resources Bureau, and Messrs. Johnson, Matthey & Co., Ltd., a London firm, are the chief buyers. The world's supply is obtained partly from bismuth ore and partly from bismuth metal recovered during the process of electrolytically refining lead and copper.

Bolivia is the chief producer of bismuth. Other important producing countries are Australia, Mexico, Peru and Saxony. An occasional shipment of bismuth ore has been reported from the "Kjenner Bismuth" mine, in Norway, and both Spain and Chile produced small quantities.

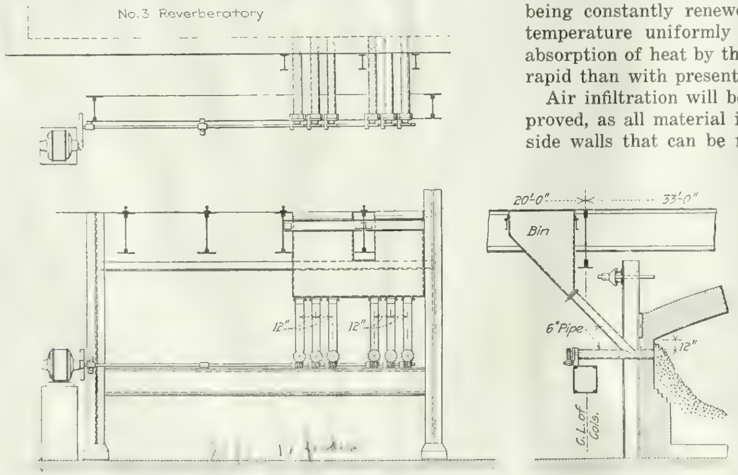
New Method of Charging Reverberatory Furnaces

By J. O. Ambler
Smelter Superintendent, Arizona Copper Co., Ltd.

Written for *Engineering and Mining Journal*

An experimental machine which promises marked improvements and economies over the present system of charging material into a copper reverberatory smelting furnace has been on trial for the last eighteen months at the smelter of the Arizona Copper Co., Ltd., at Clifton, Ariz. Briefly stated, the basic purpose is to charge the material at a practically continuous rate into the furnace by mechanical means, without the production of dust. Although the method is not new, having been advanced as early as 1914, its mechanical application has not been pushed, and for that reason results obtained from the machine are of interest.

With the above objects in view, an experimental machine was designed by Spencer Bishop, chief engineer for the Arizona Copper Co., Ltd., using mechanically driven screws for feeders, as shown in the accompanying figure. This has been running fairly continuously since June, 1919, during which time experiments have been made to determine the best type of screw and the materials of which to construct it, with tests of different methods of drive, diameters and lengths of screws and pipes, power consumption, and other operating and construction details. On the basis of the results obtained from this experimental machine, a similar machine is now being designed large enough to feed one furnace of about 500 tons' daily capacity.



CONTINUOUS SIDE FEEDER DESIGNED FOR NO. 3 REVERBERATORY AT ARIZONA COPPER CO. SMELTER

The principal advantages expected to be obtained by this method of mechanically charging reverberatory furnaces are as follows:

Dusting will be practically eliminated inside the furnace, and as the fluxing action of the dust produced by the present methods of charging causes the greatest part of the necessary roof repairs, a material saving will be made in this item. From observation, it is estimated that this saving alone will more than pay the cost of operating the machine.

A much better utilization of heat will be effected, resulting in lower oil ratios and larger tonnages. With present methods of charging, in which large amounts of comparatively cold material are charged periodically, the furnace temperature varies within wide limits. Immediately before charging the temperature is above the smelting point of the mixture, but it drops below the smelting temperature when the charge is dropped, and there is an appreciable interval during which little smelting is done. With the mechanical feeder, designed to feed the charge at about the same rate at which it is smelted, the furnace is kept at a uniform temperature and the heat acts on a thin layer of material which is being constantly renewed as it is smelted. With the temperature uniformly above the smelting point, the absorption of heat by this thin layer will be much more rapid than with present charging methods.

Air infiltration will be decreased and combustion improved, as all material is charged through pipes in the side walls that can be made absolutely dust-tight, and all holes for charging and for fettling pipes through the arch can be eliminated. The arch itself will be stronger, and the infiltration of air through all openings formerly necessary can be entirely obviated. This will materially lengthen the life of the arch, conserve heat, and, by simplifying air regulation, permit better combustion conditions, more nearly approaching boiler practice.

In this connection, experiments have indicated the possibility of feeding wet or dry high-sulphur concentrates direct to the reverberatory and utilizing their heat of combustion in this furnace instead of the roasters. Should this line of experimentation continue to develop favorably, the regulation of the air supply will be an important factor.

The slag and stack losses should be smaller. With the uniform smelting temperature and feed, the settling conditions in the furnace will be improved, and with elimination of dusting the amount of dust settling on the slag and passing into the boilers, flues, and stack should be greatly lessened.

In the machine being designed, particular attention is being paid to the elimination of dust losses while charging the material from calcine cars to the feed hoppers at the reverberatory, and to the insulation of bins to conserve the heat of the material to be smelted. The furnace on which the machine is to be installed is approximately 25 x 100 ft. in hearth area and is fired with Mexican low-gravity oil, using air at 30 to 32 oz. pressure for atomization.

HANDY KNOWLEDGE

Details of Shaft Lagging

By John L. Dynan

Written for *Engineering and Mining Journal*

An effective method of placing lagging in vertical shafts, although by no means original, has been in use at the Tonopah Extension mine in Tonopah, Nev., for several years. Fig. 1 shows the details of this method, and Fig. 2 the method in general use in Nevada.

In Fig. 1, a "keyboard" projecting two inches above and two inches below the wall plate is spiked to the back of the wall plate. This is done on the surface, before sending the wall plates down. For a 10 x 10 in. wall plate, the keyboard is 2 x 12 in. Back of this keyboard are inserted whatever stringers and blocking may be necessary to block the wall plate tightly in place. The lagging are stood upon the wall plates, and are prevented from falling into the shaft by cleats, usually 2 x 4 in., spiked to the wall plates, top and bottom, as shown. The ends of the shaft are lagged in the same way. A gap is left on the wall plates for the hanging-rod nuts and washers. This may be filled, if desired, after the hanging rods are removed.

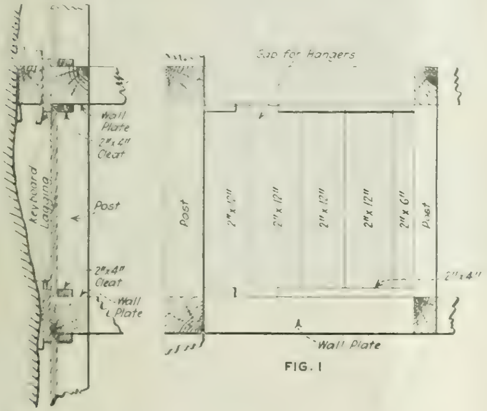
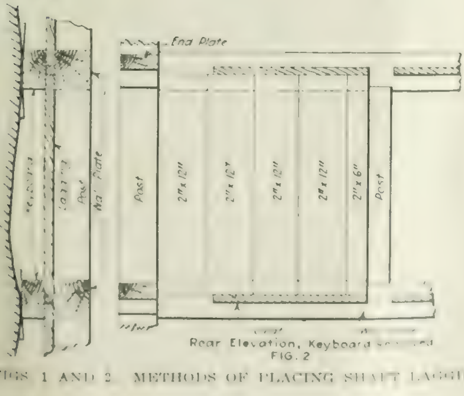


FIG. 1



Rear Elevation, Keyboard
FIG. 2

FIGS. 1 AND 2. METHODS OF PLACING SHAFT LAGGING

In the other method, shown in Fig. 2, the lagging are back of the wall plates, supported on a small cleat. The lagging for any set must be inserted from below that set, through a space at the end left without any cleat. The last lagging over this space is held by wedging it to the "keyboard."

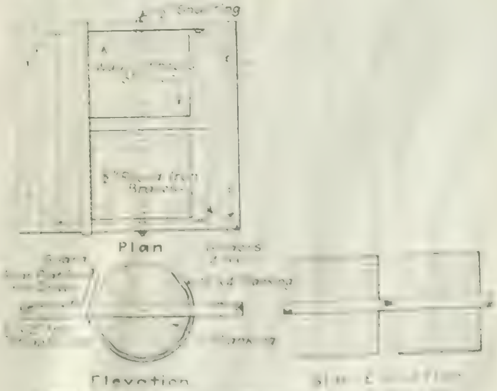
The method shown in Fig. 1 has been found to have several marked advantages. First is the much greater ease with which a set can be lagged. A shaft crew of four men can lag a set in a shaft of four 4 ft. 6 in. x 5 ft. compartments in twenty minutes. A second advantage is the ease with which lagging may be removed to be replaced when broken, or to ease the ground back of the shaft timbers. It is necessary merely to pull up the cleat with a bar or pick, instead of chopping out the lagging, as in the other method. The method provides ample strength, as the lagging will bend in the center to a degree necessitating their replacement or easing off, long before they can fail by pushing off the 2 x 4 in. cleat. In cutting, lagging must be a little shorter than the theoretical length, if the wall- and end-plate timbers are at all oversize; otherwise the lagging will not fit.

An Efficient Snow Roller

By Donald D. Fraser

Written for *Engineering and Mining Journal*

The illustration shows a snow roller which is being used successfully in Cariboo, B. C., between Quesnel and Barkerville. In that section the snow on the roads may lie up to eight feet deep. Before the roller was used, much trouble was experienced when teams met. Frequently it was a three- or four-hour job to get the one team past the other.



DETAILS OF CONSTRUCTION OF SNOW ROLLER

The device makes a fine hard roadbed and frequent turn-outs are rolled. The greatest benefit comes in the Spring when the snow is melting. The rolled roadbed melts away slowly and evenly, one side of the road not being bare ground while the other side is covered with a foot of snow. When the snow is not too sticky, the roller works to perfection.

The construction is simple. The rollers are built up on four wagon wheels, each roller having two wheels. These wheels are mounted on axles. The spacing will depend on the desired width of the roadbed. The rollers described are each about three and one-half feet wide and placed about nine inches apart. A framework is made, as shown, of 4 x 6-in. lumber, being carried by the ends of the axles. A platform is made on the rear end for the driver, and the tongue is fastened to the front end. The construction throughout is heavy, to give both weight and strength. Four horses are generally used to pull it.

Repair of a Broken Jaw Crusher

BY W. R. CANTON

Written for *Engineering and Mining Journal*

A breakdown of a primary jaw crusher usually means a stoppage of the plant that depends upon it for crushed material. A quick and also reliable repair is therefore necessary. The crusher the repair of which is here described is a 36 x 42 in., jaw type. Its breakdown necessitated the shutdown of the plant. One side frame casting broke along the line of the bolts which hold the back end of the frame. No apparent reason for the break, such as, for example, a large piece of steel, was found, but it is supposed that a piece of drill steel caught in such a way as not to slip, causing the break.

A plan for repair was devised at once and the work started. The following material was required: Six pieces of $2\frac{15}{16}$-in. shafting, each 14 ft. long, for side tension rods. Each end of the rods was threaded, for a length of twelve inches, $3\frac{1}{2}$ turns to the inch. It required about two hours in the lathe to run the thread on one end. Twenty-four 3-in. drop-forged nuts and six 7 ft. x 8 x 4-in. stays made of drop-forged steel were required. In each of these there were drilled two 3-in. holes, 6 ft. $8\frac{1}{2}$ in. on centers. It required $1\frac{3}{4}$ hours to drill one hole. Four pillar blocks were required, on account of the curve in the casting of the crusher. Two were 34 x 6 x 10 in. and two were 34 x 4 x 10 in. All were made of cast iron. The material was obtained from near-by plants, and was assembled on the job in four days. The parts were put in place and the nuts taken up with a one-ton chain block, using a 36-in. open wrench. They were tightened and then heated for one-half hour, and while the heat was on, the nuts were given one full turn on both sides of the crusher. This amounted to a length of $\frac{9}{32}$ in. In heat tightening, the middle bolt, one on either side, was tightened first; then the bottom one, and lastly the top one. The bolts on each side were tightened simultaneously. Wooden wedges were next put in between the frame and rods at both ends to prevent the lateral movement. The job was a complete success. Fig. 1 shows the broken side frame and Fig. 2 the repair work at the broken end of the crusher.

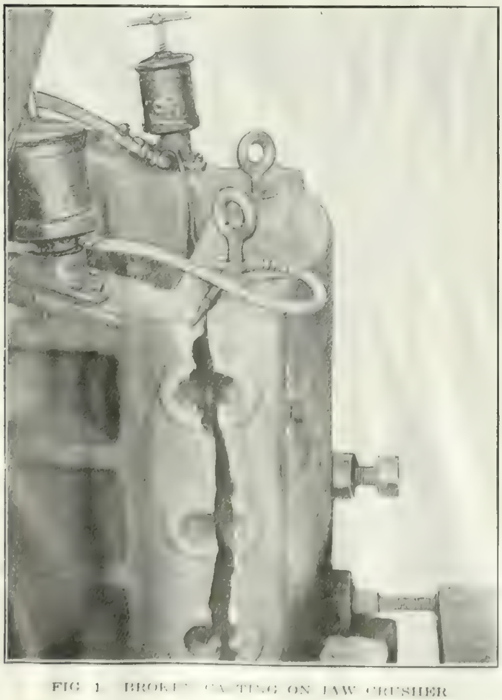


FIG. 1. BROKEN CASTING ON JAW CRUSHER

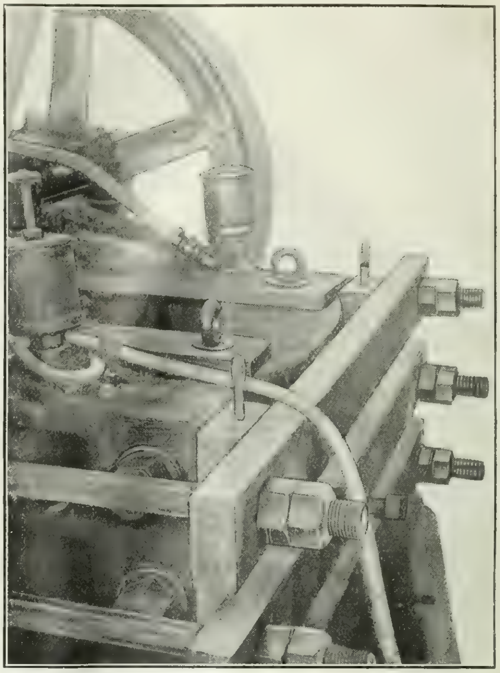


FIG. 2. REPAIRS MADE ON JAW CRUSHER

Scrap Iron for Cold Converters

When a converter is running cold, says H. C. Robson in a paper recently presented before the Institution of Mining and Metallurgy, the addition of coal is of little avail, as the volatile matter does not burn until it passes out of the converter mouth, thus only resulting in overheating the hood. Scrap iron, however, has been found most suitable for heating a cold charge, and old ladles used for dipping copper from a refinery furnace broken up into small chunks have come in handy for this purpose.

BY THE WAY

Notes on Annual Reviews

When the next Annual Review Number appears, readers will do well to peruse carefully the able article on "Pig Lead and Pig Tin," by Ellis Parker Butler, the w. k. authority on pigs.

As stated in the recent A. R. N. the Ringwood iron mine, at Ringwood, N. J., is owned by the Ringwood Co. of Ringwood. We feel sure that this statement will thoroughly satisfy every booster in the Chamber of Commerce of Ringwood.

There's one good thing about the Annual Review Number, anyway. It is the one issue that the subscriber can get along without reading. But as a reference work it is comparable only to the *Brooklyn Eagle Almanac.* No higher praise, even though it seem self-praise, can we think of.

The Almighty Dollar

Though hopeful of the future, we live in the present—a sign that youth is still with us; and as we look around thus early in the new year, about the brightest thing that we can see within our horizon is silver. As a man in love is said to see all things through rose-colored glasses, so those in the dumps may cure their ill-humor by wearing spectacles with lenses of silver that shut out all the world besides. The silver dollar, the cartwheel favored of Westerners, makes a pretty pocket piece. Gripped tightly in the fist it sends a comforting feeling through our being, that seems to tell us that here, as least, is something real and not merely a scrap of paper. It would be well if Easterners were more familiar with real money. Instead, there are tradesmen here in New York who have never seen the shining simoleon and who look the customer askance if by chance he drops one on the counter. There is in existence an organization known as the Sunshine Club. We would like to form our own sunshine club, the principal qualification for membership in which would be the possession of a silver dollar carried on the person. There are some, no doubt, who will say that such a club might better be known as the moonshine club, owing to the silvery lustre of the metal. But we wave such trifling suggestions aside. If only half of our population could be persuaded to join such a club, and hold to their obligation, no less than fifty million bright and shining silver dollars would find their way from Treasury vaults into the pockets of the people. But such a thing should not be carried too far, else this country might become another sink for silver such as India is. Perhaps our native extravagance could be relied upon to prevent this. In that case the movement could go to any length, the result benefiting the producer. We repeat, we are fond of the silver dollar. We are collecting as many of them as possible. To cure the blues over the metal situation the following prescription is recommended: Take one squint at a cartwheel, say a prayer for the Pittman Act, and presto! the deed is done.

International Courtesies

Beginning Jan. 1 the railroads of this country were permitted to accept small arms and small arms ammunition for shipment into Mexico according to an announcement by the American Railway Association. Now if Don Alvaro Obregon will facilitate the shipment of *mescal, cerveza* and other commodities in the same classification into this country the courtesy will be properly reciprocated. But has there ever been lack of any of these commodities at any time on either side of the border?

The Miner's Almanac

If Dr. Eliot had introduced his five-foot shelf of books fifty years ago perhaps he would have included the farmer's almanac, by which our grandfathers, both in town and country, were wont to inform themselves of forthcoming events and refresh their memories of things gone by. That the moon has phases and the sun rises and sets constitutes the sum total of many a person's knowledge of astronomy, and more perhaps have learned this from the farmer's almanac than from deep and learned textbooks. This almanac was an institution. It is therefore with pleasure that many will read the Miner's Safety and Health Almanac for 1921, the third of a series published by the U. S. Bureau of Mines and compiled by R. C. Williams. In it the phases of the moon are given due prominence, and a safety hint or an historical event is listed for each day of the week. On Feb. 21 the reader is informed that the day will be Monday, that flies do not wash their feet, that the sun will rise at 6.45 and set at 5.43, all of which should be enough to keep anyone straight on that particular day. The month closes with the good advice that cheerfulness increases working efficiency. In place of the jokes and anecdotes in which the old almanac abounded, numerous short sermons on hygiene, sanitation and safety are given, lightened with cartoons and other illustrations.

Before the Copper Surplus Piled Up

Ancient mining on the shores of Lake Superior was discussed by Charles Whittlesey back in 1856. Mr. Whittlesay's paper was later published in the Smithsonian Institution's "Contributions to Knowledge." He arrived at the following conclusions:

An ancient people extracted copper from the veins of Lake Superior of whom history gives no account. They did it in a rude way, by means of fire and the use of copper wedges or gads and by stone mauls. They had only the simplest mechanical contrivances and consequently penetrated the earth but a short distance (the deepest works are about the same depth as those of the old tin mines of Cornwall, which were wrought before the conquest of Britain by the Romans). They do not appear to have acquired any skill in the art of metallurgy or of cutting masses of copper. For cutting tools they had chisels and probably adzes or axes of copper. These tools are of pure copper and hardened only by condensation or beating when cold. They sought chiefly for small masses and lumps and not for large masses. No sepulchral mounds, defences, domiciles, roads or canals are known to have been made by them. No evidences have been discovered of the cultivation of the soil. They had weapons of defence or of the chase, such as darts, spears, and daggers of copper. They must have been numerous, industrious, and perservering and have occupied the country a long time.

No Gold for the Portland

Although the Portland Gold Mining Co. has mined about $100,000,000 in gold during its existence, it was unable to obtain gold coins to distribute to its employees as Christmas presents, because the banks (for some unaccountable reason) refused to issue gold for such purposes.

CONSULTATION

Manganese Deposits in the Southern United States

"Will you be kind enough to tell the writer, who has been a subscriber of yours for over twenty years, whether there are deposits of black oxide of manganese, also known as manganese dioxide and mineralogically as pyrolusite, in the southern part of this country, and, if there are any workable deposits, whether they are being worked and where they are located? I am much interested in this mineral, and any information you can give me will be appreciated."

The southeastern part of the United States contains extensive deposits of manganese. In order of importance as manganese producers, the Southern States rank about as follows, the figures being taken from data supplied by the U. S. Geological Survey:

MANGANESE ORE SHIPPED IN 1919 IN LONG TONS

	35 per Cent or More Manganese	10 to 35 per Cent Manganese
Virginia	3,900	9,765
Georgia	48	3,496
Arkansas	2,558	564
Alabama	40	....
North Carolina	....	30

It is to be remembered that 1919 was a year of low production in the industry, the production of high-grade ore (35 per cent and over) in the entire United States being 58,085 tons, compared with 305,869 tons in 1918.

In Alabama, manganese is mined principally in the Altoona district, Blount and Etowah counties, and from Calhoun, Clay and Talladega counties. In Arkansas, the most important producing locality is around Batesville—Independence and Izard counties. Polk and Sharp counties are of lesser importance as shippers.

Georgia produces about 80 per cent of its manganese ore from the Cartersville district, Bartow County. The remainder is shipped from deposits in Fannin, Floyd Lincoln, and Whitefield counties.

Virginia is the chief Southern producing state, and has shipped high-grade ore from mines in Augusta, Bland, Campbell, Craig, Frederick, Giles, Nelson, Page, Russell, Shenandoah, Smyth and Warren counties. Most of the manganese ore in Tennessee is produced in Johnson County.

It is noticeable that the Southern manganese deposits extend in a long belt in the Appalachian Mountains which begins in Maryland and extends through the states of Virginia, Tennessee, North Carolina, Alabama and Georgia.

The great stimulus of war requirements for ferromanganese was responsible for a widespread activity among manganese producers all over the United States. Although for a decade prior to the war the United States produced less than 1 per cent of its manganese ore supplies, the cessation of imports and the insistent demand for this necessary war mineral led to a phenomenal expansion in production—from about 3,000 tons in 1913 to over one hundred times this output in 1918. The resumption of importation after the war and the strong competition of other countries producing more uniform grades of manganese at costs which enable them to make a reasonable profit will probably prevent any great resumption of domestic manganese production on a scale comparable to that maintained during the war. At present Southern manganese producers are active, but more in regard to consolidation of properties and planning for more efficient working of the mines than for active ore production. They seem to feel, particularly in the Arkansas field, that is to their advantage to co-operate in an endeavor to sample and market their products in a better manner and that there are many problems of operation that can be attacked collectively with the prospects of better returns than if attempted individually.

The U. S. Geological Survey maintained close contact with the industry during the war, and has published reports on the geology and manganese resources of practically every important producing district in the country. A bibliography of the reports would be too detailed to reproduce here, but the reader would do well to communicate with the Survey if he desires to obtain reports covering the particular section of the United States in which he is interested.

Low Sulphur Content Presents a Metallurgical Problem

"We find that smelting tests of the average ores at Rosita give a sulphur content too low to throw down all of the copper as a matte. The copper content is, therefore, found to come down in the reverberatory furnace as a mixed mass of native shot copper and high-grade copper matte. I understand that under this smelting condition the copper content of the slag is usually found to be high, but in our operation we get a very clean slag of not over $\frac{2}{10}$ or $\frac{3}{10}$ of 1 per cent of copper. The problem is, will this combined mass of shot copper and high-grade matte blow well in the converters and give the usual blister copper product, or will it be necessary to add an additional amount of sulphur to the charge in order to get proper action in the converters?"

We have never had to solve the problem mentioned in your letter and also have never heard of material such as you describe being converted. Possibly some of our readers can throw some light on the subject.

Evidently your reverberatory product would contain little or no ferrous sulphide, inasmuch as free copper is present. All of the heat therefore must come from oxidation of the sulphur. Without an analysis it is impossible to calculate just how much heat would be evolved and to compare this with that which might be assumed as lost in the stack gases and by radiation. You might be able to blow the mixture to blister without difficulty provided you ran your reverberatory very hot previous to tapping and thus superheated the converter charge. It would also probably be necessary to keep the converter shell hot by oil burners or otherwise. The size and type of converter would enter into the question. Scrap iron and quartz might be charged to the converter occasionally for increasing the temperature, but then, of course, you would have a slag to handle with which otherwise it would be unnecessary to deal.

THE PETROLEUM INDUSTRY

Imperial Oil Co.'s Program for 1921

SPECIAL CORRESPONDENCE

The plans of the Imperial Oil Co. for the season's operations in the Fort Norman oil field on the Mackenzie River include the erection of a permanent camp, so that a force of men may remain there throughout the year. The season under present conditions is a short one, owing to the time required for going in in the spring and returning before navigation closes. Last year the drillers had only seventy-three days in which to work. Considerable time will be saved by the use of airplanes, which will enable more work to be accomplished in 1921 than was possible last year. When the workmen reach the Fort Norman well in the spring it is intended to test it, and if found desirable to sink it to a greater depth. The company has several blocks under lease in the field.

Drilling will also be carried on at Windy Point, several hundred miles south from Fort Norman. Three wells are being drilled in Saskatchewan and six in Alberta. Of all the operations carried on by the company in western Canada, the Fort Norman well is the only one where oil has been secured in commercial quantities. Two airplanes have been secured for the air service from Edmonton to Fort Norman.

Further Searches for Oil in Utah

SPECIAL CORRESPONDENCE

An effort is being made to add to oil production from Utah sources, and oil is being sought in Emery and Garfield counties by a number of companies. In the San Rafael field, in the former county, the Ohio, Midwest, Carter, and Kasoming companies, subsidiaries of the Standard Oil Co., have filed leases on large tracts. The Ohio and the Carter Oil and the Midwest also hold leases on lands at Circle Cliff, in Garfield County.

A recent report says that the Midwest company has opened a small flow at 75 ft. in the Circle Cliff field. The strata in which it is hoped to open a larger flow is stated to be found at a depth of 1,500 ft. Another company in the field is the Bay State Mining & Development Co., which has filed on 600 acres of oil land at Circle Cliff and 2,660 acres at San Rafael.

Oil Possibilities in Southeastern Montana

The Wolf Mountain area, in southeastern Montana, which lies within the drainage basins of Powder, Tongue, and Rosebud rivers, was examined in a reconnaissance made to discover anticlines or other structural features that are likely to contain oil, in October, 1920, by C. E. Dobbin and W. T. Thom, Jr., of the U. S. Geological Survey. The wide, shallow syncline or inverted arch of strata corresponding to the drainage basins of these three rivers includes several broad, low arches and minor flexures, but practically all the known oil fields of adjacent regions in Montana and Wyoming are associated with rocks that dip much more steeply than those observed in the Wolf Mountain area.

In this area the sands that may yield oil or gas lie at great depth, under a great thickness of coal-bearing rocks. The depth to these sands decreases gradually toward the east, owing to the thinning of the geologic formations, but this same thinning must also decrease the number and thickness of the sands in the eastern part of the field. Except on the extreme eastern and western margins of the Wolf Mountain syncline, the sands of the Colorado and older formations, which yield oil near Newcastle, lie too deep to be reached by ordinary drilling.

The three structural elevations which more distinctly invite further investigation are the anticlinal noses near Ridge, northeast of Hardin, and west of Busby. Even these features, however, do not appear particularly promising.

Oil From Pennsylvania Shales and Coals

A preliminary report on a series of experiments which have been conducted by the Pennsylvania Geological Survey to determine the amount of oil obtainable from Pennsylvania coals and black shales has recently been issued. The results show that Pennsylvania is not well supplied with rich oil-producing coals or shales. The conditions that produced the valuable anthracite in the eastern part of the state and the high carbon coals in the eastern part of the bituminous fields drove the oil and gas out of the black shales of those regions, so that good results were obtained only from the coals and black shales in the extreme western and northwestern counties of the state.

The experiments show that anthracite will yield no oil on distillation, nor will the black shales of the central and eastern parts of the state. This has been one of the facts that have led geogolists to believe that those parts of the state contain no commercial supplies of petroleum or natural gas.

The coals and black shales of the counties lying immediately west of the Allegheny front—Tioga, Lycoming, Clinton, Center, Clearfield, Cambria, and Somerset—likewise give little promise, yielding only from 2 to 12 gal. of oil per ton of coal or shale.

Specifications for Petroleum Products

The Bureau of Mines announces the publication of Bulletin 5 of the Committee on Standardization of Petroleum Specifications, containing in the latest revised form all of the specifications which have been adopted by the specifications committee for Federal purchases of petroleum products. It also gives complete descriptions of the methods of testing adopted for each product. These specifications supersede those previously published in Bulletins 1, 2, 3 and 4 of the committee. Bulletin 5 became effective Dec. 29, 1920.

The committee has done a great deal of work in revising the wording of these specifications to make them more definite. The methods of testing have also been made more definite and brought into closer agreement with standard methods adopted by the A. S. T. M. and other societies.

NEWS FROM THE OIL FIELDS

Extra Supervisors Appointed in Texas Oil and Gas Division

From Our Special Correspondent

The Texas Railway Commission has announced the appointment of four additional deputy supervisors in the oil and gas division, making a total of twelve deputies. The new appointees are W. F. Arnold, H. H. Fitzpatrick, Fred S. Kinsley, and Hamilton Parks.

In the Mexia field, Limestone County, the Humphrey No. 1 well continues to flow by heads, and will be completed in a few days, when a much larger production is expected. The Texas Co. has completed a pipe line from the Houston & Texas Central R.R. to the well. Six new derricks are being built in this section, and considerable drilling will be done.

Fire at Humble, Harris County, on Jan. 15 destroyed several buildings in the business section of the town. The total loss is estimated at $25,000. The oil field was not damaged. Production from this field is about 9,000 bbl. daily.

Hull field, Liberty County, is still increasing its production, and pipe-line and storage capacities are taxed. The largest producing well completed recently is the No. 2 Hooks Spell of the Humble Oil & Refining Co., which came in at 3,220 ft., flowing at an estimated rate of 10,000 bbl. per day. Another big well is the No. 4 Harrison of the Monarch Oil & Refining Co., making 5,000 bbl. initial capacity.

West Columbia's production for the week ended Jan. 15 was about 34,000 bbl. per day. The only important completion during this week was the No. 2 McGregor well of the Big Belt Oil Co., between the old field and the north extension. This well came in flowing 2,000 bbl. from 2,520 ft.

One producing well was added to the Blue Ridge field during the week ended Jan. 15. This was the No. 1 Pearson well of the Humble Oil & Refining Co., flowing 400 bbl. from 2,950 ft. This well is on the west side of the field near the Texas Co.'s No. 1 Robinson, but in a shallower sand, through which several other wells have been drilled, it is claimed. Kerry Kinney et al. well No. 1 Bentley, on the east side of the dome, was abandoned in salt.

One of the deepest wells in the Gulf Coast region is again producing. This is the No. 33 Ashbell Smith well of the E. F. Simms Co. The well was first brought in producing gas at 4,100 ft.; it later went to salt water, and recently, after setting screen and packer, began flowing 150 bbl. of oil daily. The Gulf Production Co.'s No. 20 Hoffman-Gaillard is pumping 50 bbl. daily from 4,200 ft., a depth exceeded by few producing wells on the Gulf Coast.

Mexican Petroleum Companies Have Extensive Programs for 1921

From Our Special Correspondent

The Tidmex Oil Co. brought in a salt water well on Lot 215, Amatlan. At a depth of 2,500 ft. the well struck the oil, but flowed only about thirty minutes, when it gradually went salt. The well was closed in soon afterward by the contractor.

Millions of dollars will be spent in the Mexican oil fields this year, as announced in the programs of several of the largest companies operating there.

The Mexican Gulf Oil Co. has planned to drill ten to fifteen new wells in proved territory, in addition to several wildcat wells in different parts of Mexico. Extensions to the company's pipe lines include two new eight-inch lines from its pump station on the Tancochin River to Lot 23, Zacamixtle, where it purposes erecting a new station to handle the oil from this field. A line will also extend south from this lot to the company's holdings in Toteco. A general camp will also be erected on this lot, including shops, bunk houses, a hospital, and a hotel.

The Freeport Mexican Oil Co. plans to drill several wells during 1921, some being in new territory. The company expects to add several tankers to its fleet, and to bring enough oil through its terminal to increase its capacity to over a million barrels a month.

The International Petroleum Corporation plans to pull two of its sea-loading lines early in the year. These will have a capacity of about 100,000 bbl. per day. This company expects to drill several wells in the Amatlan, Zacamixtle, and Toteco pools, and anticipates a large production from them. The company's second ten-inch line is nearing completion and will give it a capacity of 130,000 bbl. daily.

The Island Oil Co. will drill at least six wells in the south fields at once, with several others to follow as soon as possible. The company also plans an addition to its main line to the terminal on the coast.

The Huasteca and Aguila companies also have extensive programs, but they have not yet been made public.

A favorable report, according to the *Wall Street Journal*, has been made to the Senate on a bill introduced by Senator Owen to extend from 1931 to 1956 rights of Osage Indians in Oklahoma to oil and mineral deposits in their lands, even though surface lands have been sold. The bill also extends for the same period leases of oil companies which are now paying royalties on production.

Salt Creek, Wyo., Producers Hold Meeting With Interior Department Representatives

From Our Special Correspondent

A meeting of the crude-oil producers of the Salt Creek field, Wyoming, and a conference with the representatives of the Department of the Interior were held in Denver on Jan. 27. The Government holds big royalties in the Salt Creek field and desires to prevent damage to the field by overdrilling.

In the Lance Creek field the Cash well of the Ohio Oil Co., on Sec. 4, it is stated, has started flowing oil at the rate of 700 bbl. daily. This was originally a gas well.

Western States Oil & Land Co. recently completed its No. 12 well in the Hamilton field northwest of Thermopolis. The well is making a good production. No. 15 well will be completed soon. The Secretary of the Interior has granted this company permission to produce oil from its well on Sec. 5-39-78 of the Salt Creek field, and impound it pending the granting of the lease to the company.

Reports of Oil in Coahuila and Durango Confirmed

From Our Special Correspondent

Torreon—Reports of the existence of oil in paying quantities in the states of Coahuila and Durango have been confirmed through the Secretary of Hacienda in Mexico, according to published reports. The State of Coahuila is now producing crude oil in various regions. In the famous mining district of Mapimi, in the State of Durango, and bordering on the State of Coahuila, a producing well has been brought in.

The central government is being asked to pass a law creating a national reserve of a portion of these oil lands in order to prevent them from being monopolized by foreigners. English geologists have been prospecting for oil in the northern part of Coahuila, and are said to have discovered a good grade of crude oil in paying quantities.

It is reported from reliable sources that Nuevo Leon, Durango, and Coahuila are now producing thousands of barrels of oil per day.

Well drillers who were boring for water in the State of Chihuahua at the time the revolution broke out in 1910-1911 claim to have struck oil in a number of districts, but kept their discovery secret. It is becoming generally known to prominent geologists and big oil concerns that crude oil is to be found in large quantities throughout the entire northern part of Mexico and is going to cause an unprecedented rush to this country within the near future.

Book Reviews

Asbestos. By A. Leonard Summers. Cloth; pp. 107; 34 illustrations; 4½ x 7, Isaac Pitman & Sons, Ltd., New York. Price, $1.

This is one of Pitman's "Common Commodities and Industries Series." It claims to be the only comprehensive book on asbestos, notwithstanding Cirkel's well-known monograph which has a world-wide reputation. The author gives a fairly complete description of the various products in which asbestos is used, particularly those employed in England, and apparently he speaks with some authority on that phase of the subject. It is to be regretted that he had not confined his work entirely to finished products, for the introductory part dealing with raw materials is noteworthy particularly for its errors. The statement that Italian asbestos is the best in the world, the failure to mention Arizona and Rhodesia as producers, and the remarkable claim that "next to coal asbestos is undoubtedly the most important of the non-metallic mineral products" are examples of the numerous errors which place the book in the too common class of unreliable "popular" works. O. B.

The American Engineer in France. By William Barclay Parsons. Cloth; pp. 429; illustrated; 6 x 8¾. D. Appleton and Co., New York, 1920. Price, $4.

Colonel Parsons states in the preface to his book that, "Perhaps it may serve to give those who did not go overseas a picture of what is meant by engineering in modern war." We do not believe it is an exaggeration to say that in this particular he has succeeded admirably, and his contribution to the literature relating to the accomplishments of American engineer units in the Great War is a notable one. The reader is constantly impressed with the versatility shown by the engineers, and, although this is a trait with which we, as engineers, are entirely familiar, it is refreshing to see the statement in print and presented in such able fashion. The narrative, besides the inclusion of a great deal of statistical, historical and technical data, is interspersed with many delightful personal touches, experiences, and suggestions of the engineer's daily life, and portrays in an excellent manner his relations with the engineers of the Allied armies. D. E. A. C.

Straight Business in South America. By James H. Collins. Cloth; 5½ x 8; pp. 305. D. Appleton & Co., New York. Price, $2.50.

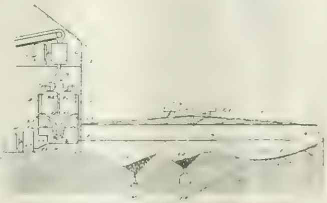
This is a well written book on a subject of very general interest to the business men of the United States. Its principal value would seem to be that it puts the reader in the proper frame of mind to absorb the details of his particular business in South America. Although many pertinent facts are presented, it indicates to one *why* certain things are done rather than *how*, and in that sense is quite different from the more technical works about the same field. The book is easy to read, and treats of interesting subjects in an intelligent way, and the author has apparently consulted with men who know the continent well.

It is unfortunate that the few Spanish expressions used have been mistreated somewhere between the typewriter and the bindery, as they tend to create a false impression upon persons familiar with the language. This is in no way a serious matter, however, and does not detract from the book's real value to busy men. V. L. H.

Recent Patents

Patent specifications may be obtained from the Commissioner of Patents, Washington, D. C., for 10c. each. Postage stamps not accepted.

Pneumatic Concentrator—Nos. 1,359,496 and 1,359,497. F. G. Gasche, Chicago, Ill. A process of blowing finely crushed ore into a confined atmosphere and separating the constituents according to the ease of settling.



Slime Cone—No. 1,360,703. Charles Allen, El Paso, Tex. A modification of the well-known Allen cone classifier.

Ball Mill—No. 1,360,648. Joseph E. Kennedy, New York, N. Y. A form of mill which has a partition screen in the middle of the mill so that relatively coarse grinding can be done in one end and finer grinding in the other. A mill of somewhat similar type is covered by patent No. 1,361,205 issued to P. C. Van Zandt, Chicago, Ill., and assigned to the Allis-Chalmers Co.

Copper Precipitation—No. 1,360,666. L. D. Mills, San Francisco, Cal., assignor to the Merrill Co. A method of using finely divided freshly reduced iron to precipitate copper from its solution.

Sealing Oil Wells—No. 1,361,282. W. E. Nolan, Tulsa, Okla. A method of sealing wells which consists in heating the walls of the well so hot, by electrical means, that the material will melt and coalesce.

Flotation Machine—No. 1,361,342. I. R. Margetts and William Fagergren, Salt Lake City, Utah. A mechanically agitated machine with a horizontal impeller.

Technical Papers

First Aid—The U. S. Public Health Service, Washington, D. C., has published *Miscellaneous Publication No. 21*, entitled, "What to Do in Accidents," which may be obtained on request. This is an excellent, illustrated pamphlet of sixty-one pages which all of our readers should have. Accidental injuries of all kinds are covered, and the best treatment, in the absence of a physician, is described. A favorite home remedy is hydrogen peroxide. Concerning this the book says: "The practice of applying hydrogen peroxide to fresh wounds is not recommended. . . . It causes a great deal of pain, wets the wound and is not an efficient germicide." Tincture of iodine is much to be preferred.

Western Australia—The annual progress report of the Geological Survey of Western Australia for 1919 has been received. Copies may be obtained by addressing the Survey at Beaufort St., Perth, Western Australia. The book gives the results of the year's field operations and reviews the mineral industry of the state. A large map, 22 x 32 in., is included.

Idaho Copper Deposits—Bulletin No. 1 has just been issued by the Idaho Bureau of Mines and Geology. It is devoted chiefly to the geology and copper deposits of the Seven Devils district, Idaho, which extends for a distance of 120 miles along the Snake River in the western part of the state. The publication also contains brief descriptions of the Heath, Hornet Creek, Hoodoo, and Deer Creek districts. The bulletin is of 101 pages, and contains numerous maps and illustrations. Copies may be obtained free from Francis A. Thomson, Moscow, Idaho.

Miners' Almanac—The Bureau of Mines has been issuing a miners' safety and health almanac for the last three years, and the 1921 issue is now available at 5c. from the Superintendent of Documents, Washington, D. C. Every man employed in the mining industry should be familiar with facts given in this forty-eight-page book. General managers and those directing the labor at mine and mill will make no mistake in placing a copy in the hands of each of their employees.

Tripoli — U. S. Bureau of Mines *Reports of Investigations* No. 2,190, (Washington, D. C., free on request) describes the mining and preparation of tripoli and diatomaceous earth. The massive form is chiefly used for filters, and the ground tripoli as a mild abrasive, as a parting sand, and as a filler for paint and rubber. A bibliography is included.

Gypsum—"Gypsum in 1919," fifteen pages (a section of "Mineral Resources"), has been published and the pamphlet may be obtained on request from the U. S. Geological Survey, Washington, D. C.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Drill Steel Failures To Be Studied By Bureau of Mines

Urgent Call for Data and Points Worth Investigation Issued by B. F. Tillson—To Meet on Feb. 16

Rock-drill makers, mine operators, drill-steel metallurgists, and all others interested in the breakage of drill steel are urged to co-operate with the U. S. Bureau of Mines and Benjamin F. Tillson, of the New Jersey Zinc Co., Franklin, N. J., by preparing such data and information as they may have on any or all of the points in the following tentative outline:

1. Study of the steels which give the greatest service before failure by breakage of drill steel.
   A. Nature of section. B. Composition.
2. Maximum and minimum service which might be expected. A. Life of steel. B. Methods of heat treatment.
3. Mechanism of failure.
   A. Micro-analysis. B. Nature of stresses. C. Detection of incipient failures—(1) Magnetic analysis. (2) Other methods not destructive of steel. D. Is failure due to fatigue of metal?
4. Methods and machine development for accelerated tests.
   A. Nature of forces involved—(1) Impact. (2) Vibrating compressural waves. (3) Combined bending and vibratory.
5. Correlation of field tests and accelerated laboratory tests.
6. Reclamation of depreciated drill steels.
   A. Before failure. B. After failure. C. Methods of heating.—(1) Oil-fired furnaces. (2) Electric furnaces—a. Resistance, Carbon, Ni-chrome; b. Induction, high frequency, low frequency. (3) Ohmic resistance methods. D. Welding of fractured steels—a. Electric; b. forge.

Conclusion: Presentation of conclusion in form understandable by men in field and development of instruction for best handling and treatment of steels, if different from methods standard now.

Mr. Tillson has been asked to co-operate with the U. S. Bureau of Mines in that investigation and has tentatively arranged for a meeting of those specially interested at the coming annual meeting of the American Institute of Mining Engineers in New York City on Feb. 16. He would like to obtain papers giving definite data which have been collected in regard to various points which might be covered by this investigation, for presentation at this time and to hold a round-table discussion of such information and proposed plans for prosecuting this work. The reader is urged to write to Mr. Tillson giving views and suggestions for elaborating this outline and to indicate what information he has available to present in February at the organization meeting. Replies should be addressed to Benjamin F. Tillson, assistant superintendent, New Jersey Zinc Co., Franklin, N. J.

Public Works Department Not Needed

Same Duties Now Performed More Efficiently and Satisfactorily—Engineer Corps Defended

Many arguments against a national Department of Public Works, with concrete illustrations of its faulty functioning if put into practice, are brought forward by Lieut.-Col. C. O. Sherill in the course of his recent discussion of the Jones-Reavis Bill (S-2232, H.R.—6649).[1]

After setting forth in their own words the arguments advanced by the propagandists of the Public Works Department Association he summarizes the objections submitted by the Chamber of Commerce of the United States. Briefly these are:

A. The proposal is too vague and indefinite for adoption.

B. Careful examination of the governmental functions for which existing Federal departments were created should furnish the basis of a logical reorganization, but the present bill has not this virtue.

C. The inefficiency of the existing arrangement of engineering and constructing services has not been proved.

D. Economy would not be promoted, but expenditures would be increased, each bureau of the proposed new department striving to build up a large clerical organization for itself.

E. "Public Works Department" at best would be a misnomer, as the United States does not have important public works of the kind described by the propagandists, sufficient to warrant setting up a new department for them. "This department suggests strongly public ownership and operation of utilities not now apparent."

F. The governmental departments can secure competent engineering services in other and more appropriate ways.

G. Governmental organization must be functional. Engineering is not a function but a branch of technique of governmental functions.

H. Many special objections will arise due to concentration of engineering work to be done for other departments.

Colonel Sherill points out that the advocates of the bill have lost sight of the two fundamentally distinct classes of engineering and construction work carried on by the Government: (1) For the public-at-large, being the principal business of the bureau and the reason for its existence, and (2) engineering and construction activities merely incidental to the primary functions of the bureau or the department. Therefore, the bill makes illogical and inconsistent groupings of bureaus.

They also fail to realize that Government departments and bureaus are created solely to carry out some essential governmental function for the benefit of the whole people. The construction of engineering works is never a function of but merely one among many means employed by the executive departments in carrying out their proper functions. Every one of the departments and nearly all the bureaus and commissions perform engineering and construction, legal, commercial, educational, and research work; all are part of the machinery essential to carrying out their purposes, and of which they must have control. Were, for example, the classes of construction work needed by the different departments to be secured through an entirely independent outside department such as this Public Works Department it would be almost impossible to secure its accomplishment, owing to interminable referring, re-referring, annoying delays, and interferences of many kinds. Before a "cantonment would be built . . . the war would be over or the battalion out of the service due to exposure."

The attack by the engineers of the association on the Corps of Engineers, U. S. Army, naturally strikes Lieutenant Sherill as being of questionable ethics as well as wholly unjustifiable from any point of view. He believes that "no possible rearrangement of Government functions can ever do more than to secure a similar high quality of service from Government officials, commissioned or civilian."

He concludes that "there should be no Department of Public Works created as a new department or out of the Department of the Interior; that there is a possible necessity of a general reorganization of the Government departments as a whole, but that any such reorganization should be based on governmental functions rather than on engineering technique; that the Corps of Engineers should continue, as in the past, to be charged with the execution of public works of construction to the fullest possible extent, in the interest of honesty, economy, and preparedness."

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[1] See *Engineering News Record*, Dec. 30, 1920, p. 1273-1276.

MEN YOU SHOULD KNOW ABOUT

W. A. Harrod, mining engineer, formerly with the Consolidated Arizona Smelting Co., was in New York recently.

Donald F. Irvin, metallurgical engineer, of San Francisco, Cal., sails from New Orleans, La., on Feb. 9, for South America.

Eugene Stebinger has tendered his resignation as a geologist of the U. S. Geological Survey. It will become effective Jan. 31.

A. R. Martinez, of the Mexican Geological Survey, is studying the methods of the U. S. Geological Survey, and particularly those used in petrographic research.

James Frame, mining engineer, has gone to Chalchihuites, Zacatecas, Mexico, to examine several silver properties near there. He expects to be absent from his Boston office until Feb. 1.

Arthur W. Burgren, mining engineer, assistant superintendent of the Dolores mine, American Smelting & Refining Co., Matehuala, S. L. P., Mexico, who has been at Oakland, Cal., has gone to Knights Ferry, Cal.

C. H. Macnutt has resigned the resident management of the Black Lake Asbestos & Chrome Co., Ltd., to take charge of the Vimy Ridge property of the Bennett-Martin Asbestos & Chrome Mines, Ltd., Coleraine, Que., Canada.

William T. Curley, assistant superintendent for the Oliver Iron Mining Co. in the Chisholm, Minn., district, will leave soon for Brazil to be employed at the Morro da Mina manganese property, recently acquired by the U. S. Steel Corporation.

H. C. Boydell, mining engineer, who has spent the last fifteen months at the Massachusetts Institute of Technology in a study of mineral deposits, was in New York City recently on his way to Greece and Macedonia, where he will do some professional work.

W. M. Weigel, recently superintendent of the smelting department of the Missouri Cobalt Co., Fredericktown, Mo., has resigned to become a mineral technologist with the Bureau of Mines. Mr. Weigel will be at the bureau's Sourthern station, with headquarters at Tuscaloosa, Ala.

A. E. Drucker, professor of metallurgy in the Wisconsin State Mining School, has resigned that position to become associate professor of mining in the department of mining engineering of the University of Illinois. Professor Drucker's new appointment at Urbana, Ill., is scheduled to take effect on Feb. 1.

Sir Robert Hadfield, chairman and managing director of Hadfield's Steel Foundry Co., Ltd., Sheffield, England, has been awarded the John Fritz gold medal for notable scientific and industrial achievement. He is the inventor and developer of manganese steel and other special steels. The award of the medal to Sir Robert was announced on Jan. 22.

R. E. Collom has been appointed state oil and gas supervisor of California to fill the position made vacant by the resignation of R. P. McLaughlin on Jan. 1, 1921. Mr. Collom was U. S. Deputy Supervisor for California in the administration of oil and gas regulations under the Federal leasing act of Feb. 25, 1920, when called to re-enter the state's service.

A. W. Allen, for some time metallurgical editor of the *Engineering and Mining Journal*, and recently in charge of extensive and successful research work by important American interests in developing a commercial process for the recovery of Chilean nitrate from low-grade caliche, has become Associate Editor of the *Mining & Scientific Press*, of San Francisco.

A. W. ALLEN

It is a pleasure to express to the *Journal's* contemporary on the Coast our felicitations on the coming of Mr. Allen to its staff, and also to extend to a much [illegible] former associate a welcome upon his return to the sphere of technical journalism.

SOCIETY MEETINGS ANNOUNCED

The Annual Meeting of A. I. M. E. will be held Feb. 14 to Feb. 17 inclusive in the Engineering Societies Building, 29 W. 39th St., New York City. The Institute of Metals Division hotel headquarters will be at Hotel Seville, Madison Ave and 29th St., as last year. Registration will begin at 9 a.m. Feb. 14 at Institute headquarters. The program includes: On Feb. 14, 2 p.m., simultaneous sessions on mining and milling, non-ferrous metallurgy, nonmetallic minerals; dinners for Iron and Steel Committee at Engineers' Club, Executive Committee of Institute of Metals at Chemists' Club, Committee on Industrial Relations at Engineers' Club; smoker in headquarters auditorium at 8:30 p.m. On Feb. 15 the annual business meeting will be held at 10 a.m.; at 10:30 come simultaneous sessions on "Rehabilitation of French Coal Mines" (illustrated), "Iron and Steel" and "Institute of Metals." The old and new directors will lunch at the Engineers' Club, and the board will meet at 1:30 p.m. in Room 903. At 2 p.m. come sessions on "Coal," "Iron and Steel" and "Industrial Relations." The Committee on Petroleum and Gas will dine at Engineers' Club. At 8:30 entertainment and dancing at headquarters. On Feb. 16 at 10 a.m. simultaneously welfare films; session on "Petroleum and Gas"; annual reports of industrial relations sub-committees; and discussion of proposed research on drill steel (Room 903). At 2 p.m. come films on asbestos and sulphur mining; continuation of drill steel research discussion; A. I. E. E. Mines Committee meets with A. I. M. E. Mining Equipment Committee. The reception to the old and the new president at the Waldorf-Astoria (6:45 p.m.) precedes the annual banquet there (7:15 p.m.). Feb. 17 forenoon will be devoted to the museums at American Geographical Society quadrangle.

Tickets to the banquet ($5) will be issued in order of mailing of payment as indicated by postmark. Reservations and checks should be sent payable to Donald M. Liddell, chairman, Room 330, 2 Rector St., New York City. Applications for hotel accommodations should be made to Wilber Judson, Room 1507, 14 Wall St., New York City.

OBITUARY

Hugh N. Camp, Jr., 150 W. 59th St., New York City, vice president and treasurer of the St. Joseph Lead Co., died in that city on Jan. 17 at the age of fifty-three. Mr. Camp had been long associated with the company and one of its trustees since 1904.

Capt. Richard J. Mitchell, general superintendent of the Oliver Iron Mining Co., in the Eveleth, Minn., district, died Jan. 12, 1921, as the result of an injury to his shoulder and side sustained some months previously. Capt. Mitchell was born in Vermont on May 22, 1857, and had been connected with the Oliver Iron Mining Co. or its predecessor since 1893, when he removed to Hibbing, Minn.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

Sale of Alice Gold & Silver Co. to Anaconda Annulled

Lower Courts Reversed—Price Paid Declared Inadequate—95 Per Cent of Stock Held by Defendant

The sale of the Alice Gold & Silver Mining Co. to the Anaconda Copper Mining Co. was set aside on Jan. 24 by the U. S. Supreme Court on the ground that the price paid was inadequate. The court, however, sustained the right of the majority of Alice stockholders to sell to Anaconda. When the latter acquired the Alice property in 1911, suit to annul the sale was brought by minority stockholders represented by Peter Geddes, Joseph R. Walker and Joseph S. Bear. The district and circuit courts affirmed the sale, however, and appeal was made to the Supreme Court. The purchase was effected through the transfer by Anaconda of $1,500,000 of its own stock for the Alice holdings. The court based its decision on the findings in lower courts that this price was inadequate and said that the fact that no bid was received at a public offering was not evidence that a sale could not have been made at a higher figure.

John D. Ryan, chairman of the Anaconda board, said that the decision was of little importance as 95 per cent of Alice stock was owned by the Anaconda company.

Miami Copper Flotation Hearing Held in Wilmington

A hearing was held before Judge Morris on a supplemental bill and answer on Jan. 17, in the U. S. District Court, at Wilmington, Del., through which bill it was sought by Minerals Separation, Ltd., to have Minerals Separation North American Corporation brought into the Minerals Separation, Ltd., vs. Miami Copper Co. suit. After each side had introduced evidence—consisting of the examination of one witness, and the introduction of several exhibits (documents) — adjournment was taken until Feb. 21, at which time the case will be argued.

Tomboy To Cut Wages

The Tomboy Gold Mines Co., Ltd., has filed notice with the Colorado Industrial Commission that it will reduce the wages of its employees 50c. per day beginning Feb. 15, 1921. The Tomboy is the seventh company to file such a notice with the commission.

WEEKLY RÉSUMÉ

Iron mines of the Gogebic Range, in northern Michigan, are beginning to reflect the dullness in the steel trade, and a general cut in wages is expected. Further curtailment and wage reductions are reported from various points. Operators in Colorado will cut wages 50c. on Feb. 15. Anaconda has shut down its ferromanganese plant at Great Falls following the closing of the Emma mine. The proposed reduction in freight rates on Plumas County (Cal.) ore shipped to Wabuska, Nev., is being opposed by the Western Pacific. On the other hand, the Santa Fe has made a more favorable rate on low-grade Chino ores between Santa Rita and Hurley, N. M. In Colorado, a bill that will greatly increase mine taxation is before the Legislature. Furthermore, permission is sought by the Colorado Power Co. to make effective at once increased rates asked some time ago, pending final decision. In Nevada, some resentment has been aroused among mine operators by propaganda unjustly belittling the amount paid in taxes by mining companies. In Montana, the customary annual bill for taxing all copper produced has been introduced at Helena. In South Dakota, the Homestake Mining Co. has broken ground for a new mill. At Wilmington, a further hearing in the Miami flotation litigation was held during the week. Some damage was caused at Pachuca, Mex., when the failure of a dam flooded the lower sections of the camp.

At Washington, the recent hearing on the metal schedule before the House Ways and Means Committee attracted many desirous of being heard. The bill to liberalize the War Minerals Relief Act has been reported favorably to the House. The McFadden Bill has been endorsed by the California Legislature.

Mines in Mohave County, Ariz., To Cut Wages

On Jan. 12 a meeting of mine operators and merchants of Mohave County, Ariz., was held at Kingman for the purpose of discussing a proposed reduction in the existing wage scale. As a result Oatman mines will make a general reduction of $1 per day on Feb. 15. Other properties will make the same reduction on Feb. 1. Living costs for the miner have been materially decreased in this section, and it was the sense of the meeting that as much publicity be given to this phase as possible.

American Smelting Directors Reply to Karl Eilers

Defend Management of Company, Calling Charges Unjust—Influence of Guggenheims Eulogized

In sending out the notice of the next annual meeting of stockholders to be held April 6, the management of the American Smelting & Refining Co. accompanies the customary call for proxies with a statement on behalf of the directors replying to the charges of mismanagement recently made by Karl Eilers. In appending this statement, Simon Guggenheim, president, says:

"I desire to add (in reference to the criticism made of my stock holdings) that my wife and myself own stock in the company of the par value of over $2,800,000, and bonds to the extent of $300,000—a total of over $3,000,000."

The directors' statement is given in part as follows:

"The attack is made by Mr. Karl Eilers, who is asking proxies for himself and a single associate, which will give them power to elect the entire board of directors. In effect, the request is for a blanket authorization to Mr. Eilers to create an entirely new organization, subject to his sole domination.

"In December last, Mr. Eilers started his campaign for stockholders' votes by bringing a wholly unnecessary and unjustifiable suit against the company for a writ of mandamus to permit him to examine the stock books. . . While the court promptly denied the writ and dismissed the petition, after the matter was heard, the apparent object was accomplished, namely, wide newspaper publicity to the various charges of misconduct or mismanagement which he had injected into his petition. These charges he could not be called upon to prove in the application heard by the court, and they could only be met by a denial and answer on the part of the company setting forth the facts.

"The suggestion or intimation (it is not definitely charged) that the Messrs. Guggenheim, or some of them, have been overpaid by the company or have received large salaries is utterly without foundation. Aside from the president, no member of the Guggenheim family now receives any salary whatever, or has received a salary since January, 1919. The salary received by the president is less by $10,000 than Mr. Eilers enjoyed at the time of his discharge. The salaries paid in former years to such of the Messrs. Guggenheim as held office in the company were always less than salaries paid at the same time to other officers. Such salaries as they did receive were reduced on their own motion in times of financial stringency. The Messrs. Guggenheim never participated in any of the bonuses paid to all other employees and officers, including Mr. Eilers.

"The falsity of the charge that the company was not permitted to acquire a certain Bolivian tin property examined by it because it was wanted by Guggenheim Brothers, who did acquire it, is shown by the simple fact that no tin or other property ever considered or examined by the company has been acquired by the Guggenheims.

"With reference to the Premier gold mining property: So far from the company having been forced to give up to Guggenheim Brothers one-half of its option on a quarter interest in the property, the company solicited the firm named to take a half of its option off its hands, for the reason that, while it was willing to take a chance on a one-eighth interest, it wanted for financial reasons to limit its investment and its risk to that amount.

"The charges which have to do with the marketing of copper (the word 'gambling' is used) are incorrect, misleading and grossly unjust. . . .

"Any losses in marketing copper were not due to any change of policy, but were the inevitable outcome of the sales agency arrangement under the abnormal and unexpected conditions created by the war. The basic vice of the sales agency as developed by war conditions was the pro-rata feature, under which this company could only sell its copper in the same proportion that the mining companies sold their copper. This feature the mining companies, though repeatedly urged by this company, would never consent to forego. In justice to the mining companies, their right to this provision could not be questioned; in justice to the smelting company, the effect of that provision could only be avoided by the termination of the agency.

"At the start of the agency, the mining companies (Utah, Ray, Chino, Nevada Consolidated, and much later Braden, Kennecott, Cerro de Pasco, and Chile) were all new and small mines, and the amount of copper belonging to this company constituted a large percentage of the total copper in the agency. The mining companies in the agency have since become among the largest producers in the world, and by the time the war broke out, the proportion of the copper in the agency owned by this company (notwithstanding it had also increased) was only about one-fifth of the total amount available for sale. The smelting company was under contract obligation to sell to the best advantage. Obviously, the opinion of the owners of four-fifths of the copper should control the policy of selling, or the smelting company might be the subject of a heavy claim for damage.

"The mining companies, having only the cost of production, wished to withhold from sale on a dull market, and to sell largely when the price met their opinion of the future.

"The smelting company sought, not to make a profit in the buying and selling of copper, but to make its profit out of smelting and refining, and was anxious to sell its copper at the price it paid for it in the ore.

"Gradually, the mining companies came to think that the smelting company's interest in selling its own copper might unfavorably affect the smelting company's attitude in seeking to get the best price.

"On the other hand, the smelting company felt that it was often unable to sell its own copper because the mining companies took a different view of the future of the market, and also often because in dull periods the market would not consume the total amount of copper controlled by the agency.

"As the result of this duality of interest, it became necessary to terminate the agency. As a matter of fact, of their own motion, some of the most important members of the agency themselves took the initiative and withdrew because of a conviction that the conflict of interest above described could not be avoided. The decision to terminate the agency, as to the remaining members, was reached by the entire board (excluding the Guggenheims) after careful and prolonged study.

"The undersigned wish to emphasize that every member of the Guggenheim family studiously avoided influencing the opinion of the remaining directors, refrained from the expression of any opinion, and absented themselves from the meeting at which the question was decided, in order that no charge of a conflict of interest on their part could possibly be made."

Colorado A. I. M. E. Elects

The Colorado Section of the American Institute of Mining and Metallurgical Engineers has elected the following officers for the ensuing year: Richard A. Parker, chairman; F. C. Gilbert, vice-chairman; H. F. Lunt, secretary-treasurer; R. W. Gordon and R. M. Henderson, members of the executive comittee.

Colorado Mining Association Chooses Officers

At the annual joint meeting of the Colorado Metal Mining Association and the Colorado Chapter of the American Mining Congress the association elected officers for the ensuing year as follows: George M. Taylor, president; Jesse F. McDonald, R. M. Henderson and Bulkeley Wells, vice-presidents; A. M. Collins, treasurer, and M. B. Tomblin, secretary. The new officers of the Colorado Chapter of the American Mining Congress are: George E. Collins, governor; J. F. Welborn, Charles A. Chase and George A. Stahl, vice-governors; A. M. Collins, treasurer, and M. B. Tomblin, secretary.

Conditions in Soviet Russia Described From Berlin

Available Evidence Confirms Worst Apprehensions—Lack of Transportation Paralyzing—No Gold for Purchases

From Our Berlin Correspondent

The conditions in Soviet Russia are an enigma even to her immediate neighbors. Most of what transpires from Russia appears in the form of rumors, and is very contradictory. Fugitives report disastrous conditions, which remind of countries on the lowest stage of civilization. Soviet emissaries on the other side are eager to spready rosy views. Of Russian newspapers very few find their way abroad, and as they are edited under the strict control of the Bolshevist authorities, their contents are highly flavored. Still they form the only source of reliable news, as verbal reports can rarely be trusted. Besides, it seems unnecessary to dig deeper for news, because what the Bolshevist newspapers are allowed to print is sufficient to confirm the worst apprehensions of the country's interior conditions. They are chaotic, and only a slight pretense of order is maintained. The Bolshevist government has made strong efforts, with surprising energy from the side of the leaders, to effect improvements, but it is easy to recognize that instead of progress the process of dissolution is continuing.

This view is upheld by no less an authority than a number of German radical leaders, who have visited Russia, on the invitation of the Bolshevist government and who have been given an opportunity to look up a party of some hundred German workmen which had volunteered to work in Russia, more than a year ago. These workmen, themselves of decided communistic leanings, who therefore can be said to be unbiased witnesses, have transmitted tales of strongest disappointment and misery. Their enthusiasm and hopefulness have suffered a complete reverse, and they are unanimous in the opinion that the country is utterly and hopelessly ruined.

Manufacturers and dealers all over the world will do well to keep these facts in view, specially as during the last months rumors have been spread of enormous orders for manufactured articles which are said to have been placed in Germany and elsewhere. It is a fact that several emissaries from Russia have visited Continental countries and negotiated with manufacturers for the purchase of machines of all descriptions and finished products, some orders having even been given, and alluring pictures drawn of further orders which were to follow. None of these orders, however, have been executed, because they all suffered shipwreck when it came to the point of settling the mode of payment. Russian buyers, when entering into negotiations, always hold out that payment will be made in gold, but when it comes to making definite arrangements, they have to confess the absolute impossibility of doing so, and they propose to pay by raw products, of which they say they have enormous quantities in store, which only need shipment. Manufacturers in Continental Europe have, however, become very sceptic toward such tales. A number of German manufacturers have even been invited to Russia to inspect stores of raw products, but came back entirely unconvinced. Such stores of merchandise which Russia could spare for furnishing against foreign purchases are widely scattered over the country, with no possibility within sight of shipping them to the frontier.

TRANSPORTATION INSUFFICIENT FOR FOOD AND FUEL DISTRIBUTION

Transportation in Russia is even unable to cope with the most stringent requirements of the distribution of food and fuel within the country. Regular goods traffic there is none. The railroads are in a state of decay; fuel and rolling stock are lacking everywhere. Over 80 per cent of existing engines are out of repair, and they have lately been put out of use at the rate of 200 a month. Repairs are carried out in a slipshod manner, as time is pressing. The same applies to cars. Visitors to Russia are struck with the number of cars out of repair or completely wrecked which are clogging the side tracks of the stations. The decay of the roadbeds is continually progressing, and the railroad bridges are in an appalling condition. As no rails are produced, repairs of the metallic bed are made by taking rails from side tracks and even from main lines. The mileage of roadbeds in service is therefore steadily decreasing. Over 2,000 miles of track were thus broken up in 1919 for repair purposes. On account of bad fuel and inferior repair of engines, the latter cannot produce sufficient steam. Even passenger trains travel at a speed of from four to nine miles per hour only.

The Bolshevist government is fully aware that before an improvement of the country's economic conditions can take place, transportation must be improved. For this reason they, a while ago, formed groups of engineering works, mostly engine and car factories, called "Advance Groups," which receive special attention in the matter of supplies of raw material, fuel, and food for the workmen. One of these groups comprises the largest and best developed mills, locomotive and car works, namely, the locomotive factories in Sormorow, Kolomna, and Brjansk, steel mills in Wyksa, and the wagon works in Twer and Moscow.

EFFORTS TO PROVIDE ROLLING STOCK BEAR LITTLE FRUIT

This group of works has been given a specific task to perform in the way of construction of rolling stock. Reports on the result of the work of the first half year have lately been made public, which showed that this task, although very modest, has not been nearly completed. The works in Sormorow, for instance, were directed to produce within six months eight new engines, thirty extensive engine repairs, and a specified number of duplicate parts. These works, which employ 8,500 workmen, performed the following work: New engines, none; repairs, fourteen, and roughly 80 per cent of the duplicate parts.

The works in Kolomna, employing 4,100 workmen, were asked to produce six new engines in six months, ten narrow-gage engines, and eighteen repairs. The result was: One new main line engine, five narrow-gage engines, and five repairs. This factory produced in pre-war times thirty engines a month. The Moscow wagon works, employing 2,500 workmen in 1914, produced per half year in peace time 1,500 trucks, reserve parts for another 1,200, 150 new passenger cars, 120 street railway cars, and sixteen motor cars. The works management states the present output of the last half year to have been 120 trucks and no passenger cars. As to snow plows, which in pre-war times were a specialty made in large numbers, the management of these works says that preparations for their manufacture have been completed and "one snow plow is actually in the state of assembling."

INADEQUATE FUEL, SCARCITY OF LABOR, AND INEFFICIENCY RESPONSIBLE FOR RESULTS

All managers' reports are unanimous in their opinion that inadequate supplies of fuel, lack of workmen, and the latter's inefficiency are responsible for the poor results. The works in Moscow are furnished only with a poor sort of lignite; pit coal is not obtainable even for these works which have the special attention of the country's rulers. It is significant that it has been impossible to procure for the works mentioned above the requisite number of workmen, which was to be 50,000. The actual number of workmen employed at these works was 18,000. It is said that none of the laborers work full time, the actual working hours having been only 60 per cent of the regulation time. One works manager states that the output per man per working day equals the output of 1½ hours of the pre-war standard.

The same deplorable conditions prevail in water transport. The complete fleet of barges for petroleum traffic on the Volga consists now of only 190 units, which is insignificant, considering that, in pre-war times, from 900 to 1,000 of such vessels were constantly moored in the harbor of Nishni-Novgorod only.

Reports from other manufacturing works show that the diminishing of the number of productive workers in Russia in general. From labor statistics recently published it is seen that in thirty-five government districts 6,090 factories, employing 1,250,000 workmen, were running in 1918. In 1920 only 5,800 of these works, employing 860,000 workmen were in business. The decrease of the number of workmen was from 26 to 42 per cent inside of two years, whereby it is to be considered that the factories have lost nearly 75 per cent of their workmen since 1918. The most strenuous efforts of the Bolshevist government to increase the army of workmen, even the strong compulsion which is exercised, are without effect. Most of the workmen have hired themselves to peasants, or have become administrative officials, of which there exist now one for every six of the population.

It is an open secret that the Bolshevist leaders have long become conscious of the utter failure of their methods. This recognition does not find expression in public, but is proved by certain measures which have been taken lately. One of them is a bill recently passed regulating the conditions under which foreign private capital and enterprise is admitted in the country. The object of this bill is stated to be the improvement of the country's production and it creates facilities in the form of concessions for foreign business men individually or organized in companies. Holders of such concessions shall have the right to export part of their production. They shall receive privileges if they introduce such new methods which will raise the production.

Such concessions will be given for a long period, and the Soviet government gives a guarantee not to interfere with them in any way, either by nationalization or confiscation. The Soviet government is trying to give this matter wide publicity, in order to attract capital and enterprise from all sides, but the opinion of Continental business men is so far highly unfavorable toward the scheme. Foreign capitalists and business men lured into embarking in the scheme are believed to take a heavy risk, as the Soviet government is hardly able to observe its guarantee, even if it were willing to do so.

Southwest Purchasing Agents Meet at Bisbee

An interesting meeting of the purchasing agents of the various copper mines and smelters in the Southwest was held at Bisbee, Ariz., at the Copper Queen Hotel, Jan. 14 and 15. Much valuable information was exchanged in regard to questions pertaining to the purchase of supplies and to the handling of stocks now on hand. Addresses were made by several of the managers. It is probable that a permanent organization will be effected.

Bill Introduced To Tax Copper Produced in Montana

The usual measure which bobs up with every session of the Montana Legislature showed its head again recently at Helena, when a measure was introduced to place a tax of one cent a pound on copper produced in Montana. The Montana Mining Association anounced that it would join with the companies in fighting the bill. The measure is regarded as having slight chances for enactment.

Taxation Propaganda in Nevada Held Unjust by Mining Men

Mines Paid $17,000 Last Year, According to Governor; Nearer $120,000, Say Operators

There is considerable feeling of injustice among mine operators of the state of Nevada over certain propaganda now being circulated and published throughout the state regarding comparative taxes paid by the mining industry on the one hand and the agricultural, manufacturing and railroad interests on the other. In the *Reno Gazette* of Jan. 10 Governor Boyle, who is head of the State Tax Commission, is credited with stating before a meeting of the stockmen that he believes "the taxes on mines last year amounted to about $17,000, or about 7 per cent. This year they will I believe pay slightly under 7 per cent of the total roll." That the statement is in error and decidedly misleading is shown in a table prepared and published by the *Tonopah Miner* in its issue of Jan. 15 which shows very approximately the amount of taxes paid by the five principal mining companies of the Tonopah district. The companies included are the Tonopah Belmont, Tonopah Extension, West End, Tonopah Mining and MacNamara, and the amount is for 1920 taxes. For these companies taxes on plant and improvements are given as $48,359.72, and bullion tax as $47,854.27, total tax being $96,213.99. It is estimated that, taking into consideration the smaller companies, total taxes in this district alone would be $120,000 per year.

The official figures of the State Tax Commission show a total assessed valuation of mines during 1919 as $15,984,187, or 8.061 per cent of the total assessed valuation in the state. It is estimated by the *Tonopah Miner* that the total taxes paid by the mines of the state will amount to about $535,470, and that of this sum $107,174, went into the state treasury.

This apparent discrimination against the mining industry in Nevada is viewed with concern by mine owners, as it is a well-known fact that costs of operation have, in most districts, offset any increase in value of product; and in many districts reduction in value of product has caused partial or complete suspension of operations until either costs of operation are reduced or value of product increased. It is quite possible that any increase in taxation on the mines of Nevada would result in decreased tax receipts from that source, on account of the shutting down of mines that would ensue.

Dam Breaks Above Pachuca, Damaging Properties

A number of people were drowned and others were injured at Pachuca, Mexico, on Jan. 18, when two dams above the city broke and the water swept through the lower sections of the mining camp.

Homestake Mining Co. Breaks Ground for New Mill

Ground is being broken for the new treatment plant to be erected at Lead, S.D., by the Homestake Mining Co. The new mill will be equipped with heavy duty stamps and ball mills and will have a capacity of 2,000 tons daily. The stamps to be used will be heavier than those now dropping and when installed the company will have a daily milling capacity of about 7,000 tons.

At present operations are nearly at full capacity and the present year's bullion recovery will exceed that for the past two years. The new hoist has been set in position at the Ellison shaft but it will require some time to cut skip pockets at the different levels and make other necessary changes to equip shaft with skips. In all probability the new electric installation will be ready for use this coming summer.

Thomas F. Ward Reported Frozen to Death in Alaska

Thomas F. Ward, president and general manager of the Ward Copper Co., was found frozen to death a few miles from Teller, Alaska, Jan. 12, according to a press dispatch from Nome dated Jan. 19.

According to the report, Mr. Ward left the company's mining camp in the inner Seward Peninsula with an Eskimo man and woman and two dog teams en route to Teller, a reindeer station on Grantley Harbor. After reaching the top of the divide above Teller the three became lost in the darkness. The Eskimos said they decided to go back to a cabin they had seen, but Ward proceeded alone.

The Ward Copper Co., of Teller, has been working a high-grade copper property on Kougrak Mountain, 50 miles inland from Port Clarence Bay, its shipping point. The deposit was discovered in 1904 by Mr. Ward, and the company was organized in 1918.

Mr. Ward left Seattle for Teller on June 2 last. During May he called at the offices of the *Engineering and Mining Journal* and outlined his plans for developing the property. He intended working eight men this winter and to purchase a hoist at Nome. The company has a New York office at 41 Broadway.

A New Use for Airplanes

Further use of airplanes is to be made in the effort to solve the smoke problem at Salt Lake City. Among the theories advanced as to why coal smoke in the Salt Lake City area does not diffuse rapidly was that gases from nearby smelters formed into strata in the upper air, through which the coal smoke did not penetrate readily. Tests of the air above the city by airplane have produced no evidence to support that theory. Airplanes are now to be used to watch the effect of wind on fog and cloud banks in nearby valleys. The Bureau of Mines is co-operating in this work.

Would Triple Tax on Mining in Colorado

Tax Commission's Bill Now Before State Legislature—Support Expected from Farmers

To increase the tax on producing mines three times the present rate and to leave to the assessor and the Tax Commission unrestricted power to fix the valuation, for taxation purposes, of non-producing mines and claims, is the purpose of a bill sponsored by the Colorado Tax Commission and now pending before the legislature.

An effort to have the bill initiated at the November election was defeated, but the Tax Commission will endeavor to secure its passage during the present session, hoping to enlist support of farming districts' representatives.

The present law provides that the valuation of producing mines (a producing mine is defined as one making a gross output of $5,000 or more annually) shall be fixed at one-fourth of the gross output, providing that the net does not exceed that amount, in which event the net becomes the valuation for that year. Non-producing mines and claims are valued and assessed as other property.

Bendigo Amalgamated May Enter Rubber Industry

Arthur Moline, general manager of Bendigo Amalgamated Goldfields, Victoria, Australia, is in New York on business for the company. According to Mr. Moline Bendigo Amalgamated, which is operating a group of thirty-eight mines, has been financially successful during the last two years after a very difficult period in 1917-1919. In round figures the company has paid £44,000 in the first dividend; it has established a reserve fund of £50,000 and in addition has decided to branch out on new lines, for which it possesses £100,000.

Having regard to the uncertain outlook for gold mining and to the fact that industrial conditions at Bendigo are satisfactory, the directors decided to embark on another industry to be run in conjunction with mining, either by a separate company or otherwise, as circumstances might determine. After reviewing the whole position they selected the rubber industry as being the most attractive. Mr. Moline has come to this country to seek information on this matter, to purchase plant and select technical assistance.

Nevada Mine Operators Elect

At the annual meeting of the Nevada Mine Operators Association, held in Reno on Jan. 10, the following officers were elected: President, Frederic Bradshaw; first vice-president, John G. Kirchen; second vice-president, W. P. Larsh; secretary-treasurer, Henry M. Rives; executive committee, Frederic Bradshaw, John G. Kirchen, W. P. Larsh, E. A. Julian, W. H. Blackburn, Roy H. Elliott and Arthur Lawry.

Colorado Power Co. Seeks Relief in Emergency

Seeks To Put Proposed Increased Rates into Effect at Once Pending Commission's Decision

On Dec. 20, 1919, the Colorado Power Co. made application to the Public Utilities Commission for permission to make a twenty per cent increase in rates for power from its transmission lines serving the principal mining districts of the state. The company was ordered by the Commission to submit under direction of its engineers, a full and complete inventory and appraisement of its physical property as of Jan. 1, 1920, located in Colorado. In the meantime no increase was anthorized.

The company was given until May 17, 1920, to complete its appraisement and later the date was extended to November 17. In October, 1920, the power company filed its inventory and appraisement made by its engineers together with a supplementary petition asking for a 40 per cent increase, instead of 20 as in the original petition. Upon verification of the inventory of the power company, by the engineers of the Utility Commission, a hearing will be held and a final determination of rates will be made which in the opinion of the Commission, will render a fair return upon the appraised value of the property. This hearing, it is believed, will be held some time in March of the present year.

Recently the power company made application for an immediate hearing upon the supplementary petition, asking for emergency relief, and that it be permitted to charge and collect the increased rate pending the final hearing. With the application the company tendered a bond, in an amount to be determined by the Commission, conditioned upon the final determination of rates by the Commission, and guaranteeing the refund of excess rates, if any, to the users when the final rate is fixed by the Commission.

The petition stated that according to the inventory and valuation report on file it was shown that the present rates do not yield a just and reasonable rate of interest upon the value of the property and that the increase asked for would not yield a net revenue in excess of 6 per cent on the appraised value of the property.

Notice has been sent to power users by the Commission, advising them of the application, and numerous protests have been filed by power users. It is generally believed that action on the supplementary petition will be deferred until the final hearing in March.

McFadden Bill Endorsed

A resolution endorsing the McFadden Gold Bonus Bill was adopted by the California Legislature on Jan. 20.

Cie. du Boleo, Baja California, produced 1,014,160 lb. copper in December against 771,680 in November.

Colorado Operators To Reduce Wages in Fortnight

Notice of a 50-cent decrease in wages, effective Feb. 15, has been filed with the Colorado Industrial Commission by the principal mining companies of the state. The Colorado wage scale varies in the several districts, the minimum for machine men ranging from $5 to $5.50 per day, and hand men from $4 to $4.50. No trouble is anticipated in any part of the state.

The low price for metals and the distressing conditions affecting the metal mining industry have resulted in the closing down of several of the largest mining enterprises in Colorado during the past sixty days.

Among the mines where production has ceased during the last two months, is the Vanadium Corporation of America, employing 400 men, the Sunnyside Mining & Milling Co., employing 500 men, the Standard Chemical Co., employing 300 men, and the Wellington mine, employing 150 men.

According to the report of the U. S. Geological Survey, the number of producing mines in the state has declined from 852 in 1916 to 288 in 1920.

British Columbia's Mine Output Increased in Value in 1920

In the official review and estimate of British Columbia's mineral production in 1920, just issued by William Sloan, Minister of Mines, is given the following table comparing the output of the various mineral products in 1920 with that of the previous year:

MINERAL PRODUCTION OF BRITISH COLUMBIA FOR TWO YEARS, 1919–20

	Production, 1919		Estimated Production, 1920			
	Quantity	Value	Quantity	Value	Increase	Decrease
Gold, placer, oz	14,325	$286,500	13,500	$265,000	....	$21,500
Gold, lode, oz	152,426	3,150,645	118,176	2,442,698	....	707,947
Total gold	....	$3,437,145	....	$2,707,698	....	,$729,447
Silver, oz	3,403,119	3,592,673	3,404,926	3,265,324	....	327,349
Copper, lb	42,459,339	7,939,896	42,773,660	7,485,390	....	454,506
Lead, lb	29,475,968	1,526,855	21,545,047	1,540,471	$13,616	....
Zinc, lb	56,737,651	3,540,429	76,765,268	5,143,272	1,602,843	....
Total metalliferous	....	$20,036,998	....	$20,142,155	$105,157	....
Coal, tons, 2,240 lb	2,267,541	$11,337,705	2,712,228	$13,561,140	$2,223,435	....
Coke, tons, 2,240 lb	91,138	637,966	68,190	477,330	....	$160,636
Total collieries	....	$11,975,671		$14,038,470	$2,062,799	.
Miscellaneous and building material	....	$1,283,644	....	$1,400,000	116,356	.. ..
Total production	....	$33,296,313	....	$35,580,625	$2,284,312	..

Cananea Consolidated Down

The shutdown of the Cananea Consolidated Copper Co.'s plant at Cananea, Sonora, was completed Jan. 17. Pumping is being done at the Capote mine. This shaft drains several of the adjacent mines. Pumps at the Cananea-Duluth mine have been pulled and the mine allowed to fill. This is a hard rock mine and no damage can result. The power house is being operated and will supply the town with lights and power for the Capote pumps. The city water plant at Oja de Agua is being run. Several excursion trains have been run from Cananea to Guaymas via Nogales to accommodate the people who are leaving the town.

Jones & Laughlin Get Breitung Iron Ore Property

Hematite Mine and Adjacent Holdings at Negaunee, Mich., Acquired by Steel Company

The sale of a portion of the Breitung iron mining property at Negaunee, Mich., to the Jones & Laughlin company has been consummated. The consideration was a large one and by the provisions of the contract there is to be a royalty paid the Breitung interests on all the ore mined in future. The principal ore producer is the Breitung Hematite mine, and stock interests in the adjacent Lucky Star, Bunker Hill and Arctic properties were also secured. These properties have prospective value in bessemer-grade ores. The Breitung interests retain the Mary Charlotte mine, located near the Breitung Hematite, and still hold properties at Humboldt, on the Marquette Range, as well as mines in Wisconsin and Minnesota.

Western Pacific R.R. Opposing Freight Cut to Wabuska

The attorneys for the Mason Valley Mines Co. have received notice that the Western Pacific R.R. Co. will file exceptions to the report of the examiner of the Interstate Commerce Commission, which recommends a reduction of rates on ore from Plumas County, Cal., points to Wabuska, Nev., where the Mason Valley smelter is located. The Southern Pacific has indicated its desire and readiness to put into effect at once the rate recommended by the examiner. The attorneys for the Mason Valley Co. have also filed exceptions with the commission to that part of the report having reference to the division of the rate between the Western Pacific and the Indian Valley railroad, the latter being owned by the Engels Copper Co. and running from Paxton on the Western Pacific to Engelmine, a distance of 26 miles.

Calumet & Hecla produced 7,517,712 lb. copper in December (7,326,763 in November). Production by subsidiaries was: Ahmeek, 1,914,500; Allouez, nothing; C. & H., 4,754,000; Centennial, nothing; Isle Royale, 845,800; La Salle and Osceola, nothing; Superior, 3,412; Tamarack and White Pine, nothing.

Effort To Stop Steel Company From Moving Hibbing Fails

The application of H. P. Reed and others of Hibbing, Minn., for a permanent injunction to restrain the Village of Hibbing, the Oliver Iron Mining Co. and the Mesaba Ry. Co. from removing a portion of that village to South Hibbing was recently denied by Judge Freeman of the district court of St. Louis County, Minn. The suit grew out of an attempt of the Oliver Iron Mining Co., with permission of the village officials and others, to buy all the property within certain limits of the village, as the company owned the mineral rights under a part of the original village of Hibbing.

The application alleged that there was a conspiracy among the village officials and the mining and railway companies to acquire the entire retail and shopping district of Hibbing without regard to interests of the community as a whole. Judge Freeman, however, completely vindicated the defendants.

Mexican Mine Fraud Alleged

Charges that parties in authority in Mexico are interested in fraudulent legal proceedings involving title to the Naica mining property in that country, were made by Frank L. Polk, former Under-Secretary of State, in a memorandum filed with the State Department on Jan. 14 in his capacity as counsel for American claimants to the property.

Informal inquiry as to the status of this case was addressed to the Mexican Government by the State Department this week through Chargé Summerlin.

The memorandum asserts that "principal backers" of the Mexican claimant to whom the property has been awarded under a decision of the Mexican Supreme Court, the validity of which is attacked by the American stockholders, are "Roque Estrada, brother of the present Minister of War, the late General Hill, until a few weeks ago Minister of War, and many others."

A. I. M. E. To Organize Section in Northern Minnesota

Organization of a Northern Minnesota Section of the A. I. M. E. has been proposed. A committee composed of W. G. Swart, W. R. Van Slyke, Ralph N. Marble, Carl Zapffe, William Van Evera and Earl E. Hunner has recommended a set of by-laws. There will be three districts of the association, one in Duluth, and one each on the Mesabi and Cuyuna ranges and all members of the Institute are eligible to membership. The officers will be a chairman, two vice-chairmen and secretary-treasurer, these officers to compose the executive committee. It is proposed that the chairman and two vice-chairmen be elected from each of the three main districts and that the expenses of the section, beyond the amounts which may be appropriated by the Institute, shall be met by voluntary subscription, but that no member shall be asked for any subscription exceeding $5 in any one year.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Repeal of Pittman Silver Act Held Unlikely

Effort in This Direction Has Made Scant Headway—Proposal Never Before Committee

Although there is some talk of repealing the Pittman Act providing for the purchase of silver at $1 an ounce to replace the silver dollars broken up during the war, it is very unlikely that any effort to set aside this law will be successful. To start with, the Government is bound morally to sustain this legislation, since the law never could have been placed on the statute books without promise of repurchase at the figure agreed upon at the time. During the negotiations which preceded the enactment of the Pittman Act, some of the senators from silver mining states were of the opinion that the silver reserve could be sold at a higher price than $1 an ounce.

One session of Congress cannot bind another. To a lesser extent one administration cannot bind another, but when a moral obligation is entered into, especially when it is not a partisan obligation, there are few cases in which succeeding Congresses and succeeding administrations have not carried out such an understanding in good faith. The effort thus far to secure the repeal of the Pittman Act has made no headway. The matter was considered by a sub-committee of the Committee on Banking and Currency, but the proposal was dropped and never has come before the full committee.

Metal Men Flock to Washington To Testify at Tariff Hearings Before Ways and Means Committee

House To Get New Bill in April—Revision a Delicate Matter in Time of Business Depression—A. S. & R. Wants Tariff on Tin "for Revenue"

A new tariff bill is to be written for presentation at the forthcoming extra session of Congress. Chairman Fordney of the Ways and Means Committee promises to lay the completed bill before the House of Representatives on or before April 10. Preparatory to writing the bill the committee is conducting public hearings. A very large number of witnesses are being heard.

It is very evident from the testimony thus far presented that one of the basic factors in considering a tariff must be disregarded almost entirely. That is the differences in wage scales and production costs in the United States as compared with those in competing foreign countries. There are so many uncertainties in the situation that it is believed the new rates of duties will be arrived at more or less arbitrarily. This likely will be accompanied by an understanding that the schedules will be subject to frequent amendment as conditions change.

The Republican members of the Ways and Means Committee are keenly alive to the economic and political consequences of tariff revision at a time of business depression. A change in tariff policy is likely to be blamed for effects which may spring from a hundred sources. For that reason unusual care will be exercised to prevent too great a degree of tariff protection. There is no question that the Underwood tariff act will be revised upward to a material extent, but it can be stated with a fair degree of assurance that the expectations of many of those requesting new rates of duty will not be realized.

The Ways and Means Committee has taken a large amount of testimony in connection with the metals schedule. Representatives of the domestic zinc industry asked a duty of 2c. per lb. on ores containing zinc content in excess of 25 per cent. For the ores containing from 10 to 25 per cent of zinc a duty of 1⅜c. per lb. is asked. One of the witnesses was Otto Ruhl, of Joplin, Mo. He testified that the essential factor in the whole situation is the difference in the cost of production in the United States and in Mexico. The zinc producers found it impracticable to compile the costs of the 212 concerns operating in the Missouri-Oklahoma-Kansas district, but did take the costs of eleven representative plants, from which they calculate the basic cost of each ton of concentrates to be between $45 and $50 per ton. The cost to the foreign producer is calculated as being about $24 less.

William Loeb, Jr., of the American Smelting & Refining Co., appeared before the committee in support of a duty of 10c. per lb. on tin in bars, blocks, pigs or other metallic form and a duty of 6c. per lb. on tin in ores. He pointed out that no duty is needed on tin and ores for protection purposes, due to the absence of tin deposits in the United States which can be worked commercially. He suggested the duty, however, as a source of revenue. The rates of duty which he proposed will have a revenue yield of $12,000,000 per annum, he estimated. This protection, Mr. Loeb testified, will enable American tin producers to compete on equal terms for tin ores from Bolivia, the one source of supply now available and free. He said it would enable American interests to trade a larger Bolivian output and a consequent increased production of domestic refined tin. He also called attention to the fact it would aid in an effort to enter the Chinese field with the view of opening another source of supply of raw material.

E. H. Wolff, president of the American Zinc Institute, called the attention of the committee to the fact that the zinc industry in the United States is experiencing the worst period of depression in its history. A continuation of the present conditions, he said, would work irreparable injury to the industry. He said that the European smelters have recovered from the effects of the war and that 100,000 tons of slab and sheet zinc are on hand in Europe. The present American cost of production, he declared, is higher than the market price of the metal.

The American Brass and Copper Statistical Exchange submitted a list of proposed rates on brass and copper products. The duties ranged from 1½c. per lb. on copper wire to 14¾c. on brass, angles and channels. The argument in favor of this duty was made by Edward H. Binns, of New York.

A duty of 50c. per lb. on quicksilver was suggested by H. P. Baker, general manager of the New Idria Quicksilver Co., which produces one third of the American output. This duty would amount to $38 a flask on imported mercury. He pointed out that last year over 16,000 flasks of quicksilver were imported. Of these 5,700 came from Italy, where the cost of production is much lower than it is in the United States.

Herbert W. Smith, chief of the tariff division of the American Mining Congress, told the committee that there are sixteen mineral industries which are requesting protection by tariff. Nine of these minerals are now on the free list.

Clinton H. Crane, president of the St. Joseph Lead Co., testified that the costs to his company for placing lead on the New York market, including depreciation, depletion and 6 per cent on invested capital, aggregated $6.80 per 100 lb. He recommended a specific duty on lead in ore, in dross, in bullion, pigs, bars and matte, as well as the lead in copper regulus, in sheets and pipes and that imported as old and scrap. He said he would leave it to the committee to determine the proper rate of duty, but declared that the present ad valorem duty is most unsatisfactory in its method of working. Jerome J. Day, representing the lead producers in the Cœur D'Alene district, asked for a specific duty on lead of not less than 2c. per lb. A similar rate was asked by Ernest Bamberger, representing the lead ore producers of Utah.

Clifton Taylor, of the Molybdenum Corporation of America, requested a duty of 50c. per lb. on molybdenum and $1 a pound on ferromolybdenum. Arthur V. Davis, of the Aluminum Co. of America, requested the restoration of the Payne-Aldrich rate of 7c. per lb. on aluminum.

Amendment to Zinc Tariff Bill Introduced

An amendment to the pending zinc tariff bill has been introduced by Senator Spencer of Missouri. His amendment provides a duty of one and one-half cents per pound on the metallic zinc content of ore containing more than 10 per cent and less than 25 per cent of zinc. Upon all ores and drosses containing more than 25 per cent of zinc, the metallic zinc content is to be dutiable at two cents per pound. Ore containing less than 10 per cent of zinc is to be imported free of duty. Zinc in blocks, pigs, slabs and old is to be dutiable at two and three-fourths cents per pound. Zinc oxide is to pay two and three-fourths cents per pound, while zinc in sheets, plates, strips or in manufactured form and zinc dust are to be dutiable at three and three-fourths cents per pound.

Report on Mining Law Revision Expected Soon

H. Foster Bain, the acting director of the Bureau of Mines, states that a final report will be forthcoming in the very near future in the matter of the revision of the mining laws. A committee headed by W. R. Ingalls has gone into the matter exhaustively and is expected to submit a final report shortly.

Assistant Director of Bureau On Western Trip

E. A. Holbrook, assistant director of the Bureau of Mines, is making an inspection trip which will include several of the Western experiment stations. He attended the dedication of the new Reno station on Jan. 21. He will be present at a meeting of Western experiment station superintendents with representatives of co-operating colleges. In addition, he will make some first-hand observations as to the operating phases of the Mineral Leasing Act regulations.

Bill To Liberalize Relief Act Reported Favorably to House

Consideration Unlikely at This Session —Secretary Payne Opposed

The bill intended to liberalize the War Minerals Relief Act, which passed the Senate May 31, 1920, has been reported favorably to the House of Representatives by its Committee on Mines and Mining. The bill was reported in exactly the same language as contained in the Senate bill. An unsuccessful effort was made to pass the bill by unanimous consent. To secure its consideration at this session of Congress will require a special rule. It is very doubtful if such a rule can be secured. In all probability the legislation will die with the session on March 4.

Any amplification of the War Minerals Relief Act is opposed by the Secretary of the Interior. If there is any additional legislation at all it is his opinion that it should be confined to the questions of law surrounding the "request or demand" and the "purchase price" features of the existing act. The opinion of Secretary Payne in this connection was given in response to a specific request on the part of Representative Rhodes, the chairman of the Committee on Mines and Mining of the House. H. R. 13,091 is now on the House calendar. Secretary Payne opposes H. R. 13,091 on the ground that it is too broad and would permit of a re-examination of all claims by the Court of Claims. It would not be wise, he says, or necessary to pass this bill.

Awards to the amount of $6,946.90 were recommended by the War Minerals Relief Commission during the week ended Jan. 15. The awards recommended were: Orren Osborne, tungsten, $887, 21 per cent; Parsons & Carter, chrome, $430.87, 63 per cent; Kerley, Van Winkle & Heinick, chrome, $2,249.22, 52 per cent; Kerley, Van Winkle & Heinick, chrome, $745.29, 29 cent cent; Rose, Kerley, Van Winkle & Heinick, chrome, $2,311.85, 39 per cent. In addition, the claim of Virgil V. Anderson, which had been disallowed, was reconsidered and an award of $322.67 recommended. That amount was 85 per cent of the amount claimed.

During the week ended Jan. 8: A. Hyde, chrome, $2,910.65, 58 per cent; G. J. and W. D. Fuller, manganese, $831.95, 47 per cent; Talbott, Byrne & Wayne, chrome, $234.25, 29 per cent; W. J. Overbeck, manganese, $1,036.69, 55 per cent. The claim of Gustave T. Pinson was reviewed and an additional $415.85 was allowed him.

The Senate has agreed to a resolution introduced by Senator Robinson, of Arkansas, calling upon the War Minerals Relief Commission to furnish the following information: A complete list of all claims filed or presented under the War Minerals Relief Act; a list of all claims allowed; a list of all claims disallowed, and a list of all the legal opinions which have been rendered in connection with the act.

NEWS BY MINING DISTRICTS

Special London Letter

Foreign Office Vetoes Spitsbergen Scheme—Barnatos Reported Seeking Interest in National Mining Corporation

By W. A. Doman

London, Jan. 11—Some time ago I reported that negotiations were in progress for the transfer of the control of the Northern Exploration Syndicate, which owns iron, coal and marble properties in Spitsbergen, to a foreign corporation. Mr. Salisbury-Jones, who was the prime mover in this business, had arranged to obtain an option on shares to be pooled, the idea being that persons pooling would net something like £2 per share on the scheme arriving at fruition. It was believed at the time, though of course it did not appear, that Herr Hugo Stinnes was at the back of the purchasing company. Considerable disappointment has now been caused by the refusal of the British Foreign Office to allow the deal to be consummated, the reason given being that it would be inimical to the interests of Great Britain. The delay in vetoing the scheme has caused a good deal of comment, and in some quarters in the city it is held that the Foreign Office has "crabbed" a fine deal. Presumably the British government is aware of the actual facts of the position, for it seldom interferes in matters of this kind. From the £3 or £4 which the shares of the Northern Exploration Syndicate reached several months ago they have fallen to about 5s. nominal. The decline is not wholly the result of government action; it began last year when experts reported adversely concerning the existence and quality of the iron ore, of which such a splash was made at the flotation of the company.

An interesting rumor is current concerning the National Mining Corporation. For some time it has been under a cloud, mainly, it would appear, owing to the fact that some of the properties in which it has invested capital are still in the development stage. It possesses so powerful a backing that many speculators bought the shares heavily in the belief that they would enjoy a substantial rise. This did not materialize, as all mining and kindred shares have been out of favor, and there was talk of wiping out the liability of 10s. a share. Now it is said that the firm of Barnato is endeavoring to secure a big holding in the National Mining Corporation. The companies that formed it took up £1,000,000 and Barnatos were not included. This latter is the richest mining firm in the city, and is always credited with maintaining a very substantial liquid position, ready for any contingency or opportunity. Its activities embrace the Johannesburg Consolidated Investment Co., various subsidiary gold mining companies, the De Beers, the Premier, Jagersfontein Diamond Mines and the Diamond Syndicate, to say nothing of industrial ventures. One of the mines under its control, the New State Areas, in the Far Eastern Rand, has just struck the reef in a shaft at a depth of 3,578 ft. The assay was disappointing, both in regard to width and value, the former being only 6 in. and the latter 1 dwt. This does not repeat the concern's former experience with Van Ryn Deep and Government Gold Mining Areas. The shaft, however, touches only a pin point so far as the size of the property is concerned.

Some of the Nigerian tin-mining companies have certainly fallen upon evil days. The Northern Nigeria (Bauchi) company was at one time regarded as one of the best concerns operating on the plateau. Owing to financial reasons it is in such low water that the possibility of reconstruction with a 5s. liability has reduced both the preference and ordinary shares to a merely nominal value. Another company, the Jantar, is in need of funds, and the shares are suffering in consequence.

CANADA

British Columbia

Premier May Build Aerial Tramway—Bunker Hill Action Cheers Kootenay Shippers

Squamash—Preparations are being made by the Tatlayoco Lake Gold Mines, Ltd., to install a 100-ton mill. The ore contains gold, silver, antimony and arsenic.

Vancouver—The manager of the Hedley Gold Mines, Ltd., stated recently that if economic conditions permit the Nickel Plate mine will be reopened within three months.

Stewart—It is reported to be a possibility that an 11-mile aerial tramway will be constructed from the Premier mine, Salmon River, to tidewater to take care of the transportation problem facing the management of the Premier Gold Mining Co. To keep the road open is said to be proving too costly and constant a task. The drop between No. 2 tunnel, where shipments originate, and Stewart is about 1,400 ft., of which 900 ft. occurs in the first three miles.

Alice Arm—The Dolly Varden mine has closed down temporarily owing to a heavy snowfall which shut down the railroad.

Sandon—Milling was stopped at Silversmith mill about Jan. 15 owing to water shortage and market outlook. About forty men will be kept on development work during the winter. Over 400 tons of silver-lead concentrates are on hand and a much larger quantity of zinc concentrates.

New Denver—Milling operations have been suspended at the Rosebery-Surprise mill which ran last season entirely on the product of the Bosun mine, between New Denver and Silverton. The Surprise mine, at Sandon, has continued inactive since the start of labor troubles in the Slocan last spring, as have also Canadian and Ivanhoe groups.

Kaslo—The only mining activity of any consequence being carried on this winter along the South Fork of Kaslo Creek is at Silver Bell and Silver Bear groups. A resumption of operations at Revenue group, also on the South Fork, is looked for in the spring. Affairs of Gibson Mining Co., Ltd., which have been in a chaotic condition following protracted litigation, have been placed in the hands of a liquidator, James H. Doyle, sheriff of South Kootenay.

Ainsworth—Mining operations at the Florence mine, Princess Creek, are very largely in the hands of lessees at the present time, five different sets being engaged.

Nelson—Dismay of silver-lead producers of West Kootenay at the condition of affairs brought about by the virtual refusal of the Consolidated smelter at Trail to handle any more custom ore for the time being, and upward revision of freight rates on ore shipped from this side to smelters in the United States, is tempered somewhat by announcement that Bunker Hill & Sullivan Mining & Concentrating Co. has at last secured a through freight rate on ores and concentrate from British Columbia points to the Bunker Hill smelter at Kellogg, Idaho. Rates from Slocan points are given as \$6.90 per ton on ore running up to \$50; \$8.10 per ton on ore valued at between \$50 and \$75; \$10 per ton on ore valued at between \$75 and \$100. The Bunker Hill management is prepared to pay cash for such product as proves acceptable, instead of effecting a temporary settlement by means of warehouse receipts, the method now followed by the Consolidated smelter at Trail.

Ontario

Drilling Near Timmins Stopped—Davidson Consolidated To Be Sold

Porcupine—The English interests which were diamond drilling on the sand plains southwest of Timmins have stopped for the winter. Several thousand feet of drilling was done. The claims on which this work is being done are in a direct line with the McIntyre vein systems, but are covered with about 100 ft. of sand overburden.

At a meeting of the shareholders of the Davidson Consolidated on Jan. 17, it was decided to sell the property to an English syndicate. The latter has purchased 1,000,000 shares of treasury stock at 75c per share and will buy the outstanding stock held by shareholders at $1.18 per share. The mine will be reopened March 1 with ample funds to carry on work and erect a 500-ton mill.

Toronto—Mining men are keenly interested in a proposed change in the mining regulations, which would permit the time spent in road cutting and trail-making to render their properties accessible to count on their assessment duties. It is pointed out that during the last two years the government has given very little assistance in road making, which has mainly had to be done by the mining men at the season of the year when they should be working on their claims. A strong case is made out for the change in connection with the building of the Boston-Creek-Skead road, built to reduce the haul to the railway by 12 miles. The work was done entirely by prospectors and miners on account of the delay by the government in providing badly-needed road facilities.

Cobalt—The McKinley Darragh has been closed. The company has a considerable portion of its surplus tied up in silver bullion, which it has not sold.

It is understood that the recent developments on the Ontario-Kirkland have shown two years' ore supply for a 60-ton mill. It is expected that construction work will be started on the mill in the spring.

MEXICO

Durango

Decreased Export Tax on Silver Encouraging—Wages and Prices Coming Down—No Further Shutdown

Durango—The Federal government has lowered the export taxes on metals materially, and as a consequence the mines that were holding on have continued operations. Under the new decree the tax will be 1 per cent when silver is over 60c. and not exceeding 70c. per ounce in New York, and when less than 60c. in New York there is to be no tax whatever. When silver is between 70 and 80c. the tax will be 1½ per cent; between 80 and 90c., 2 per cent; over 90c. and under $1, 7 per cent; over $1 and under $1.10, 8 per cent; over $1.10 and under $1.20, 9 per cent; over $1.20 and under $1.30, 10 per cent, and so on up to 12 per cent when silver is above $1.40.

The workmen are also realizing the difficulty of the present situation in the mining field, and seem willing to accept a reduction in wages. This reduction is accepted by labor more particularly because at this season of the year in Mexico and for the next three or four months there is no other field of activity for the common laborer, as the crops have been gathered.

The effect of the general reduction of prices is now just beginning to be felt in this district. Lumber and some other construction materials have dropped, but not to the extent to which similar materials are reported to have fallen in the United States. Dynamite, caps and fuse have not yet reacted. The small miner is waiting and the companies are running along from hand to mouth on all classes of supplies.

According to information at hand there have been no further shutdowns during the last two weeks, but, at the same time, there is no report of any of those closed at the end of last year opening up. Notices have been sent out to some of their clients by the Minerales y Metales Co. that they will open their smelter at Torreon some time in February, but a fixed date has not been set. This notice, with the continuance of operations at Asarco, Dgo., of the American Smelters plant, has given encouragement. Unless something more than is at present apparent develops the mines now working will keep on, and within a few months those that have closed down will resume.

The temporary panic in Mexico City and the short run on the banks there had practically no effect here whatever. There are no organized banks in Durango, and as the banking business is distributed among the stronger commercial houses of the city there was no occasion for alarm at this capital. Each mining company of importance has its own financial agent in the capital, and as all the important commercial houses do their own banking business the funds available and usable are so widely distributed that no outside panic can make more than the merest ripple on the surface of general business at this center.

To sum up, the present situation is one of hope. Most mining men do not expect any great change in metal prices to occur soon, and so have gone to work to do the best they can as things are.

Coahuila

Minerales y Metales To Reopen Torreon Smelter

Torreon—Practically all of the mines in this district which are resuming operations are doing so with a 30 per cent reduction of wages to miners and a general curtailment of overhead expenses. Managers and office men are accepting a reduction in salaries. Preparations are being made to blow in all of the furnaces of the Torreon smelter on or about the first of the month and the company will shortly resume the purchase of ores.

Saltillo—La Esperanza Mining Co. at the last meeting of stockholders resolved to issue 50,000 new assessable shares, the maximum assessment to be six cents per month each. The present members of the company will be given 45 days in which to subscribe for this new issue and in the event it is not all subscribed for by them the remainder will be placed on the market to the general public.

Sonora

Cananea—A reduction of 20 per cent has been made in the rate of pay at the property of the Calumet & Sonora Mining Co. This was effective Jan. 15.

CALIFORNIA

Pacific Coast Borax Co. Shuts Death Valley Plant Down

Eureka—Positive assurance that a large electro-smelting plant is to be established shortly at Trinidad, together with large hydro-electric plants at Ishi Pishi Falls and below Orleans, has been received from the Electric Metals Co. of San Francisco. With the water power it is proposed to generate electricity, which is primarily for the purpose of transmission to the Port of Trinidad, there to be used in the electrometallurgical industry. The sale of power, should the demand arise, is also a possibility, but it is not the intention of the company to engage in the commercial power business.

Amador City—The mill at the Bunker Hill mine, near Amador City, resumed operating this month, after nearly a year's cessation of work.

Greenwood—The Grit company on Jan. 14 settled with W. A. Buckman, the owner of the mine, for the first payment becoming due in April. The next payment of $7,500 will fall due Nov. 1.

Angels Camp—Work is going on actively at the Toll Gate mine, formerly the Port Arthur. The three-stamp mill is ready for operation. New buildings have been completed.

Death Valley—The mines and calcining plant of the Pacific Coast Borax Co. in Death Valley have been closed down. Increased freight rates to eastern points is given as the cause. Over 150 men were laid off. The company's product was marketed under the famous "Twenty-mule Team" trademark.

NEVADA

New Company To Take Over Clifford Mine Near Tonopah

Arrowhead—The Arrowhead Mining Co. reports that the face of the west drift on the third level, which is 267 ft. below the collar on the incline, shows 2 ft. of high-grade ore and 6 ft. of milling ore. The shaft is now down 50 ft. below water level and, after a little more development is done on the third level, it is planned to sink to the fourth level and drift.

Clifford.—Preliminary negotiations toward selling the Clifford mine to New York interests have been completed. This mine is situated at Clifford, about 40 miles east of Tonopah, and has been worked intermittently in a small way since 1905. Total production is about half a million dollars in gold, all of which was in high-grade ore. There is said to be much ore of milling grade in sight, besides good chances of high-grade as the deepest workings are only 200 ft. down. The company to be organized will be known as the Clifford Silver Mines Corporation, and it is expected that a leasing system will be adopted until plans for development and mill construction are completed.

Pioche—Ore shipments from the Pioche district from Jan. 6 to Jan. 12

were above the average, owing to increased tonnage from the Prince and the Virginia Louise. Shippers were: Prince Cons., 1,350 tons; Virginia Louise, 850; Bristol, 315; Black Metals, 105 and Battles-Smith Bristol Lease, 40.

There are over forty men on the payroll of the Prince Consolidated and no wage cut is anticipated.

Tonopah—In the Tonopah Extension the McCane shaft has reached a depth corresponding to the 1440 level of the Victor. Crosscutting will soon be started from the 1880 level of the Victor. This is the deepest working in the Tonopah District. Development totaled 271 ft. for the last week.

The West End reports no new developments of importance from either the West End or Ohio shaft. A connection has been made from the 800 level in Tonopah "76" territory to the Monarch Pittsburg 600 level. This will improve ventilation in both mines.

Divide—The Tonopah Divide reports no change in the southeast drifts on the 800 and 1,000 levels. Daily shipments of 50 tons of ore of a grade said to exceed $30 per ton are being made to the Belmont mill in Tonopah.

In the Rosetta, in the southeast portion of the district, encouraging values have been found on the 300 level. Two drifts are being driven in opposite directions from the main crosscut and spots containing high grade values have been encountered.

Ely—The payroll of Nevada Consolidated for December, 1920, was approximately $265,000. Of this $95,000 was paid out at the mines and $170,000 at mill and smelter. This is about 20 per cent below the average payroll six months ago. At present there is about 2,600 tons of blister copper stocked at the smelter.

Consolidated Coppermines has suspended operations at Kimberley and cut the force to a care-taking basis. However, only a small crew has been working and the suspension affected only fifty men working at Pilot Knob.

Local men have taken over the old Wildwest mine in the Spruce mountain district. About 90,000 tons of ore are reported to be blocked out. There is a mill on the property.

ARIZONA

C. & A. Completes Diamond Drill Work at Bisbee

Bisbee—The Boras Leasing Co. has finished sinking its shaft from the 600 to the 700 level. Sinking was started Dec. 27 and completed Jan. 14. The station is now being cut and after completion the 700 level will be extended toward the ore-bearing ground on the 600 level.

The Night Hawk Leasing Co. is extending a drift on its 650 level to connect with the Boras company's workings.

N. Beatrand has returned to Bisbee after completing several diamond drill holes at the Calumet & Arizona Mining Co.'s Eighty-five mine at Lordsburg, N. M. The C. & A. company has for the present completed its diamond drilling campaign at Bisbee, which has extended over a period of five years and comprises 50,000 ft. of hole drilled. Mr. Beatrand has done most of this work under contract.

Johnson—The Keystone Copper Co. started work Jan. 10 after a sixty-day shutdown. All work will be confined to development and erection of the mill.

Dragoon—Los Angeles and New York mining men have taken an option on the Centurion. The first payment has been made and it is reported that a mill will be erected at once.

The Texas-Arizona has cut the ore on the 3rd level and shipments of lead-silver ore will be resumed.

Stockton Hill.—The C.O.D. mill is rapidly near completion. Practically all machinery is on the ground, and construction is well on the way. Present outlook is that treatment will start within sixty days. The old dumps of ore and tailings, comprising about 50,000 tons, will be run through first.

Chloride — The Dardanelles has shipped a 40-ton car from its new 160-ft. level. Development is progressing on this level, and conditions are checking out with showings on the upper level. A raise being driven to the 100 level has opened up ore averaging $40 in gold and silver.

The retimbering and unwatering of the Pay Roll shaft has been completed. Sinking has been resumed. Superintendent Blackwell reports good progress.

Hayden—The Continental Commission Co. is reported to have sold the 79 Mine near Hayden Junction to Hugh H. Hanger, of Washington, D. C., and associates.

NEW MEXICO

Santa Fe Makes Special Rates for Low-Grade Chino Ores

Santa Rita—The Santa Fe railroad has notified the State Corporation Commission that a rate of 12½c. per ton will be made on low-grade ores between Santa Rita and Hurley, N. M. This is in the interest of the Chino Copper Co. and affects ores hauled from mine to concentrator, a distance of 8 miles.

COLORADO

Portland Gold Passes Dividend After Long Unbroken Record

Cripple Creek—The Portland Gold Mining Co. passed its last quarterly dividend after an unbroken record for many years. The reason is the unwillingness of the company to deplete its resources and ore reserves under operating conditions which do not permit it to make a profit.

Telluride—Shipments from Telluride during December were: Smuggler-Union, 59 cars; Tomboy, 48; Liberty Bell, 19; total 126.

Ophir Loop—The Belmont-Wagner Mining Co. has resumed development in the 7 by 7-ft. mill-level tunnel, which will be advanced to the vein to serve for haulage purposes in place of the aërial tram heretofore employed. The work is under John M. Wagner, former manager.

UTAH

Tintic Standard Again Heaviest Shipper from Tintic District

Eureka—Ore shipments from the Tintic district for the week ended Jan. 15 amounted to 184 cars. Shippers were: Tintic Standard, 77 cars; Chief Consolidated, 31; Dragon Consolidated, 16; Iron King, 15; Eagle & Blue Bell, 15; Victoria, 8; Iron Blossom, 7; Swansea, 3; Grand Central, 3; Bullion Beck, 2; Colorado, 2; Eureka Mines, 1; Sunbeam, 1; Centennial-Eureka, 1; Eureka Hill, 1; Ridge & Valley, 1; total 184 cars. The Tintic Standard is again the heaviest shipper. In addition to direct shipping ore, this company is now sending a large tonnage to its new mill.

Park City—Shipments for the week ended Jan. 15 amounted to 1,911 tons as compared with 1,763 tons the week preceding. Shippers were the Judge allied mines, including the Judge, Daly West, Daly, and Park-Utah—806 tons; Ontario, 600; and Silver King Coalition, 500.

MONTANA

Anaconda Shuts Ferromanganese Plant Down—Boston & Montana Mill Under Cover

Butte — Anaconda has suspended operations at its ferromanganese plant at Great Falls, Mont., following its closing down of the Emma mine of the Butte Copper & Zinc Co.

Mining operations have been suspended at the Moulton mine, pending an improvement in the spelter market. This property is owned by the Moulton company, controlled by the W. A. Clark interests.

The Plutus shaft of the Butte & Plutus has been unwatered and will be sunk from a depth of 360 ft. to the 400-ft. where a crosscut will be driven to the Norwich vein, estimated to be about 325 ft. away.

Silver mining in remote districts of Montana, which practically ceased when increased freight rates went into effect, gives promise now of reviving in consequence of all Montana railroads taking action voluntarily to reduce their tariffs on low-grade ores so as to permit small operators and independent producers to make a profit. The reduction in schedules is as high as 20 per cent on intrastate shipments.

Elkhorn District—The Boston & Montana concentrator at the Elkhorn mine is under cover, and the installation of twenty carloads of machinery will begin shortly. Milling equipment consists of gyratory crushers, Hardinge conical ball mills, Wilfley tables and Janney flotation machines. The first section of the mill with a capacity of 50 tons daily will be completed within 60 days, or possibly a month longer. The Hardinge company, of New York, is under contract to equip the plant.

MICHIGAN

The Copper Country

Franklin Shuts Down—Wolverine Plans Exploration Campaign

Houghton—The Seneca has cut the plat at the 6th level and drifting has started in both directions on the lode. All the drifts in the upper levels are in good copper-bearing ground. The 5th level south drift is approaching the Ahmeek boundary. At the Gratiot branch of this property the two raises being put in from the 13th level to the 11th level are giving satisfactory indications of the ground being developed.

The Mayflower Old Colony Copper Co. is continuing its development program. The west crosscut from the south drift is in about 30 ft. but as yet has not encountered the Mayflower lode.

The Osceola Cons. Mining Co. has installed concrete foundations for electric pumps at its North Kearsarge property. This mine, which is not operating, will be kept unwatered with bailers and air-operated pumps until delivery of electric pumps, a matter of sixty or ninety days.

The Quincy Mining Co. has shut down its three-head stamp mill and is treating its total product at the five-head plant. This is a matter of economy.

The management of the Franklin Mining Co. has decided to suspend all operations for an indefinite period. The last ore was shipped to the Point Mills concentrator in May, 1919, since which time all underground work has been confined to exploring the amygdaloid lode. This work was encouraging, but the depressed condition of the metal market together with the high cost of labor and supplies has forced a shutdown. All equipment has been removed from the shafts, and that at mine and mill has been placed in shape for a long period of idleness.

For over sixty years the Franklin has been a producer of copper, with but few periods of inactivity in that time. It has explored and produced copper from various lodes but has always been unfortunate in that the copper contents of its ore has been very low. The future of the property undoubtedly depends on large scale production.

The Mohawk Mining Co. is drifting south on the 25th level of No. 1 shaft. This shaft is operating but one shift per day and will continue on this basis until such time as sufficient men are available to man it completely on a two-shift basis, when drifting will proceed both north and south on all the lower levels. No. 4 shaft has reached a depth equivalent to the 26th level and the plat is being cut. The 16th level plat has been cut in No. 6 shaft. Mohawk is now producing 2,400 tons of ore per day, which is about the capacity of its stamp mill. At the latter plant the mixed pressure turbine takes the exhaust steam from the stamps in both the Mohawk and Wolverine mills. This practice in common with other plants in the country shows a very marked coal saving, especially worth while at this time.

The Wolverine Mining Co. is producing about 900 tons of ore per day. This production will probably remain constant for some time. The management hopes to inaugurate a campaign of systematic exploration in the near future. Several copper formations will be tapped and developed from different levels of No. 4 shaft in the hope of prolonging the life of the property.

Gogebic Range

Mines Reflecting Dullness in Steel Trade

Ironwood—The iron mines are now showing more results of the dullness in the steel trade. The Newport and Anvil mines were shut down the last week of December and were reopened with wage reductions of about 15 per cent for their 1,200 employees besides reducing forces slightly. Other operators are expected to follow suit, and few would be surprised if the U. S. Steel Corporation should also reduce wages before spring. There seems to be no great number of men out of employment, but the labor turn-over has dropped to nearly nothing. At some mines this decrease has been from about 15 or 20 per cent last fall down to 1 or 2 per cent per month at present.

It is reported that to meet operating expenses the Charcoal Iron Co., operating the Yale mine, has negotiated a loan secured by the ore in stock at the mine. The company is preparing to resume work at its mill at Marenisco.

The Ironton mine of the McKinney Steel Co. has laid off about 140 men. It is expected that all the independent operators on the Gogebic Range will reduce forces and cut wages on or before Feb. 1. The Plymouth open pit of Pickands Mather & Co. has already been shut down, the usual winter stripping work being stopped entirely.

No. 10 shaft of the Tilden mine has been put in operation again after a two-months shut down to permit erecting the shaft-house and engine transferred from the Aurora mine. The shaft has also been fitted out with an electric haulage system supplied from a 100-kw. rotary converter in the new engine house. Putting "H" shaft of the Pabst mine into regular operation has been delayed while alterations are being made to the cage. A storage battery locomotive is being tried out there for use on the stockpile trestles.

The E. P. Allis 30 x 72-in. Corliss duplex first motion hoist at the old "A" Norrie engine house is being dismantled and taken to the Ashland mine, where it will be erected at No. 9 shaft. The engine house will also be moved. A motor-driven Prescott high head pump with 6-in. poles is being installed on the 24th level of No. 9 shaft.

Menominee Range

Iron Mountain I. & C. Co. Decides To Build New Furnace

Iron Mountain—The Iron Mountain Iron & Chemical Co. has finally decided to erect a charcoal iron furnace and chemical plant on the property recently purchased here. Delay in starting construction was due to former high costs, but these have decreased so that the company feels it can go ahead on a basis more nearly normal. The furnace will have a capacity of 100 tons of pig iron daily.

Florence—The Florence Iron company has reduced the forces at the Florence and Ernst mines and has laid some off at the Bates, at Iron River, and the Youngs, at Stambaugh. The mines will run throughout the winter.

MINNESOTA

Cuyuna Range

Onahman Iron Co. Reorganized—Stripping Marquette Ore Co.'s Property Progressing Rapidly

Trommald—Rapid progress is being made in stripping the new pit of the Marquette Ore Co. south of town. Hydraulic equipment is being used and, favored with an unusually mild winter, the operators have succeeded in excavating 135,000 cu.yd. since fall. The largest monthly yardage was that of December, 50,000 cu.yd. Ore is exposed for more than 200 ft. along the bottom of the pit and a raise has been started from the bottom of present shaft to come into the pit near the footwall, to be used later as a chute for ore mined in the pit by steam shovel.

Crosby—John A. Savage & Co. has completed the sinking of a 6 x 12-ft. timbered shaft from surface to the 266 ft. level of its Croft Mine. An electric hoist and cage for handling the timber are being installed. This mine is working a full force double shift and will push production throughout the winter. New ore reserves were blocked out by development of the 330 ft. level during 1920, and all ore is now being hoisted from this level.

At a recent meeting of directors of the Onahman Iron Co., former operators of the Ferro and Algoma manganese mines near here, a complete reorganization was effected, W. A. McClaren, Minneapolis, succeeding M. A. Dunning, Duluth, as president. Leases to the two mines formerly operated by the company were allowed to lapse last year through alleged mismanagement. The new directors will endeavor to re-establish the company as a miner and shipper of manganiferous iron ores.

Mesabi Range

Rogers Brown Starts New Shaft at Hibbing

The M. A. Hanna Ore Co. and the Pickands Mather & Co. have announced a reduction of 15 per cent on their mine payrolls at all of their mines to take effect Feb. 1. No other pending cuts have been announced.

Virginia—The Julia mine is working a full crew of men underground and stockpiling is to be continued during the winter.

Hibbing—The Rogers Brown Ore Co. has started to sink its new steel-timbered shaft on the south side of its open pit.

Biwabik — Active operations will start at the Ajax about Feb. 1.

THE MARKET REPORT

Daily Prices of Metals

Jan	Copper, N. Y. net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
20	12.65	31.75	36.50@37.00	4.75@5.00	4.75	5.45
21	12.55	30.00	35.00@35.50	4.75@5.00	4.75	5.40
22	12.55	30.00	34.50@35.00	4.75@5.00	4.75	5.40
24	12.50	29.00	34.00@34.50	4.75@4.90	4.70@4.75	5.30@5.40
25	12.50	28.00	32.50@33.00	4.75@4.90	4.70@4.75	5.25@5.35
26	12.50	28.75	33.50@34.00	4.75@4.90	4.70@4.75	5.25

*These prices correspond to the following quotations for copper, "delivered": 12.90, 12.80, 12.80, 12.75, 12.75 and 12.75c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Jan	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
20	70	70⅛	79	187	191¾	23	23⅜	25	26
21	69¼	69½	79	179½	184½	23¼	23¾	25½	26½
22									
24	67¾	68	78	171½	177¼	23⅛	23½	24¾	26
25	67	67¼	76	164	169¼	23¼	23¾	24¼	25¼
26	68⅛	68½	77	169	175	23⅝	24⅛	24¼	25¼

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Jan.	Sterling Exchange	Silver New York Domestic Origin	Silver New York, Foreign Origin	Silver London	Jan	Sterling Exchange	Silver New York, Domestic Origin	Silver New York Foreign Origin	Silver London
20	377	99½	67⅞	40⅝	24	377	99½	66¾	40
21	376¾	99½	66¾	40	25	379	99½	66¾	39¾
22	376¾	99½	66⅞	39¾	26	381½	99½	66⅞	40

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, Jan. 26, 1921

Conditions continue much depressed in the non-ferrous metal market, with prices declining gradually in the absence of substantial demand. Neither speculative interests nor consumers are buying. Practically all sales at present prices mean sacrifices under cost of production, so that many producers are out of the market. However, there is always some metal in comparatively weak hands, and this is more than sufficient to take care of the demand. Some consumers are still running on stocks which they would ordinarily have had to replenish long ago; others are buying up odd lots of scrap and miscellaneous metal fabricated into munitions.

There is a feeling in the New York market that it is now up to the steel industry to do its bit, and that high prices for iron and steel are having a considerable influence in retarding a resumption of business. The steel industries, of course, do not have to meet foreign competition, and, being in good condition financially, do not seem disposed to cut prices under cost of production. Whether they will later find it advisable to do this as a business stimulant remains to be seen. It is also felt that labor prices must be materially reduced. Failing a reduction in costs or an improvement in consumption, and with the foreign market dominating the non-ferrous metal situation, the only alternative is for a complete shut-down on the part of certain high-cost producers. This is being seriously considered, and the cost of holding an idle property and reassembling an organization is being compared with present operating losses.

No one is counting much on the emergency tariff bill to relieve the situation, and there seems to be considerable doubt as to whether any help can be expected from this source for some months.

Copper

Not in the last year do we recall as little business reported in copper as in the week just passed. The export demand of a few weeks ago has flattened out, and no domestic sales have taken its place. Producers generally continue to ask 13c. delivered for first-quarter business. One or two interests, however, have cut under this, but even at reduced prices no business worth the name is resulting. The prices we quote are therefore largely nominal.

In the advertisement of the Ordnance Salvage Board, on page 27 of the Searchlight Section of this issue, the closing date for the reception of bids is given as Feb. 12. Bids close on Feb. 15. The correction was received after the Searchlight Section had been printed.

Lead

The A. S. & R. official price of 4.75c., New York and St. Louis, continues.

Lead quotations have been firmer than those of any other metal in the last few weeks, but demand is now quiet and restricted to small tonnages, except for one large order which was placed during the week at our average prices. Lead has been freely offered in St. Louis at 4.75c. and probably could be obtained for less.

There is a disposition on the part of sellers of corroding lead to increase the premium for that grade to $4 per ton. Increased costs of production are assigned as the reason. Pure ores are becoming much scarcer, and careful segregation of bullion is necessary. The premium has been $2 until recently, when $3 has been charged in some quarters. The $4 figure would seem to be fully justified.

Zinc

Forced selling on the part of small producers in the Middle West, with no demand to absorb the metal offered, has caused the recession shown in our quotations, and today sales even under 5.25c. are rumored, which we have been unable to confirm. There appears to be little hope of immediate improvement, as galvanizers do not anticipate much demand until steel prices recede further, and the brass industry is finding sufficient scrap available for its needs.

Tin

The London market has been greatly agitated, and apparently some one has been hard hit financially. London interests are actively interested in what American producers and consumers are doing and in their plans for the future.

Bargain prices yesterday tempted a little inquiry on the part of consumers, and some sales were made. It is extremely unlikely that Straits tin will be sold for any length of time at anywhere near current prices. Sellers of futures are now scarce. A fair amount of electrolytic tin has been sold at concessions of a fraction of a cent under Straits.

Straits tin for future delivery: Jan. 20th, 37.25@38.00c.; 21st, 36.00@36.50c.; 22d, 35.50@36.00c.; 24th, 34.50@35.50c.; 25th, 33.00@33.75c.; 26th, 34.50@35.00c.

Arrivals of tin, in long tons: Jan. 24th, Straits, 5; 25th, Hongkong, 25.

Silver

Although the New York market has been quiet of late, prices have been well maintained. Buying inquiry for China account continues small, with the real support for the market coming from India. The London market has fluctuated over a narrow margin, and today's advance to 40d. appears to be a squeeze for spot silver, as the future price for sixty days' delivery is only 38⅞d.

Mexican Dollars.—Jan. 20th, 51½; 21st, 50¾; 22d, 50¾; 24th, 50¾; 25th, 50¾; 26th, 50¾.

Gold

Gold in London: Jan. 20th, 108s. 9d.; 21st, 109s.; 24th, 108s. 6d.; 25th, 107s. 4d.; 26th, 107s. 9d.

Foreign Exchange

On Tuesday, Jan. 25, francs were 6.95c.; lire, 3.58c.; and marks, 1.73c. New York funds in Montreal declined to 12¾ per cent premium.

Other Metals

Aluminum—List prices of 28.3@28.5c. are purely nominal.

Antimony — Chinese and Japanese brands, 5¼@5½c.; market quiet. W.C.C. brand, 6¼@6½c. per lb. Cookson's "C" grade, shipment from England, 9¾c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony[1] (200 mesh), 7@7¼c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 7c.

Bismuth—$2.40 per lb., 500-lb. lots, and $2.42 per lb., 100-lb. lots.

Cadmium—Nominal, $1.40 per lb., in 1,000-lb. lots.

Cobalt—Metal, $4.50 per lb.; black oxide, $3.40 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $325 per oz.

Magnesium — Crude, 99 per cent, $1.35 per lb. f.o.b. Philadelphia.

[1]**Molybdenum** Metal in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Ingot, 43c.; shot, 43c.; electrolytic, 45c., f.o.b. Bayonne, N. J.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $70@$80 per troy oz.

Palladium—$70@$75 per oz.

Platinum—Firm at $70@$75 per oz.

Quicksilver—Nominally $50@$52 per 75-lb. flask. San Francisco wires $50.

[1]**Rhodium**—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 55@60c. per unit, New York. Practically no change on California chrome ore since August; 40@50 per cent can be bought at 50@60c. per unit, f.o.b. cars, California. One party has offered 800 tons of 40@45 per cent at 55c., and has been able to dispose of only 150 tons.

[1]**Manganese Ore**—38@40c. per unit, seaport; chemical ore (MnO_2) $60 per gross ton, lump; $65@$70 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

[1]**Tantalum Ore**—Guaranteed minimum 60 per cent tantalic acid, 40c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¼@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

[1]**Tungsten Ore**—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3.25@$3.50, New York.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Jan. 22—Zinc blende, per ton, high, $33.90; basis 60 per cent zinc, premium, $28.50; Prime Western, $27.50; fines and slimes, $25@$20.

Lead, high, $52.85; basis 80 per cent lead, $50@$51; average settling price, all grades of lead, $48.95 per ton.

Shipments for the week: Blende, 6,562; lead, 796 tons; no calamine. Value, all ores the week, $152,230.

Five buyers in the market last week bought no ore this week, only two of those buying taking an average amount. All others were on short orders. The purchase of 4,500 tons is about 2,000 tons under the production. The Eagle Picher company expects to restrict operations at the Henryetta zinc smelter to two blocks within a fortnight.

Platteville, Wis., Jan. 22—No market for lead or zinc ores. Shipments for the week: Zinc ore, 247 tons. Shipments for the year: Zinc ore, 898 tons; lead ore, 360 tons. Shipped during the week to separating plants, 688 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $2,000@$3,500; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, $23; ground (white), $45; ground (off color) $30@$32 per net ton, less than carload lots, f.o.b. New York. Crude, first grade, $10 per ton, f.o.b. cars, Missouri; floated, $28 per ton in bbls.; $26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis.

Chalk—English, extra light, 5@5½c.; light, 5@6c.; dense, 4½@5c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$12; washed, $12@$15; powdered, $18@$22; bags extra, per net ton, f.o.b. mines, Georgia; crude, $8@$12; ground, $15@$40, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $25@$35; powdered, $30@$35, f.o.b. New York.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $25 per ton, f.o.b. Illinois mines, and $25.50, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, $60; lump, $15, f.o.b. Tonuco, N. M. In Canada 85 per cent calcium fluoride sells for $20 per ton, f.o.b. Madoc; output limited. Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines.

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Fuller's Earth—$16 per ton, carload lots, f.o.b. mines.

Graphite—The 90 per cent crucible grade is held in Alabama for 9c. per lb. and 85 per cent grade, 7@9c. Lubricating grade commanding the best price is a fine flake, passing a 100@120 mesh, and running higher than 96 per cent carbon. Linotype machines use a flake passing 90 mesh and standing on a 120 screen, with 90 per cent carbon, retailing at 75c. to $1 per lb. and selling to jobbers at 11@40c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Dolomite, 1@2 man size, $1.60@$1.65; 2@8 in., $1.55@$1.65 per net ton, f.o.b. Plymouth Meeting, Pa.; fluxing, $1.65@$1.75 per net ton, f.o.b. Howellville, Pa.

Magnesite, Calcined — High - grade caustic calcined, lump form, $35@$40 per ton, carload lots, f.o.b. California points. In Chicago district, $57.70; Atlantic seaboard, $61@$63.

Dead - Burned — $38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 50c.; No. 5, $1.20; No. 4, $2@$3; No. 3, $3.25@$3.50; No. 2, $5.50@$7; No. 1, $8. Clear block: No. 6, 55c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $10; extra large, $25; ground, $60@$150 per ton (depending upon quantity); all f.o.b. New York. Ground mica in Philadelphia, $150 per ton.

[1]**Monazite**—Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $13; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $8.35; 68 per cent, $7.85; 68@66 per cent, $7.60. Finely ground Tennessee rock sells for $8.50 per net ton for 13 per cent phosphorus content, agricultural application; for acid-making, 14 per cent, $9; both prices f.o.b. Centerville, Tenn.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 16½c.; Spanish lump, 14@16c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Sand (Glass)—Dry glass sand, $4 per net ton, f.o.b. cars Mapleton, Pa. Sand, f.o.b. Ottawa, Ill., is $3 per ton; $2.50 on annual contracts. Sand at Klondike, Gray Summit and Pacific, all in Missouri, is $2.50 on contract; some outside sales have been made at $4. St. Louis, open market, at $3.50; contract price on large quantities, $2.50; on small quantities, $3.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $12@$22 per ton; roofing grades, $9.50@$15; rubber grades, $12@$18; all f.o.b. Vermont. California talc, $20@$45, talcum powder grade. Southern talc, powdered, carload lots, $12@$15 per ton; less than carload, $25, f.o.b. cars; freight to New York $5.25 per ton, carload lots; less than carload lots, $9.25. Imported, $40@$50; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 10¾@11c. per lb.; sulphide, powdered, 15@15½c. per lb. in carload lots.

Sodium Nitrate—$2.85@$3 per cwt. ex vessel, Atlantic ports. Market quiet.

Sodium Sulphate—For 95 per cent material, $22 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract.

Potassium Sulphate—Domestic, $220@$230 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrocarbontitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 16@17c. per lb. of chromium contained; 4 to 6 per cent carbon, 17@18c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $110, f.o.b. seaboard bases; resale, $100; English, $110, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $45, f.o.b. furnace.

[1]**Ferromolybdenum**—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2 per lb. of contained metal. f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $55@$60; 50 per cent, $78@$80; 75 per cent, $140@$145.

[1]**Ferrotungsten**—Domestic, 70 to 80 per cent W, 55@60c. per lb. of contained tungsten, f.o.b. works. Foreign, 60c.

Ferro-uranium—35 to 50 per cent U, $7 per lb. of U contained, f.o.b. works.

[1]**Ferrovanadium**—Basis 30 to 40 per cent, $5.75@$6.75 per lb. of V contained, according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York list price, 21½c. per lb.; wire, 15¾.

Lead Sheets—Full lead sheets, 8½c.; cut lead sheets, 8¾c. in quantity, mill lots.

Nickel Silver—33½c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets, 19¾c.; sheathing, 19¾c.; rods, ⅝ to 3 in., 16¾c.

Zinc Sheets—$11.50 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $80 per net ton, shipping point; arches, keys, wedges, $85; splits, soaps, $100.

Fire Brick—First quality, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $45@$50.

Magnesite Brick — 9-in. straights, $100 per net ton; 9-in. arches, wedges and keys, $105; soaps and splits, $120.

Silica Brick—9-in., per 1,000: Chicago district, $65@$70; Birmingham, Ala., $56@$61; Mount Union, Pa., $50@$60.

Iron Trade Review

Pittsburgh, Jan. 25, 1921

The volume of buying in the steel industry has not increased. In addition to new orders there are some "releases" against instructions previously given by buyers to suspend shipments on old orders, but the sum of the two does not altogether equal the exhaustion of old orders.

As is invariably the case in an industrial depression, the amount of shading of steel prices is exaggerated in many rumors. In the main prices are being maintained quite stiffly. The real decline will occur when demand broadens and it becomes worth while to name competitive prices. Then declines will be no secret when they occur.

In the general tone or sentiment there is some improvement, as indicated by the reinstatement of orders here and there that had been suspended indefinitely. An increase in buying is expected by April 1, but no really heavy movement, sufficient to give the steel industry anything like full employment, before September.

Pig Iron—The market has been absolutely stagnant. The majority of merchant furnaces are out, and additional stacks are going out, and there is no tendency for idle stacks to come in. Prices remain quotable at $31.50 for foundry, $32 for bessemer and malleable and $30 for basic, f.o.b. Valley furnaces, freight to Pittsburgh being $1.96.

Semi-finished Steel—Mills are generally quoting $47 on sheet bars and $45 for billets, but these prices are nominal, buyers not being [illegible].

Charcoal and Coke

Charcoal—Willow, [illegible] per lb. in bbls.; hardwood, 5½c. per lb., in 250-lb. bbls. Barrel charge is 35c. additional.

Connellsville—Furnace, $6.25@$7; foundry, $5@$5.50.

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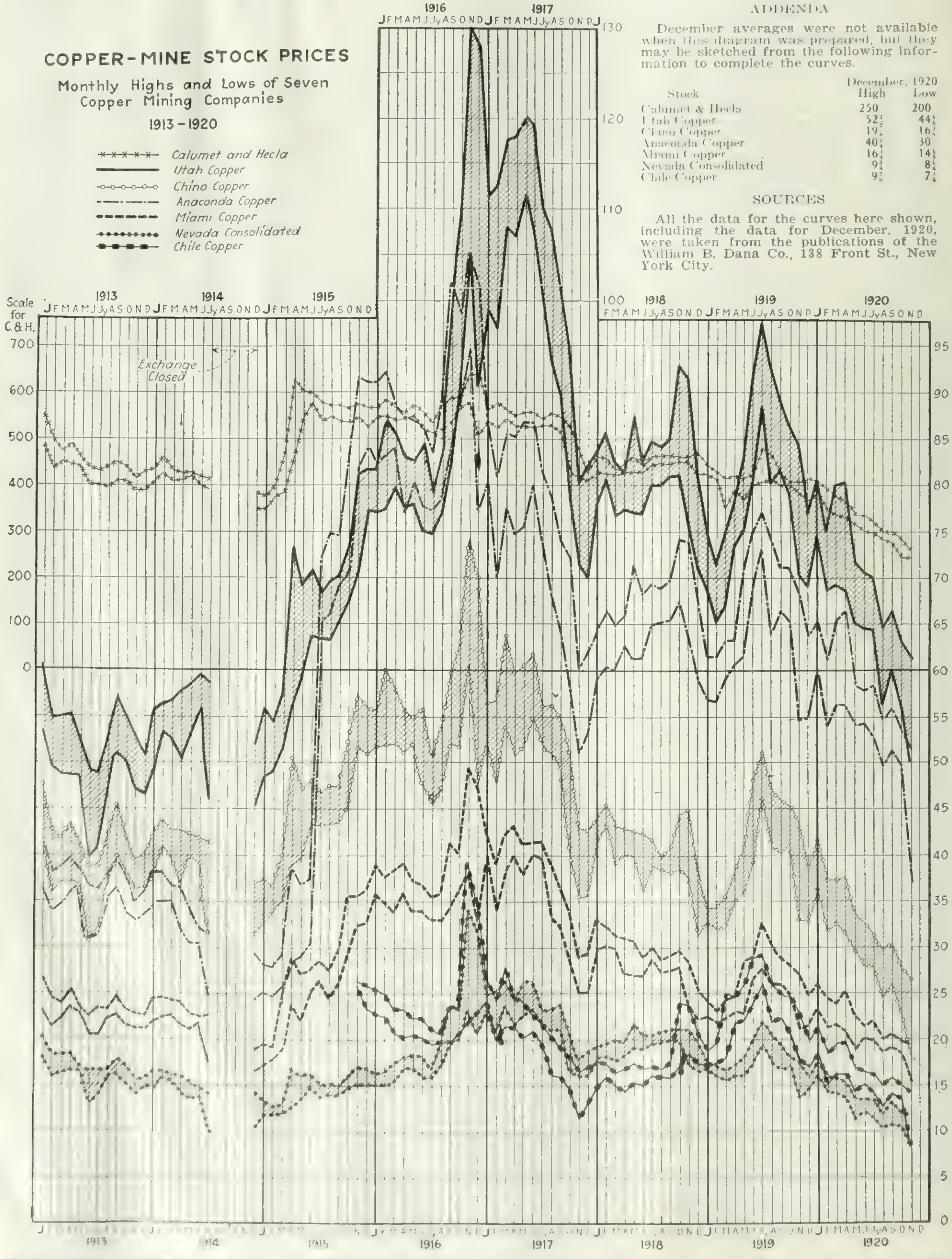
[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Eight Years' Stock Market Fluctuations in Copper Shares



ADDENDA

December averages were not available when this diagram was prepared, but they may be sketched from the following information to complete the curves.

Stock	December, 1920 High	December, 1920 Low
Calumet & Hecla	250	200
Utah Copper	52½	44⅛
Chino Copper	19⅞	16¼
Anaconda Copper	40¼	30
Miami Copper	16¼	14⅛
Nevada Consolidated	9¼	8¼
Chile Copper	9⅞	7¼

SOURCES

All the data for the curves here shown, including the data for December, 1920, were taken from the publications of the William B. Dana Co., 138 Front St., New York City.

The companies represented in the curves shown above include one Michigan producer, one Utah porphyry, two Arizona porphyries, one Montana deep-level, one Nevada porphyry, and one South American producer.

The curves afford interesting comparisons between the different shares. In general, all responded to the same rises and declines. The autumn of 1916 was the peak of the war boom in prices, and the summer of 1919 the peak in the post war rise. Chile Copper Co.'s financial operations did not begin until the latter part of 1915, hence the apparent incompleteness of that curve.

COMPANY REPORTS

Utah-Apex Mining Co.

Zinc, Lead: Utah

The annual report of the Utah-Apex Mining Co., covering operations for the fiscal year ended Aug. 31, 1920, indicates that 109,578 tons of ore was produced, containing 2,731.58 oz. of gold, 352,663.1 oz. of silver, 22,300,652 lb. of lead, 788,142 lb. of copper, and 9,496,169 lb. of zinc. Gross returns amounted to $1,785,177.18 from this production. Profit and loss account follows:

DEBITS

To mining and milling expenses:		
Mining	$538,522.25	
Development	258,085.24	
Milling	73,111.12	
		$869,718.61
To insurance		27,080.80
To general expense, Bingham		39,065.49
To general eastern expense, including salaries, transfer agents' fees, legal and accounting fees, London agency expenses and sundries		36,651.49
To taxes		25,694.63
To depreciation of plant	30,387.69	
To reserve for depletion	63,199.03	
		93,586.72
To litigation expenses		132,479.59
To balance, being profit for year		55,285.51
Total		$1,279,562.84

CREDITS

By proceeds of sales of ore after deducting smelter charges	$1,263,980.52
By interest, discounts and miscellaneous receipts	15,582.32
Total	$1,279,562.84

The company is capitalized at 600,000 shares of $5 par, of which 528,200 shares are issued and outstanding.

Tonopah Belmont Development Co.

A condensed statement of operation of the Tonopah Belmont Development Co. for the quarter ended Sept. 40, 1920, follows:

RECEIPTS

Received and receivable for ore	$432,114.07
Mining, milling, and administration expenses	342,498.88
Net earnings for three months	$89,615.19
Miscellaneous income	8,105.71
Dividend from Belmont Surf Inlet Mines, Ltd	100,000.00
Total net income for three months ended Sept. 30, 1920	$197,720.90

AVAILABLE RESOURCES, SEPT. 30, 1920

Due from smelters	$174,984.80
Due from others	9,931.70
Liberty bonds	22,250.00
Cash in banks	166,783.65
Total	$373,950.15

The net earnings of the Belmont Surf Inlet Mines, Ltd., for the quarter ended Sept. 30, 1920, of which this company owns 80 per cent, were $68,639.98.

Davis-Daly Copper Co.

Copper: Montana

The report of operations of the Davis-Daly Copper Co. for the year ended June 30, 1920, states that 123,607 tons of ore was hoisted and 122,379 tons was shipped, with a metallic content of 319.33 oz. of gold, 902,978.717 oz. silver and 13,564,064 lb. of copper. Total ore returns amounted to $1,778,919.07, and total receipts to $1,944,600.31. Disbursements consisted of $1,079,593.17 for mining costs, $377,748.58 for depletion, $33,145.96 for depreciation, $65,276.55 for taxes, $71,844.06 for Butte expenses, and $24,813.29 for Boston disbursements, a total of $1,652,421.61. Net operating profit was $292,178.70.

The company is capitalized at 670,000 shares at $10 par, of which 600,000 shares have been issued, with a paid in subscription of $5,100,000.

Coniagas Mines, Ltd.

Silver: Ontario

The annual report of the Coniagas Mines, Ltd., for the year ended Oct. 31, 1920, indicates that 994,235 oz. of silver was produced from 97,634 tons of ore. A price of $1.25 was realized for the silver sold. The cost of mining and concentrating the ore amounted to 48.98c. per oz., which includes overhead, royalties, and miscellaneous expenses. Smelting, refining, and marketing costs amounted to 7.35c. per oz.

During the year five dividends of $100,000 each were paid. Profits amounted to $512,380.83, without allowing for depreciation. The company is capitalized at $4,000,000, consisting of 800,000 shares of $5 each, fully paid.

Tomboy Gold Mines Co.

Gold, Silver, Zinc, Lead: Colorado

After twenty years of continuous profits the annual report of the Tomboy Gold Mines Co., Ltd., for the year ended June 30, 1920, shows a loss of £4,894 6s. 10d. A total of 146,066 tons of ore was milled, producing bullion to the value of $811,989.55 at a cost of $815,855.06, resulting in a loss of $3,865.51. Average working costs were $5.586 per ton. A profit and loss statement for the year follows:

DEBITS

	£	s.	d.
To mining, milling, cyaniding and general expenses in America	206,369	8	2
To directors' fees	700	0	0
To agency and consulting engineer's fees, legal expenses, cables, postages, traveling expenses, and general expenses in London	1,657	14	0
To interest	198	6	1
Total	£208,925	8	3

CREDITS

	£	s.	d.
By bullion and concentrates recovered	202,997	7	9
By sundry receipts	1,033	13	8
By balance carried to balance sheet	4,894	6	10
Total	£208,925	8	3

The company is capitalized at £310,000, consisting of 310,000 shares of £1 each, fully paid.

United Eastern Mining Co.

Gold: Arizona

In a report covering the operation of the United Eastern Mining Co. for the year 1920 it is stated that 94,051 tons was milled of a gross value of $1,998,275.63. Operating costs were $857,001.83; tailing loss was $63,904.45; operating income, $1,077,369.37; operating income per ton, $11.455.

Latest Rand Gold Production

In December the output of gold at the mines of the Rand was 632,215 fine ounces, compared with 633,737 fine ounces in November and 662,472 fine ounces in October. The following table summarizes Rand gold production since 1917:

RAND GOLD OUTPUT 1917-1920 IN FINE OUNCES

	1920	1919	1918	1917
Jan.	[illegible]	[illegible]	[illegible]	[illegible]
Feb.	[illegible]	[illegible]	[illegible]	[illegible]
March	[illegible]	[illegible]	[illegible]	[illegible]
April	[illegible]	[illegible]	[illegible]	[illegible]
May	[illegible]	[illegible]	[illegible]	729,385
June	[illegible]	[illegible]	[illegible]	759,724
July	[illegible]	[illegible]	[illegible]	757,890
Aug.	[illegible]	[illegible]	[illegible]	[illegible]
Sept.	[illegible]	[illegible]	[illegible]	[illegible]
Oct.	662,472	[illegible]	679,764	[illegible]
Nov.	633,737	[illegible]	[illegible]	[illegible]
Dec.	632,215	[illegible]	[illegible]	[illegible]

MINING STOCKS

Weeks Ended January 15 and 22, 1921

Stock	Jan. 15			Jan. 22			Last Div.	
	High	Low	Last	High	Low	Last		
COPPER								
Adventure	....	....	*60	....	....	*60		
Ahmeek	52	50	52	56	50	54½	Sept. '20 Q	$0.50
Alaska-Br. Col.	11/16	9/16	⅝	⅝	½	9/16		
Allouez	22½	20	20	21	20	21	Mar. '19,	1.00
Anaconda	38⅞	37	37⅝	40⅛	37½	38¼	Nov. '20, Q	1.00
Ariz. Com'l	8½	7¾	8	8½	8	8¼	Oct. '18,	.50
Big Ledge	7/16	5/16	⅜	7/16	5/16	⅜		
Bingham Mines	....	....	9½	8⅜	8¼	8⅜	Sept. '19, Q	.25
Calumet & Ariz.	50½	48	48	50	49	49	Dec. '20, Q	1.00
Cal. & Hecla	250	240	245	245	240	245	June '20, Q	5.00
Canada Copper	....	....	*13	....	....	*13		
Centennial	....	....	7	9¼	9¼	9¼	Dec. '18, SA	1.00
Cerro de Pasco	31⅜	29½	30½	32½	30	30¼	Dec. '20, Q	1.00
Chile Copper	11¾	11⅛	11¼	12½	11⅛	11¾		
Chino	22⅜	21	22	23⅛	21⅞	22⅜	Sept. '20, Q	.37½
Columbus Rex	*42	*36	*39	*36½	*33	*34		
Con. Ariz.	....	....	1/16	....	....	1/16	Dec. '18, Q	.05
Con. Copper	....	....	2¼	2½	2⅛	2⅛		
Copper Range	33¼	31½	32	34	32	33¼	Sept. '20, Q	.50
Crys. Cop. (new)	*38	*35	*38	*38	*35	*38		
Davis-Daly	7½	6⅞	7	7	6¾	7	Mar. '20, Q	.25
East Butte	10	9	9	9¾	9¼	9¼	Dec. '19, A	.50
First Nat'l.	1 1/16	*77	*90	*90	*80	*85	Feb. '19, SA	.15
Franklin	3	2¾	2¼	2½	2¼	2½		
Gadsden Cop.	....	....	*25	....	....	*25		
Granby Consol.	23	22	22	24¼	22⅞	23½	May '19, Q	1.25
Greene-Cananea	22⅞	22⅞	22⅞	22⅞	22½	22⅝	Nov. '20, Q	.50
Hancock	3½	3¼	3¼	....	....	3¼		
Howe Sound	....	....	2⅝	....	....	2⅝	Jan. '21, Q	.05
Inspiration Con.	36½	34¼	34½	35⅞	34½	35	Oct. '20, Q	1.00
Iron Cap	9	6½	6½	7	7	7	Sept. '20, K	.25
Isle Royale	22½	20	20	21½	19¾	20¾	Sept. '19, SA	.50
Kennecott	20¾	19⅞	19⅞	21	19⅞	20	Dec. '20, Q	.50
Keweenaw	1¼	1¼	1¼	....	....	1¼		
Lake Copper	2¾	2½	2½	3	2½	3		
La Salle	....	....	1¼	....	....	1¼		
Magma Chief	....	....	*21	....	....	*21		
Magma Copper	21	20	20¾	....	....	20¾	Jan. '19, Q	.50
Majestic	....	....	*8	....	....	*8		
Mason Valley	1⅝	1¼	1⅝	1¼	1¼	1¼		
Mass Consol.	3½	3	3	3	3	3	Nov. '17, Q	1.00
Mayflower-O. C.	5	4½	4½	5	4 9/16	4 9/16		
Miami Cop.	19	18¼	18½	18⅞	18⅝	18¾	Jan. '21, Q	.50
Michigan	3	3	3	....	....	3		
Mohawk	46	45	46	47	45½	46¾	Nov. '20, Q	1.00
Mother Lode	5½	5¼	5½	....	....	5½		
Nevada Con.	11	10⅜	10⅞	11⅝	10⅝	11⅛	Sept. '20, Q	.25
New Arcadian	....	....	2½	....	....	2½		
New Baltic	....	....	3	....	....	3		
New Cornelia	16½	15½	16	16½	16	16	Aug. '20,	.25
Nixon Nev.	....	....	*5	....	....	*5		
North Butte	12⅛	11	11	12	11¼	11¾	Oct. '18, Q	.25
North Lake	*30	*30	*30	....	....	*30		
Ohio Copper	....	....	3/16	....	....	3/16		
Old Dominion	21	19½	19½	20	20	20	Dec. '18, Q	1.00
Osceola	28½	27	28	29	26	29	June '20, Q	.50
Phelps Dodge	†175	†150	....	†175	†160	....	Jan. '21, Q	2.50
Quincy	41	40	41	40	39	40	Mar. '20, Q	1.00
Ray Con.	14	12¾	13¼	14¼	13¼	13½	Dec. '20, Q	.25
Ray Hercules	....	....	*50	....	....	*50		
St. Mary M.L.	33⅝	31	31½	34	33	33	June '20, K	2.00
Seneca Copper	20	19	19	20½	20	20½		
Shannon	1¼	1 1/16	1 1/16	1¼	1	1⅛	Nov. '17, Q	.25
Shattuck Ariz.	6¼	6	6⅛	6½	6¼	6½	Jan. '20, Q	.25
South Lake	....		1	2	1	1		
Superior Cop.	4	4	4	....	....	4	Apr. '17,	1.00
Sup. & Boston		1 1/16	1¼	[illegible]	1⅜	1 7/16		
Tenn. C. & C.	[illegible]	8½	8¾	9¼	8½	8½	May '18, I	1.00
Tuolumne	*56	[illegible]	*56	*60	*54	*54	May '13,	.10
Un. Verde Ex.	29½	[illegible]	28	28¼	27	27¾	Nov. '20, Q	.50
Utah Consol	5	4	4¼	4¼	4¼	4½	Sept. '18,	.25
Utah Copper	56	52¼	53⅞	59¼	54	55¾	Dec. '20, Q	1.50
Utah M. & T.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1¾	Dec. '17,	.30
Victoria	[illegible]	[illegible]	[illegible]	2	2	2		
Winona	*60	*48	[illegible]	....	....	*60		
Wolverine	12	11½	[illegible]	12½	11¼	12½	Jan. '20, Q	.50
NICKEL-COPPER								
Int. Nickel	15¾	15	[illegible]	16	14	15	Mar. '19,	.50
Int. Nickel, pfd	..		[illegible]	.	.	75	Nov. '20, Q	1.50
LEAD								
Nat. Lead	73	71	71¼	74	71	72½	Dec. '20, Q	1.50
Nat. Lead, pfd.	105	[illegible]	105	102½	102	102½	Dec. '20, Q	1.75
St. Joseph Lead	13	[illegible]	13	12¼	12½	12½	Dec. '20, QX	.50
Stewart	..		*6			*6	Dec. '15,	.05
ZINC								
Am. Z. L. & S.	9¾	[illegible]	[illegible]	9½	[illegible]	8¼	May '17,	1.00
Am. Z. L. & S. pf	33	[illegible]	[illegible]	33	29½	29½	Nov. '20, Q	1.50
Butte C. & Z.	5½	[illegible]	[illegible]	5	[illegible]	5¼	June '18, I	.50
Butte & Sup.	13½	12	[illegible]	14	12	12½	Sept. '17,	1.25
Callahan Z. L.	7½	[illegible]	[illegible]	7	6	6½	Dec. '20, Q	.50
New Jersey Z.			[illegible]	158	[illegible]	157	Nov. '20, Q	4.00
Success	*3	[illegible]	[illegible]			*2	July '16,	.03
Yellow Pine	..		[illegible]	...		*45	Sept. '20, Q	.03

* Cents per share. † Bid or asked. ‡ Quotation missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, includes extra.

Stock	Jan. 15			Jan. 22			Last Div.	
	High	Low	Last	High	Low	Last		
GOLD								
Alaska Gold	1⅛	[illegible]	1	1⅛	⅞	1⅛		
Alaska Juneau	1½	1⅜	1⅜	1⅜	1⅜	1⅜		
Carson Hill	....	..	22¾	....	....	22¾		
Cresson Consol.	....	..	1¼	....	....	1¼	June '20, Q	$0.10
Dome Ex.	*43	*43	*43	....	....	*43		
Dome Mines	12	11½	11¾	12⅛	11⅛	11½	Jan. '21, Q	.25
Golden Cycle	‡...	...	*73	‡...	....	*73	Dec. '20, Q	.02
Goldfield Con.	*8	*6	*7	*8	*6	*8	Dec. '19,	.05
Hollinger Con.	6.25	5.80	6.25	6.30	6.19	6.26	Dec. '20, BM	.05
Homestake	50½	50	50	50⅛	50	50	Sept. '19	.50
Kirkland Lake	*49¾	*47	*47	*48½	*47	*48		
Lake Shore	1.19	1.07	1.15	1.22	1.15	1.20	Jan. '21, K	.02
McIntyre-Por.	1.83	1.82	1.82	1.89	1.82	1.89	Jan. '21, K	.05
Porcupine Cr.	*21	*18½	*20	*23	*20½	*23	July, '17,	.03
Portland	‡...	....	*60	....	....	*60	Oct. '20, Q	.01½
Reorgan. Booth.	*4½	*3	*4½	*5	*3	*5	May '19,	.05
Silver Pick	*11	*7	*10½	*11	*8	*8½		
Teck Hughes	*11	*11	*11	*11¾	*10¾	*10¾		
Tom Reed	1.20	1.10	1.16	1.16	1.14	1.14	Dec. '19,	.02
United Eastern	2½	2¼	2 7/16	2 7/16	2⅛	2 5/16	Oct. '20, Q	.15
Vindicator Con.	‡...	..	*18	‡...	....	*18	Jan. '20, Q	.01
W. Dome Consol.	*8½	*7	*7¾	*9½	*8¾	*9½		
White Caps	*9	*5	*8½	*9½	*7	*9½		
Yukon Gold	....	....	*50	*60	*60	*60	June '18,	.02½
SILVER								
Arizona Silver	*20	*19	*20	*36	*20	*29	Apr. '20, M	.03
Beaver Con.	*31½	*31	*31½	*38	*32	*35	May '20, K	.03
Coniagas	2.18	2.00	2.18	1.90	1.90	1.90	Nov. '20, Q	.12½
Crown Reserve	*18	*18	*18	*18	*16	*18	Jan. '17,	.05
Kerr Lake	3⅛	2½	2⅞	....	....	2⅞	Jan. '21, Q	.12½
La Rose	*31	*31	*31	*33	*33	*33	Apr. '18,	.02
McKinley-Dar.	*29	*29	*29	*29½	*29	*29½	Oct. '20, Q	.03
Mining Corp.	1.05	1.10	1.13	....	....	1.13	Sept. '20, Q	.12½
Nipissing	8½	7½	8⅛	8¼	8	8⅛	Jan. '21, QX	.50
Ontario Silver	5¼	5	5⅛	5	4⅞	4⅞	Jan. '19, Q	.50
Ophir Silver	13/16	⅝	⅝	⅝	⅝	⅝	Jan. '12,	.10
Peterson Lake	*12	*11¾	*12	....	....	*12	Jan. '17,	.01¾
Temiskaming	*25	*25	*25	*25	*24	*24	Jan. '20, K	.04
Trethewey	*20	*18½	*19	*20½	*19	*19	Jan. '19,	.05
GOLD AND SILVER								
Atlanta	*2	*1½	*2	....	....	*2		
Barnes-King	‡...	....	1.11	....	....	1.11	Aug. '20, Q	.05
Bost. & Mont.	....	....	*63	....	....	*63		
Cashboy	*7	*5	*7	*7½	*6½	*7		
El Salvador	½	⅜	7/16	7/16	⅜	7/16		
Jim Butler	*18	*16	*17	*18	*16½	*17	Aug. '18, S.A.	.07
Jumbo Exten.	*6	*5	*6	*7½	*5	*7½	June '16,	.05
Louisiana Con.	¼	¼	¼	....	....	¼		
MacNamara M.	1/16	*17	*18	*18	*17	*18	May '10,	.02½
N. Y.-Hond. R.	†10½	†9	....	†10½	†9	....	Oct. '20, QX	.50
Tonopah-Bel.	1 9/16	1⅜	1½	1 9/16	1	1 9/16	Jan. '21, Q	.05
Tonopah-Div.	1¼	1⅛	1 3/16	....	....	1 3/16		
Tonopah Ex.	1½	1 5/16	1 7/16	1½	1⅜	1½	Jan. '21, Q	.05
Tonopah Min.	1½	1¼	1½	1½	1⅜	1 7/16	Oct. '20, SA	.05
West End Con.	1 3/32	1	1 1/16	1 1/16	1	1	Dec. '19, SA	.05
SILVER-LEAD								
Caledonia	*16	*14	*16	*17	*15	*15½	July '20, M	.01
Chief Consol.	2⅞	2⅝	2⅞	2¾	2¾	2¾	Nov. '20, Q	.10
Consol. M. & S.	19¼	18	18	19	18¼	19	Oct. '20, Q	.62½
Daly Mining	...	...	1.95	2.50	2.50	2.50	July '20, Q	.10
Daly-West	3⅞	3⅞	3⅞	4⅛	3¾	3¾	Dec. '20, Q	.25
Eagle & B. B.	...	...	2⅛	....	....	2⅛	Dec. '20, K	.25
Electric Point	*5	*5	*5	*5½	*5	*5½	May '20, SA	.03
Fed. M. & S.	8⅞	8⅞	8⅞	....	....	8⅞	Jan. '09,	1.50
Fed. M. & S. pf.	28½	27	27	28¼	27	28¼	Dec. '20, Q	1.75
Florence Silver	*15	*14	*15	....	....	*15	Apr. '19,	.01½
Grand Central	..	..	*37½	...	....	*37½	June '20, K	.03
Hecla Mining	4¼	3½	3¾	4⅛	3¼	4	Dec. '20, QX	.15
Iron Blossom	3/16	*17	3/16	*20	*15	*20	Apr. '20, Q	.02½
Judge M. & S.	....	....	3.00	....	....	3.00	Sept. '20, Q	.12½
Marsh Mines	*8½	*7	*7½	*8	*7	*8		
Prince Consol.	5/16	¼	¼	5/16	¼	5/16	Nov. '17,	.02½
Rambler-Carib.	*8½	*8	*8	*8	*7½	*7½	Feb. '19,	.01
Rex Con.	*5	*4	*5	*5	*4½	*5		
South Hecla	.	.	*65	*65	*60	*65	Sept. '19, K	.15
Stand. S. L.	3/16	3/16	3/16	....	....	3/16	Oct. '17,	.05
Tam.-Custer	2.00	1.90	1.95	1.90	1.80	1.90	Jan. '21, K	.04
Tintic Stand.	3.35	3.15	3.20	3.37½	3.25	3.30	June '20, Q	.10
Utah Apex	2⅛	2¼	2¼	2¾	2½	2½	Nov. '20, K	.25
Wilbert Min.	*3	*2	*3	*3	*2	*2½	Nov. '17,	.01
QUICKSILVER								
New Idria			*95	....	....	*95	Jan. '19,	.25
TUNGSTEN								
Mojave Tung.	.	.	*5	...	....	*5		
VANADIUM								
Vanadium C.	41	34¾	38¼	40¾	36½	37¾	Jan. '21, Q	1.00
ASBESTOS								
Asbestos C.	.	...	79½	82½	79	80¾	Oct. '20, Q	1.50
Asbestos C., pf.	94½	90	92	95	94	94¼	Oct. '20, Q	1.75
MINING, SMELTING AND REFINING								
Am. S. & R.	39½	36¾	37½	39½	37¼	37¾		
Am. S. & R., pf.	82	79½	82	83	81½	82		
Am. Sm. pf. A.	64½	63	64	66	66	66	Jan. '21, Q	1.50
U. S. S. R. & M.	34¾	33	34¼	35½	34	34	Jan. '21, Q	.50
S. R. & M., pf.	44	42½	43½	43½	42½	43¼	Jan. '21, Q	.87½

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The Long Look Upward

IT IS THE GENERAL OPINION that business conditions have passed the main crisis of deflation and that the danger of a financial panic is over. It has been said and written many times that only the Federal Reserve banking system averted a worse panic than any we have seen in our generation. Concerning that we cannot say: it would appear, however, that there is enough paper extant to cushion almost any shock.

Fundamentally, we have every ground for prosperity: we lack neither raw materials, nor funds, nor willing hands, nor an essentially sound and stable government. General business conditions, we are told, should gradually improve. This, it is argued, has been indicated by the rise in the stock and bond markets, which has been marked since the first of the year. The quick absorption of new bond offerings indicates an abundance of funds ready for investment, and renders the theory of threatening preponderance of "frozen credits" doubtful. Evidently, if the banks are short of ready money for investment, others have it in plenty.

The next problem, then, is to nurse our markets, at home and abroad. At home, reasonable and declining prices for finished products alone will tempt sustained buying. Part of this may be accomplished by economical and more thorough business methods, tending to lessen the wide gap between the price of raw material and finished product—squeezing the undue profits out of the multitudinous middlemen. In the metals, as we have before editorially indicated, special investigation should be here applied, and may easily result in a higher price to the miner and a lower price to the consumer.

For those important metals which we are organized to produce in excess of our requirements, and so depend absolutely on a good export market for prosperity, as is unequivocally the case with copper, the problem is not how to dispose of our product, but how to get paid for it. Impoverished Europe needs our metal, but cannot pay with gold: and we get weary of paper in the long run. Our bankers like to pay with paper, but will not accept it in payment, demanding, with strange insistence, gold. This problem, then, resolves itself into one of international finance, and the solution can hardly come about without the co-operation of the United States. In this one respect our export industries, including copper, are really dependent, for the immediate future, on the foreign policy of our new administration. The problem is something more than the extension of credits to foreign purchasers for a short or a long term. The War Finance Corporation has been revived for this purpose: and the American Bankers' Association has organized a $100,000,000 corporation, the Foreign Trade Financing Corporation. But the Copper Export Association, organized under the Webb Law, has the same general purpose as the War Finance Corporation, to facilitate export trade, and is well financed.

The problem still remains as to how finally to collect. As a concerted banking arrangement, it is difficult to see how this can be done; and this was President Wilson's view when he vainly vetoed the re-establishment of the War Finance Corporation. If categorical methods fail, the problem of the liquidation of foreign credit will be solved in time by the private transfer of American gold to the smitten countries in the form of investments made attractive by the low rates of exchange and encouraged by the Foreign Trade Financing Corporation, and by what is more important, the importations of European produce—an element in the situation that is giving and will give the incoming administration much trouble in its consideration of tariff problems. An ironing out of the great inequalities of exchange and credit is bound to take place in the long run, unless new wars, revolutions, and repudiations occur.

Electricity in the Mining Industry

THE commercial application of electricity hardly existed before the present generation; in fact, it is only in the last twenty or thirty years that the most apparent use of electricity—in lighting and in street railways—has become common. The electric automobile was seen fairly often on the streets ten or fifteen years ago, but is now almost entirely superseded by gasoline-driven vehicles. The general utilization of electricity in the mining industry is even more recent: we are tempted to speak of it here by the announcement of the Bunker Hill & Sullivan company of its intention to erect a $1,000,000 electrolytic zinc plant at Kellogg, Idaho.

Copper was the first of the important metals to be electrolytically refined on a large scale, the first plant in this country to use the process being that of the Balbach company, which was established in 1883. Now, practically all American copper containing appreciable amounts of the precious metals is refined by this process. The electroytic refining of zinc is much more recent, but the list of plants is constantly growing, and includes Anaconda, the Consolidated plant at Trail, British Columbia, and several other smaller plants in various parts of the world.

Poor recoveries retarded the adoption of the electrolytic refining of zinc until recently. The importance of pure solutions was not realized. With the present scientific development of the process, the cost of power is perhaps the most important item to be considered. It is now almost certain that electrolytic zinc has a brilliant future and may displace "Prime Western" as a standard grade, just as electrolytic copper has displaced "lake." In districts where complex lead-zinc ores are found, an electrolytic zinc plant will [illegible] to be particularly useful.

The electrolytic refining of doré bullion, developed by Dr. Moebius thirty or forty years ago, has received wide application. Within the last decade tin and nickel have been added to the list. The American Smelting & Refining Co. has a plant at Perth Amboy where the troublesome Bolivian tin concentrates are smelted and electrolytically refined, the product commanding about the same price as the high-grade "Straits" tin. Part of the International Nickel Co.'s product is electrolytically refined, and the new plant of the British America Nickel Co. at Deschenes, Que., uses the Hybinette electrolytic process entirely, thereby permitting the recovery of platinum and palladium. Electricity is certainly coming to be the principal agent in metal refining.

In smelting, the application of electricity is still narrow and in general confined to special complex problems. Certainly no electric reduction process is being applied on a large scale to iron, copper, lead, zinc, tin, gold, or silver ores. Aluminum is the most important metal which is commonly electrically smelted. Still, electricity plays an important part in the mill and smelter. For pumping, compressing air, rail transportation, crane operation, furnace tilting, flue-dust recovery, and minor uses it is almost indispensable in the smelter. In the mill, concentration by electrostatic methods has found only limited applications, but, as in the smelter, electricity is possibly the chief source of power.

Electric hoisting in mines has been developed to an extent undreamed of a few years ago. The Inspiration hoist, for example, is a revelation in automaticity. Mine lighting has been revolutionized, and the old reliable mule for tramming is gradually becoming extinct. With mechanical loading machines coming into use, the drill is about the only other tool in a mine on which our electrical research engineers can concentrate.

High Prices for Manufactured Copper and Silver

WE REPRODUCE on page 256 a letter from a Canadian silver producer whose opinion coincides with the ideas recently expressed in an editorial in these columns on "Why Is Copper a Luxury?" So far, no one has yet come forward with any justification for the apparently extravagant prices asked for many copper products. One reason, we suspect, for the high prices, is that most articles made of copper are not produced on a quantity basis and must meet the high manufacturing costs which are charged to the production of a side line for which the demand is small. A reduced price followed by intelligent advertising would, we feel, so increase the sales as to enable manufacturing costs to be greatly reduced and make them more comparable with those of steel and galvanized products.

Mr. Bourne points out that the demand for sterling-silver products is also restricted by unjustifiably high prices. The price of silverware we know is high, for we had occasion to buy a wedding present recently. We were informed that no reduction in the price had been made since silver sold at $1.35 an ounce. As the price asked represented several times the bullion value of the silver contained in the article, the price of the raw material seems to have little effect. Labor is, of course, the largest factor in most manufacturing costs, and wages have receded only slightly toward the pre-war scale. And yet the jewelry trade is unalterably opposed to the McFadden Bill, which would tax that industry $10 per ounce more for its gold, and which would in all probability add little or nothing to the selling price, if we may judge from the general conditions already mentioned.

The Solution of the Apex Muddle

WE CALL special attention to a letter on page 255 in this issue from Mr. L. S. Ropes, on the subject of the apex law, in which he truly points out that criticism should be constructive as well as destructive, and gives as the solution private agreements establishing vertical boundary rights between the owners of contiguous mining properties.

We wish to indorse Mr. Ropes' suggestion unqualifiedly. That the law which gives extralateral rights to the owner of a lode apex has proved absolutely impracticable of equitable interpretation is a conclusion that we have editorially voiced: and this opinion is held almost unanimously by mining engineers. The question is, what to do about it. It is easier to make an omelette than to unscramble the eggs. By our present system of court trials the omelette is dumped into the fire. Alteration of the law of course suggests itself, and this has been attempted several times, without getting action. There is pending, however, the report of a special committee, consisting of W. R. Ingalls, chairman, with Walter Douglas, J. Parke Channing, J. R. Finlay, John Hays Hammond, L. D. Ricketts, Horace Winchell, and James R. Jones. To Mr. Jones, then connected with the Bureau of Mines, belongs, we believe, much of the credit for research and legal study in drafting the views of the committee into a bill, which has been placed informally in the hands of the committees on Mines and Mining of the Senate and the House in Washington. It has not yet been formally acted upon and made public by the entire committee, however; but in our issue of July 3, 1920, the gist of it was given in our Washington News. This proposal establishes vertical boundary lines in the future, but, of course, this cannot be made retroactive, and can apply only to claims located hereafter. As most mining claims in the United States have probably already been located, and the extralateral rights of these, one against the other, cannot be alienated, our apex difficulties, despite mining law revision, promise to go on, unless the pressure exerted by those most vitally interested can be made effective, for a thousand years.

The indicated remedy is what sometimes becomes necessary in an emergency—for mine owners to "take the law into their own hands." Private agreements establishing vertical boundaries can in most cases be made between owners of contiguous claims, if the attempt be made, as a matter of principle, in the beginning. After ore is found, certain strong human emotions dwarf judgment and the universal instinct for fairness and generosity, and these emotions produce the fight for booty, which is so gainful to the lawyer and the professional witness and so wasteful of time, talent, and of investors' resources.

Mr. Ropes specifies Bisbee as a camp where this beneficent principle has been established. Leadville is another instance where the absurdity and ruinousness of the apex law became evident in early suits, and the mine owners "took the law into their own hands" and established vertical boundaries, to their vast profit and contentment. Even in Tonopah, which has been the scene of bitterly fought apex controversies, a number of vertical boundary agreements were early made, and all the makers profited thereby.

Boycott the apex law! Render it a dead letter. Make your vertical boundary agreements. Do it now! It will be a patriotic act, and a profitable one.

WHAT OTHERS THINK

The Law of the Apex

The Utah Consolidated-Utah Apex suit has brought out considerable discussion. In general, with reference to the question What is a lode? I wish to express my approval of your editorial of Jan. 15, particularly the following: "But we were not discussing the matter with the lawyer's mind and standards, but those of the geologist and engineer. Equity, not decisions; common sense, not arguments; what should be, not what is and has been"; also the quotation therein from a "distinguished engineer."

There is more that is suggestive in this case and the discussions than quibbling over an unfortunately chosen expression, which should point out the necessities for changes in the mining laws. Recalling House Resolution 12,275, Feb. 25, 1916, by Representative Foster, an effort was initiated to amend the mining laws as affecting locations on public lands. War measures superseded all peace-time measures, and nothing further has been heard from this resolution—it were better for the mining industry if nothing more is heard of it, as written.

Nevertheless, the subject is a live issue and should be taken up and constructive legislation passed which will do away with such costs, as "it cost two mining companies over half a million dollars"; a direct loss to the stockholders.

Getting away from the public lands, for example, I wonder where the court would be, the lawyers, and the geological witnesses, in dealing with such formations as occur along the Gogebic Range, in Michigan and Wisconsin—their isolated deposits of iron ore; some cropping at the surface; others entirely subsurface in occurrence, and, in all, with no veiny interconnections? There they would lack the "limestone" even, on which to predicate a "broad lode" theory.

Am I mistaken in assuming a more or less marked analogy between the general geology of the Utah district mentioned and that of Bisbee, Ariz.? A sedimentary formation, including limestone strata; a porphyry intrusion in itself more or less mineralized; *occurrences* (to be circumspect in classification) of commercial, metalliferous ores within the limestone strata in this particular, local section of a formation which may, originally, have covered thousands of square miles and yet exists, unmineralized, without the camp.

Bisbee! One of the foremost copper camps of the world. Will someone cite legal decisions, some current litigation over the right of the apex, in the Bisbee camp? No? Here is something to think over: Compare the history of the legal entanglements between Bisbee operators and those of Bingham, of Butte, and of the Cœur d'Alenes. I doubt if the majority of your readers are cognizant of the conditions, in Bisbee, which account for the contrast. With the advent of new operators in the Bisbee camp and the acquisition of large groups of claims by the several development organizations, it was at once recognized that complications would arise over rights if an attempt was made to base operations on the usual lines of the apex law. The result was an agreement among all the large interests to observe vertical bounding planes to their respective holdings; a simple solution and one immensely profitable to their stockholders, when the vast waste of resources in litigation in other camps is considered.

The Utah Consolidated-Utah Apex suit and its waste of assets by both companies afford an example of the futility of the existing mining laws to meet the exigencies of vastly altered, economic, mineral conditions. It presents an opportunity to point out the necessities of radical changes in the laws, and the Bisbee agreement, backed by the practices of the older mining regions, not effected by the Federal mining laws, suggests the solution.

L. S. ROPES.

Helena, Mont.

The Legal Status of Oil-Shale Deposits

Referring to "The Legal Status of Oil-shale Deposits on the Public Domain," by James R. Jones, in *Engineering and Mining Journal* of Jan. 8, I wish to offer a correction to the statement under the subhead "Limitations on Size of Lode Claims," that "the discovery should have been well identified either by means of a shaft at least ten feet deep from the lowest rim, or by an open cut, crosscut, or tunnel of the same depth, or an adit at least ten feet in along the lode. . . ."

As Mr. Jones is referring in this paragraph to the Federal law, the natural assumption is that such an opening is required by Federal statute, but this is not the fact. Federal law requires only a discovery, and if this is evident on the surface, no opening to expose it is necessary. Most of the Western states, however, by laws of their own, require a shaft or other opening at the discovery point. I am writing this from the field, where I have no reference works on the point, but I think that California and Utah are the only states which do not require such an opening.

Regarding the width of lode claims, Colorado is the only state in which any restriction is placed on the 300 ft. each side of the lode line provided by Federal statute. Here the width is 150 ft., and until 1912 it was only 75 ft. in four counties—Gilpin, Clear Creek, Summit, and Boulder.

At one time South Dakota had a law allowing only 150 ft. each side, but that was repealed long ago. Prior to our present mining code, the size of claims was a matter of local regulation, and many irregularities existed. In many districts in California and Colorado, 50 ft. x 3,000 ft. was a size prescribed.

Many of these local regulations were very interesting. I once had occasion to look up the status of a piece of ground in California which was 600 ft. x 3,000 ft. I naturally supposed that it consisted of two regulation size claims, but found that it dated back to the 50's, and consisted of one claim with twenty-nine locators. On inquiry, I found that it had been located in accordance with a local rule giving each person 300 ft. on each side of the lode but only 100 ft. along it, but giving an extra 100 ft. to the discoverer of a new lode. Hence, with an extra 100 ft. for discovery, the twenty-nine locators were entitled to 3,000 ft., which was the limit in length for one claim.

Throughout the old rules and customs the lode and not surface area was the basis of location. This practice was followed out in formulating our present code, and was made the basis of the apex law, with its attendant grief. As I have no desire to "start something," however, I shall not pursue that point any farther.

San Francisco, Cal. LEROY A. PALMER.

Expensive Copper and Silver Products

I have read with much interest your article regarding the limited use of copper, due to the high price of products of that metal. The same state of affairs exists in the silver industry. The name "sterling silver" means, in the arts, that the purchaser pays $2 or $3 per oz. for silver that costs the manufacturer only 80 or 90c. (in Canada).

In the mining business tons of copper could be used where it would give infinitely better service than iron, but the first cost is prohibitive, and the buyer continues to buy iron and renew it every few years.

Thirty or forty years ago practically all kitchen utensils were made of copper, and gave years of good service. The same can be said of the hardware used in shipbuilding and in general building applications. The old serviceable solid copper or brass trimmings are now replaced by a cheap lacquer or imitation copper article that a few cleanings will destroy. Few people seem to realize that it is money well spent to buy something that will, like copper or brass, give good service and then fetch a good price as scrap.

All producers of metal should take a little interest in the sales department of their product, and find out why a pound of manufactured copper cannot be placed on the market at a reasonable price. They can also help the mining business along if they will themselves use more of their own product. If any intelligent man will follow the evolution of a pig of lead or a pound of copper from the furnace to the user, he will not be surprised that the public look upon these metals as being in the category of gold and diamonds.

Your paper was most timely, and I hope you will follow it up. F. J. BOURNE,

Cobalt, Ont. Manager, Bailey Silver Mines, Ltd.

Postponement of Assessment Work

Your attack on the hundreds of owners of unpatented mining claims with a blanket classification of "Gamblers in Mining Claims" is unjustifiable. The urgent request for an exemption or extension was made, and petitions were signed by hundreds of men actively engaged in developing their respective districts, for the same reason that the miners and producers asked for the gold bonus.

The conditions in mining in general and in the low-grade gold camps in particular are deplorable, as you have stated in many issues of your publication, and the owners of unpatented mining claims belong, as you well know, to the poorer classes who would rather develop their properties than pay taxes on idle patented ground, but are unable to pay the prevailing fancy prices for powder, fuse, caps, and tools.

You have been boosting for the McFadden Bill, which, if passed, means more than relief to the producing companies. Cost of supplies and materials is one of the main reasons for asking for a higher price of gold per ounce, and thereby overcoming the difficulty of raising money for mining enterprises. These same conditions affect the small owner in regard to assessment work, and it is about time to adjust your ideas and encourage *all* those engaged in mining, not alone the large companies, which are able to take care of themselves anyway.

Incidentally, I would like to know the percentage of owners of unpatented mining claims who were able to spend this winter in California from money saved because of the extension of time on assessment work.

Deadwood, S. D. A. T. ROOS.

A View of the Copper, Lead, and Zinc Markets

Copper is a serious topic of conversation in mining circles in New York. Bankers are no less interested. I am a buyer of just sufficient odd lots for export to keep in touch with the market and have no interest either in the rise or fall of the price of the red metal. The banks took huge quantities of copper as collateral on loans when metal was worth 18c. per pound. The fact that it can be bought for 13c. today means that the bankers have required further security where this is obtainable and otherwise have insisted on liquidation of stocks.

Buying is extremely slow, both domestic and export. It is the universal expectation that the price will go still lower. Many mines are closing down. Formerly copper wire was sold on a base price, with extras for gage. It is now bought at a flat price. Formerly it was impossible to bargain. At present copper is offered at a surprising number of different prices. Until recently it was possible to arrange to have wire drawn from one's own copper. At present the mills will not do this, though some have such heavy stocks that they quote surprisingly low prices.

There is no demand, little consumption, and not much prospect for immediate increase in the consumption of copper. This means that no one need be in any hurry to buy. It is now possible to buy copper in this market for pounds sterling, francs, kronen, and even marks. Several export houses have built up an interesting though small business in this way. They do not speculate in exchange, but have arranged with banks which require a certain amount of paper regularly. Naturally, the buyer pays a fraction for the quotation in his own money but only sufficient to cover the exchange transaction. It is even done on a sixty-day confirmed letter-of-credit basis, though to only a limited amount, and the interest rate is not low.

We in America are continually hearing threats of Belgian competition in zinc, and recently several small consignments have been imported from that country. We also note heavy reductions of prices of zinc here, of the labor employed and coal consumed in the zinc districts, and, more important, of the demand for zinc. This is all in line with the decreased demand for galvanized products both here and abroad. There are large stocks of zinc and galvanized sheets in various world markets (much of it unpaid for). The largest producers and exporters are of course willing to sell to cash buyers, but the important ones have taken the position lately that it is better to protect their buyers abroad until these have had time to unload stocks on the public without too heavy a loss. This would indicate that though low prices are quoted both from here and Belgium, Eastern and South American buyers are not in the market at any price.

Competition between English and American steel and other metal products will not come for some time. In the meantime we must all sit tight until the consumers get back their confidence to a degree that will warrant new buildings, railroads, and other enterprises.

Lead has slumped in response to the sudden stoppage in new work and the curtailment of output of established old factories. Even the largest producers are not hopeful of higher prices. One important manufacturer of sheet lead says that lead will go no lower and is buying freely for forward delivery but only for a minimum requirement. This is not to be taken too seriously, however, as this particular buyer is frequently on the wrong side of the market. MARK R. LAMB.

New York.

More About Copper Losses in Slags

In *Engineering and Mining Journal* of Jan. 8 Charles G. Maier has commented on my article "Copper Losses in Slags," which appeared in the Dec. 4 number. The five points concerning his silver-nitrate method of determining suspended sulphide copper are not all "objections" to the method—rather they are points on which my findings differed from his. I wish to consider them briefly:

1. Solubility of copper sulphide in silver nitrate. Fused sulphides appear to be almost completely soluble. The incomplete solution of mineral sulphides is not of importance except in indicating that the method is useless when applied to ores.

2. Segregation of dissolved copper sulphide on solidification of slags. A number of the samples I analyzed had been air-cooled, so the opportunity for segregation was particularly good. Less segregation would be expected in granulated samples. However, when the maximum particle of a sample has passed through an opening of 0.0029 in., it is easy to believe that a large portion will be under 0.0010 in., or even 0.0001 in. If so, I believe that much of the copper set free on cooling would be attacked by the silver nitrate.

3 and 4. Solubility of oxidized copper in silver nitrate. The point is that, unless the oxides and silicates of copper are insoluble when free, one cannot be certain that they will be unattacked in the main body of the slag. Mr. Maier is conservative when he says "the method involves *no conclusions* as to the *chemical form* of suspended copper." But if he cannot state the form of the copper dissolved by silver nitrate, is he justified in stating the form of the copper not so dissolved? One would rather expect the reverse to be the case.

5. Effect on metallic iron. As there was no iron in Mr. Maier's samples, it need not be further discussed.

In his criticism of my methods Mr. Maier describes an experiment with copper *sulphate* to show that metallic iron interferes. As there was no copper sulphate in my solutions, this has no bearing on the case. In a solution of copper *sulphite*, metallic iron does not precipitate copper sulphide.

Mr. Maier asks why I did not remove magnetite from my samples. For the double reason that it is both impossible and unnecessary. Many slags containing only a little magnetite are, nevertheless, almost entirely magnetic. And inasmuch as magnetite has no effect on copper sulphide in the presence of sulphurous and hydrofluoric acids, there is no necessity for its removal. Whether its harmlessness is due to reduction by sulphur dioxide or to low dissociation of the ferric fluoride formed is immaterial. I am well aware of the fact that reduction by sulphur dioxide takes place much faster in neutral than in strongly acid solutions.

Calculation of suspended matte from the gold-copper ratios is a method open to criticism, I readily acknowledge, but I believe it to be the best method available. My determinations of gold in slags were made on samples of twenty assay tons each, and the results of these were averaged over long periods of time. I therefore feel that the results calculated from them are of considerable accuracy.

Regarding metallic copper in converter slags, Mr. Maier and I agree that it is usually there, but we differ as to the amount. It is not very soluble in copper sulphide, as shown by the fact that during the final converter blow metallic copper of 98 per cent begins to fall out soon after the matte passes 80 per cent copper. In my article I stated my belief that "the copper soluble in hydrofluoric and sulphurous acids represents closely the total of oxide, silicate and metallic copper in all samples analyzed." As silver nitrate dissolves sulphide and metallic copper, and attacks the oxides (silicates?), it is not strange that the sum of the copper dissolved by the two methods is more than the total copper present. It is my belief that most of the overlapping is due to solution of oxidized copper, but I agree that whatever metallic copper is present is dissolved in both methods.

As for the final statement about the preponderating form of copper in converter slags, I agree with Mr. Maier that what he says is true of many slags—I found such to be the case in my experiments. I would not say, though, that any microscopic method for the quantitative analysis of slag has been well established.

I do not claim that my method of determining oxidized copper in slags is of an accuracy comparable with that of the standard methods of determining total copper. I do believe, however, that it will give a clear idea of the form in which copper is lost in any ordinary slag, and may therefore indicate possible means of saving it.

Deschenes, Que. FRANK E. LATHE.

Stand Tanks and Sand Tanks

I should like to correct an error, typographical or clerical, in my article on "Desert Prospecting" in issue of Oct. 30.

Under the heading "Water Scarce, but Usually Available" reference is made to "open and *stand* tanks." The word "stand" should be "sand." A tank is a collection of water in a depression in the rock as distinguished from a spring. If the water stands as a pool it is an open tank, but if the depression is filled with sand and gravel so that the water is available only by digging it is a sand tank.

Sand tanks are not so convenient as open tanks, nor as easily found, but are preferable, as the water is not as apt to be contaminated as that in the open tank. It is a rule of the desert that when one leaves a sand tank he should fill the hole that he dug to get his water in order to protect the supply from contamination and evaporation.

Referring to my statement regarding [illegible] as water finders, I would say that we located [illegible] sand tank at which I camped where we found a coyote had been digging. [illegible] A. PALMER.

San Francisco, Cal.

Rubber in Mine and Mill

Structure of Power Transmission Belting—Formulae for Computing Sizes and Plies of Belting—Bucket-Elevator Belts—Various Sizes and Capacities of Conveyor Belts—Hose Structure—Grades of Rubber

BY A. M. OLIVER

Written for *Engineering and Mining Journal*

CONSIDERING the wide use of rubber in the mining field, it is natural to assume that every mining man has a comparatively thorough knowledge of the subject. But this is not the fact. To be sure, the average mill or mine superintendent has his theories and can in a general way judge the quality of a piece of mechanical goods, but very few superintendents have the requisite knowledge to decide definitely and precisely upon the adaptability of a belt or a piece of hose for the work in hand.

Requests for price quotations received by the manufacturer of mechanical rubber goods from mining men tell the story in no uncertain terms. They show clearly the lack of definite knowledge. The descriptions of the articles on which a price is desired are in most instances entirely inadequate and incomplete. Transmission belting is described as "your best grade 8-in., five-ply rubber belt," or "your best grade conveyor belt, 24 in. wide, ¼ in. thick." I shall endeavor to point out the complete inadequacy of such descriptions.

The fact that these commodities differ widely, not only in quality but in the physical properties of the material used in their manufacture, seems to be overlooked entirely. Take belting, for example. It is generally known that rubber transmission belting is composed principally of cotton duck held together by so-called "friction" rubber and that the cotton duck is folded in the process of manufacture, forming plies. It is assumed that a five-ply belt is stronger than one composed of only four plies. The fact of the matter is that a four-ply belt, under given conditions, may be much stronger than one composed of twice as many plies. To assume that a five-ply rubber belt will transmit so many horsepower is about as logical as to think that a six sixteen-wire cable is twice as strong as one composed of six eight-wire strands. The strength of the cable would depend upon the gage of the wire used. It is the same with belting. The duck from which belting is made varies in "weight" as well as in quality. So does the "friction" rubber with which the plies are treated.

FACTORS DETERMINING STRENGTH OF DUCK

Duck for belting is spoken of as being so many ounces in weight—usually from 20 to 36 oz., with a tensile strength of from 235 to 600 lb. per inch of width. The standard by which the weight is ascertained is a piece of duck 36 x 42 in. This means that a piece of duck 42 in. wide by 36 in. long weighing 20 oz. is called 20-oz. duck; a piece of this size weighing 30 oz., 30-oz. duck, and so on. Needless to say, the 36-oz. duck is much stronger than 20-oz. duck, and a belt made of 36-oz. duck will naturally transmit more power than a 20-oz. duck belt, everything else being equal. But the weight of the duck is not the only indication of strength. Cotton fibre varies in length from one-half to two inches. Long-fibre cotton makes the best duck, and obviously commands a higher price. Even before the cotton reaches the loom, it is put through several operations which have an important bearing on the tensile strength of the finished duck. In the "plaiting" of the cotton, for example, some threads may remain loose, leaving only part of the total number of threads to carry the load. This operation has a definite effect on the quality of the finished product. So it is quite possible to have several pieces of duck, all of 30-oz. construction, yet each piece having a different tensile strength.

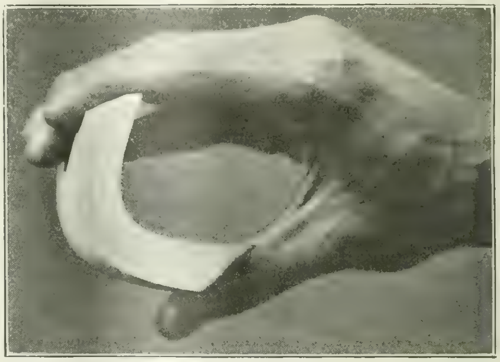


FIG. 1. A PACK OF CARDS BENT TO A RADIUS SERVES TO ILLUSTRATE THE EFFECT UPON THE PLIES OF A BELT WHEN PASSING OVER A PULLEY

A similar story may be told about the "friction" with which the plies are united. This friction is highly adhesive rubber which is forced into every ply of the belt until each ply is thoroughly inpregnated, making the whole a flexible and waterproof body. A good friction means a flexible, permanent bond for the plies, permitting free flexing of the belt around the pulleys, with the least possible generation of heat. Some manufacturers claim a "strong" friction for their belts, and they usually try to prove their point by demonstrating how difficult it is to separate the plies from one another. The fact of the matter is that this so-called "strong" friction is a detriment. It prevents the free flexing of the belt over the pulleys, causing it to generate an excessive amount of heat. As heat deteriorates rubber, ply separation sets in, and when this happens the belt has passed its useful stage. Ply separation, or "bootlegging," as it is commonly called, is caused also by the fact that the attrition between the plies increases as the diameter of the pulley over which the belt passes decreases. The speed of the pulley and the weight of the duck must therefore also be taken into consideration.

In deciding upon the number of plies which may be operated over a pulley of a certain diameter, the weight of the duck from which the belt is constructed is of prime importance, because the thickness of the duck governs the over-all thickness of the belt. As the belt passes over the pulley, the outer ply must stretch so much more than the inside one that a certain amount of attrition is unavoidable. It is a difficult matter to make a rule governing the number of plies, as all belts differ. However, the following may serve as a guide: A five-ply rubber belt, if made of duck heavier than 30 oz.. cannot be operated, in most cases, over a pulley smaller than 12-in. in diameter, unless the pulley travels at a speed of less than 1,000 r.p.m. Belts constructed of lighter duck—28-oz. or less—can be successfully operated over smaller pulleys, provided the friction is of a good grade. I have seen five-ply belts made of 28-oz. duck run over 4-in. pulleys at a very high rate of speed, but of course the friction was of high grade. One cannot go far wrong if one takes into consideration the weight of the duck of which the belt is made, the quality of the friction, the diameter of the pulley, and the speed at which it travels.

POWER TRANSMITTED BY BELTING

The amount of power which a rubber belt is capable of transmitting depends entirely upon the quality and weight of the duck. It is safe to say, however, and it will serve as a guide, that a belt made of a good grade of duck will transmit the following horsepower per inch of width, per ply, when traveling at a speed of 1,000 ft. per min. with an arc of contact of 180 deg.

Weight of Duck in Ounces	Horsepower
36	0.45
32	0.4
30	0.375
28	0.35

To find the number of horsepower that a 12-in., five-ply belt made of 32-oz. duck will transmit at 2,000 ft. per min., the arc of contact being 180 deg., it is necessary to multiply 0.4 by the number 12 (the width of the belt), the result by 5 (the number of the plies), and the product by 2 (double the power transmitted by 1,000 ft. per min.). The answer is 48 hp. Speaking approximately, in 99 per cent of all cases the power a belt will transmit depends on: The speed at which it travels; the tension under which it is placed on the pulleys; and the belt surface in contact with the pulleys.

The speed at which the belt travels governs the amount of power transmitted. If a belt traveling at 500 ft. per min. transmits one horsepower, at 1,000 ft. per min. it will transmit two horsepower; at 1,500 three horsepower, at 2,000 four, and so on. Where the belt reaches a very high velocity, centrifugal force causes a loss of power, but ordinarily this factor may be left out of the calculation. The belt speed may be found by multiplying the diameter of one of the pulleys by its speed and dividing the result by the constant 3.82.

The tension under which a belt is placed on the pulleys, called the initial tension, is the second important factor. It is common practice to cut the belt ⅛ in. shorter for every foot of its length when applying it. In other words, a belt 30 ft. long would be shortened by 3¾ in. (30 x ⅛ in.). It must be borne in mind that the tension thus obtained constantly decreases in service, and in time will fall below the point at which it will transmit the desired power. It must therefore be retightened at intervals to restore its original tension. The stretch to which a rubber belt is subject varies, and it is not possible to name an average, but it will be found that rubber belting does not stretch nearly as much as most leather belting.

The belt surface in contact with the pulleys is of no less importance. The foregoing table giving the horsepower for the various ducks is based on a pulley contact of 180 deg.; that is, exactly one-half of the smallest pulley over which the belt travels is in contact with the belt. The power transmitted will decrease in proportion to the arc of contact. The loss of power due to a decreased arc of contact is not, however, in exact proportion. Where the angle of the arc of contact is 90 deg., the power transmitted will be 65 per cent of the total at 180 deg. The following table indicates the relation for arcs of contact less than 180 deg.:

Arc of Contact in Degrees	Per Cent	Arc of Contact in Degrees	Per Cent
100	70	150	91
110	75	160	94
120	79	170	97
130	83	180	100
140	87		

The arc of contact may be ascertained by multiplying the difference between the diameter of the two pulleys by 4.775, dividing the result by the distance between the pulley centers in feet, and subtracting the whole from 180 deg. Expressed in equational form:

$$\text{Arc of contact} = 180\text{ deg.} - \frac{4.775\,(D - d)}{X}$$

D = diameter of large pulley in inches
d = diameter of small pulley in inches
X = distance between pulley centers in feet

How should transmission belt be ordered? How should the mining man know the weight of duck of which each belt is made? How may he ascertain the weight of duck of the belt purchased? There is a logical answer to each of these questions. Present-day merchandising methods are no longer based on "let the buyer beware," but, rather, on "the buyer must be satisfied." Today the manufacturer of belting knows exactly what his product is suited for. He knows or should know how to apply his product to the specified conditions to insure the maximum service to the user. In ordering belt it is therefore best to outline the working conditions to the belt manufacturer, or, better still, ask him to analyze the drive himself, giving you his recommendation of the belt best suited for the work.

ELEVATOR BELTS

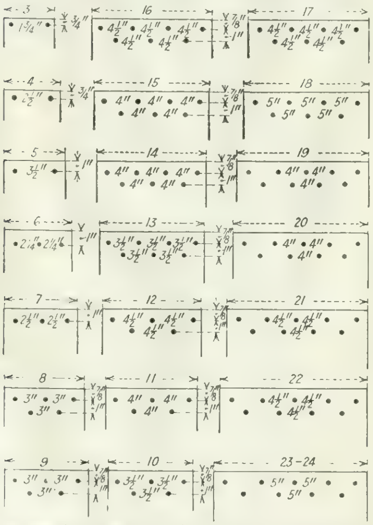
The fundamental rules for the application of elevator belts are slightly different. The principal thing an elevator is called upon to do is to lift material, often of a very abrasive nature, by means of steel buckets. An elevator belt must first of all have a sufficient number of plies to bear the tension. This tension depends upon the weight lifted, the height to which the material is lifted, and the speed with which it is lifted. To this must be added the weight of one-half of the belt itself and the weight of one-half of the buckets. From the total tension thus obtained the number of plies required can be computed. The power required to lift the load equals tons per hour multiplied by lift in feet divided by 1,000. The actual horsepower which must be transmitted to the belt is from 25 per cent to 100 per cent greater than the above figure, due to the friction of the buckets in passing through the partly filled boot. Where light material is elevated 25 per cent may be enough. On heavy lumpy material such as ore, 50 to 100 per cent must be added.

The horsepower thus obtained is converted into "pounds pull," as follows: Horsepower multiplied by 33,000 divided by feet per minute (the belt speed in feet per minute). The result is in pounds pull. This is, however, not the total tension on the belt. The total tension to which an elevator belt is subjected is equal to the tension required to lift the load, as established by the foregoing formulæ, plus the weight of one-half the buckets, plus the weight of one-half the belt. The weight of one-half the belt is found as follows: Width of the belt multiplied by number of plies multiplied by 0.04 (a constant) multiplied by distance between pulley centers. Then the number of plies necessary to lift the load is equal to the total tension divided by the product of the width of the belt in inches and a factor which equals 29 for 36-oz. duck, 27 for 32-oz. duck, and 28 for 34-oz. duck.

Standard Punching
For Elevator Buckets on Belt

Punching is for Malleable A, AA. B, C, Salem, Avery and similar buckets The spacing is also correct for steel continuous types of buckets, but position of holes should be changed to one half the depth of bucket

Projection of Bucket	Thickness of Belt	Length of Eclipse Elevator Bolts
5" and under	4 Ply	¼" - ¾"
6" " 7"	5 Ply	¼" - 1"
8" " over	6 Ply	¼" - 1"



... holes in buckets ⅝" for ¼" eclipse elevator bolts. Use one ¼" ... washer on each bolt between bolt and bucket.
... of belt - Length of bucket + 2"

FIG. 2. STANDARD PUNCHING, BUCKET ELEVATOR SET

The weight of duck used depends upon the nature of the material elevated. Heavy, lumpy material will be most efficiently handled by a belt made of heavy duck. For light material such as grain a belt made of a lighter duck will suffice.

The width of an elevator belt should be governed by the length of the bucket, that is, the belt should be two inches wider than the bucket is long.

As an example assume 12-in. malleable iron buckets weighing 13 lb. each. The material to be elevated is copper ore consisting of 2-in. lumps, weighing 135 lb. per cubic foot. Assume that the buckets are to be spaced 24 in. apart and that the belt travels 200 ft. per min. and elevates 60 tons per hour to a height of 65 ft., perpendicular. The power required is equal to 60 (ton per hour) multiplied by 65 (lift in feet) which is 3,900, divided by 1,000, equaling 3.9 hp. To this is added 100 per cent for digging in the boot, or 3.9 plus 3.9 equals 7.8 hp. Converting this into "pounds pull": 7.8 (hp.) multiplied by 33,000 equals 257,400 divided by 200 ft. per min. equals 1,287 lb. tension to lift the load. Add to this the weight of half the buckets. There are thirty-three buckets on one-half of the belt. The weight equals 429 lb. The weight of the belt itself is next computed. From the length of the bucket a belt 14 in. wide is needed. Assume that six plies are necessary to do this work. Then the weight of one-half the belt is equal to 14 (the width) multiplied by 6 (the ply) multiplied by .04 (a constant) multiplied by 65 (the lift in feet). This is 218.4 lb. The total tension imposed on the belt is found by adding:

Pounds	
1,287	the tension to lift the load;
429	the weight of half the buckets;
218	the weight of half the belt;
1,934	pounds total tension.

The number of plies required is found by dividing 1,934 by 406, the product of the width of the belt multiplied by the constant 29, thus: 1,934 divided by 29 multiplied by 14 equals 4.7 or five plies.

However, a belt 14-in wide consisting of only five plies would not be very substantial. Experience has shown that a minimum of six plies where the belt is from 10 to 18 in. wide, seven plies where the width is from 20 to 28 in. and eight plies on belts 30 in. and over is good practice.

The spacing of the buckets is from twelve to twenty-four inches, it being generally recognized that there should be sufficient room between them to prevent interference in filling. Twice the depth of the bucket is the usual distance. When the bucket is bolted directly to the belt there is sufficient relative motion between to cause considerable wear. Rubber washers or strips of rubber belting are used to keep them apart and to allow free passage of the sand and grit which otherwise would work in between.

The life of an elevator belt depends upon internal conditions rather than upon the normal stretching and releasing of stress as it picks up and discharges the load and bends over the pulleys. The greatest wear takes place between the belt and the pulleys. Old rubber belting on mill scrap piles will show several plies worn through on the pulley side. It is impossible to prevent the material from getting between the belt and the pulleys. To increase the life of the belt it is equipped with rubber covers, 1/16, 3/32 or 1/8 in. in thickness. The pulley side of the belt has usually a thicker cover than the bucket side, by reason of the greater wear. To decide upon the thickness of the rubber cover to be used, it is necessary to know the "compound" of which the cover is made, its ability to resist abrasion, and other factors. It would be unwise to decide upon the specifications of a belt without knowing its physical properties, as it may develop that the cover will last twice as long as the body of the belt, or vice versa. The secret of economic belt operation is to find a balanced belt; that is, one so constructed that all its ingredients will pass the stage of usefulness at one and the same time. There again, I must point out, the manufacturer of the belt should be allowed to decide the makeup of the belt.

One of the most efficient and economical methods employed for handling materials in bulk is by belt conveyors, and it is perhaps used more extensively in the mining industry than anywhere else. The installation cost as well as the depreciation on the belt itself, leaving the rest of the equipment out of consideration, is a most appreciable item. The cost of the belt has been found to range from 40 to 60 per cent of the cost of the total equipment, depending upon its width and length. The maintenance charge is estimated to be as high as 33⅓ per cent. Abrasive wear, due to slippage or sliding of the material on the belt, is the chief cause of belt deterioration. As the belt carries its load, a constant readjustment of the lumps takes place, thus gradually wearing out the rubber cover on the belt. Naturally, the property of the carrying surface of the belt, the rubber cover, is an important factor. A belt with a hard, highly vulcanized cover increases the tendency of the material to slide on its surface; one with a comparatively soft and resilient cover is to be preferred. After the cover is exposed to the air for some time it becomes hard if not compounded properly. Cheap belts soon "bloom" after being exposed to the air; that is, the belt assumes a white color, certain ingredients crystallize on its surface, and those remaining form a hard non-resilient mass. The tendency of the cover to harden is somewhat compensated for by the fact that the surface will become rough, allowing a thin layer of the finer material to adhere, which slightly protects the cover.

Where the material must be conveyed on an incline, the abrasive wear is more pronounced, because the material slides back longitudinally. Preventing excessive wear on the belt of an inclined conveyor due to longitudinal sliding of the load can be accomplished only by limiting the angle of incline of the belt to a few degrees below the angle of repose of the material handled.

The wear due to the loading of the conveyor is more difficult to prevent. Neither the wear nor its causes can be entirely overcome, but the destruction can be lessened by proper design of loading chutes and by increasing the area of belt over which the load is distributed. If it were possible to deliver the load in the same direction and at the same speed as the belt travels, no wear would occur at the loading points, but such conditions can be only approximately approached and an oblique impact shock is unavoidable when the load strikes the belt. A resilient cover naturally reduces the destructive action of such impact, and to reduce further the shock with which the material strikes the belt, an adjustable curved plate or lip is often attached to the lower edge of the chute, so that the material leaving the chute is deflected in the general direction in which the belt is moving. The unloading of conveyor belts is often accomplished by means of a tripper, a device consisting of three pulleys so arranged that the belt can be unloaded at any point. These trippers increase the wear on the belt because of the added flexing of the belt around its pulleys, as well as the readjustment of the load while passing over the tripper.

Many factors must be taken into consideration when deciding upon a conveyor belt, and it is impossible to determine the type of belt and the thickness of covers from mere book knowledge. There are no formulæ for calculating the thickness of cover to resist abrasion; this is something which can be determined only from actual experience. The width and number of plies required to carry the load can be ascertained mathematically. The width of the belt depends principally upon the size of lump of which the material consists. Several rules are used by which the width of the belt may be determined. One of these is as follows: Four times the average size piece plus six inches. In other words, if the average lump measures two inches, the belt must be fourteen inches wide. This rule is all right as far as it goes. It must be remembered, however, that the tonnage to be handled, the speed, and other details are deciding factors which govern the dimensions of the belt. The foregoing formula simply marks the minimum width permissible to prevent spilling.

The carrying capacity of belt conveyors is given in Table I.

TABLE I. CAPACITIES AT 100 FT. PER MINUTE OF CONVEYORS HANDLING MATERIAL WEIGHING 100 LB. PER CUBIC FOOT

Flat Conveyor		Troughed Conveyor	
Width, Inches	Tons per Hour	Width, Inches	Tons per Hour
10	7.6	10	17.6
12	10.8	12	25.2
14	14.8	14	34.4
16	19.2	16	44.8
18	24.4	18	56.8
20	30.0	20	70.0
22	36.4	22	84.8
24	43.2	24	100.8
26	50.8	26	118.4
28	58.8	28	137.2
30	67.2	30	157.6
32	76.8	32	179.2
34	86.8	34	202.4
36	97.2	36	226.8
38	108.4	38	252.8
40	120.0	40	280.0

The tonnage a conveyor belt will handle increases in proportion with the speed of the belt and with the weight of the material. That is to say, if a 20-in. belt handles thirty tons per hour of material weighing 100 lb. per cu.ft., the belt traveling 100 ft. per min., it will convey 120 tons per hour if the material handled weighs 200 lb. per cu. ft. and the belt travels at 200 ft. per min.

The power required by a belt conveyor is approximately 2.5 hp. per 100 tons per hour for every 100 ft. of belt. To this must be added the power necessary to lift the material, in case the belt operates on an incline, and the power absorbed by trippers should there be any. The power necessary to lift the load is equal to the tons per hour multiplied by the lift in feet divided by 1,000. The total horsepower thus found multiplied by 1,500, a constant, and the result divided by the product of the width multiplied by the speed, gives the number of plies necessary. Thus: Number of plies equal hp. multiplied by 1,500 divided by width multiplied by ft. per min.

These formulæ are derived from basic principles. Other factors peculiar to each case must be given consideration, but the formulæ will serve as a guide. It is impossible to deal with this subject in its entirety within the limits of this paper.

HOSE

Perhaps nowhere else does hose receive such severe punishment as in the air-drill service in the mine. The continual dragging over extremely sharp ore, the constant vibration, the high pulsating pressure, the oil vapor mixed with the air passing through the hose, combine to make the treatment inflicted extremely severe. A hose for this service must have a tube so compounded that it will resist the action of lubricating oil, which is bound to pass through it from the compressor. In some mines the drills are actually lubricated through the hose, which greatly shortens its life, for oil deteriorates the rubber. It is impossible for the user to test the tube of a hose for oil-resistance except by actual use.

Next in importance is the pressure which the hose must withstand. The air pressure used in most mines ranges from 80 to 130 lb. per sq.in., and the carcass of the hose must be so constructed that it will resist this pressure with the least possible expansion. The tube must be non-porous, so that the air and oil vapor cannot work into the body of the hose. The exterior of the hose must resist the abrasive wear to which it is subjected.

The economical use of air drill hose is by no means the simple problem which some mining men seem to consider it. At least a fundamental knowledge is necessary, and a thorough understanding of the subject will prove an asset. The first thing to be considered is the working pressure to which the hose is subjected. Here it must be remembered that the pressure which a hose will withstand is inversely proportional to its size; that is, as the bore of the hose increases, the pressure which it will stand decreases. A 1-in. six-ply hose may have a bursting pressure as high as 800 lb., whereas a 2-in. six-ply hose made of precisely the same material will burst at 650 lb. Like belting, hose is made of duck varying on weight and in tensile strength. Air-drill hose duck commonly used ranges in weight from 4 to 10 oz. Naturally a five-ply hose made of 4-oz. duck will not stand the pressure that a five-ply hose made of 10-oz. duck is good for. Hose duck is usually cut on the bias, from strips 40 to 42 in. wide, into pieces long enough so that when placed end to end, and lapped, the resulting strip is just wide enough to produce the necessary number of plies. This method makes the finished hose more flexible, and minimizes kinking.

As already mentioned, the pressure a hose will stand is inversely proportional to its size. High-grade hose made of 8-oz. duck will show approximately the bursting pressure given in Table II.

TABLE II. BURSTING PRESSURES OF HIGH-GRADE HOSE

Inches, Diameter	Ply	Bursting Pressure in Pounds per Sq.In.
¾	4	800
1	4	700
¾	5	900
1	5	800
1¼	4	675
1	6	850
1¼	5	775
1¼	6	825
1½	4	650
1½	5	750
1	6	800

Hose made of heavier duck will show a higher bursting pressure, and vice versa. The relation of the working pressure to the bursting pressure should be as one is to five; that is, a hose guaranteed to burst at a pressure of 1,000 lb. per sq.in. should not be used for working pressures above 200 lb. This applies to hose of wrapped-ply construction.

Another method of making hose is the so-called braided or moulded principle. In this construction the carcass consists of layers of cotton cords which are braided about the tube. This construction has the advantage that it can be made in any length up to 500 ft., whereas the maximum length that a wrapped hose can be made is 50 ft. Braided hose is usually made either two or three braid, in sizes ranging from ⅜ to 1 in. A high-grade moulded air hose of three-braid construction has a bursting pressure approximately equal to that of a four-ply wrapped hose. A factor of safety of five should be used.

Air-drill hose has probably to withstand more external wear than hose used for other purposes, and some mining men take it for granted that air-drill hose must be protected by wire winding. It would surprise some of them to learn that the wire which they think protects their hose is responsible for most of their hose troubles. A steel wire wound about the hose forms a non-yielding rigid armor, in contrast to the hose which expands and contracts as the pressure within it rises and falls. When subjected to pressure, expansion is inevitable, but a natural expansion is impossible because of the wire surrounding it. Consequently, internal attrition takes place, the inner tube of the hose separates from the fabric plies, causing a blister which sooner or later closes up and prevents air from passing through the hose in the required volume. This is one reason why hose should not be wire-wound. There are many others of equal importance. An examination of wire-wound hose found upon a scrap pile of a mine will show some of the reasons. Perhaps the wire was broken by a falling rock, puncturing the hose, or the wire was bent, closing the passage. Actual experience has proved that a properly constructed air hose will withstand the abrasive wear to which it is subjected better than a wire-wound hose. By a properly constructed hose, I mean a hose with a high-grade rubber cover such as is found on a conveyor belt. This cover resists the cutting action of the ore and allows free expansion and contraction of the hose.

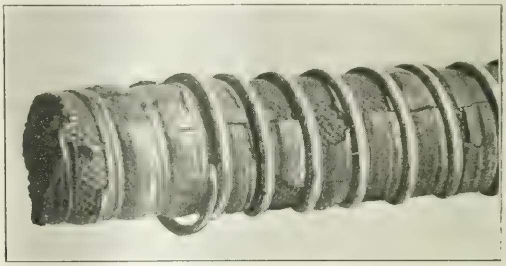


FIG. 3. DISTORTION PRODUCED BY WIRE WINDING WHICH PREVENTS THE FREE EXPANSION OF THE HOSE

In conclusion, it may be well to say a few words on the subject of rubber. The term "rubber," as commonly employed, does not refer to pure rubber as it comes from the rubber-bearing trees, but rather to a vulcanized compound consisting of gum, mineral matter, and sulphur, mixed in various proportions, according to the purpose for which it is intended. Mineral matter, or "filler," as it is commonly called, serves a useful purpose in adding desirable properties which could not otherwise be obtained. Its presence, therefore, should not be looked upon as an adulteration.

The real value of rubber depends upon the length of time that it will retain those properties which are desirable. Deterioration, as indicated by loss of strength and elasticity, is considered to be the result of oxidation, which action is accelerated by heat and sunlight. Other things being equal, the better grades of rubber possess greater strength and elasticity, and may be stretched to a greater extent than the poorer grades, and they also deteriorate less rapidly. The physical properties of rubber, however, are subject to variation within wide limits, depending upon the proportion of gum present, the materials used as fillers, and the extent of vulcanization.

Iron in Peru

Explcitation of Deposits Practicable on Development of Transportation Facilities Now Under Construction—Fuel and Fluxing Materials and Ferro-Alloys Conveniently Available—Hydro-Electric Possibilities—Government Liberal in Tax Demands and Customs Exemptions

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IN VARIOUS parts of Peru there are deposits of iron, which have been very little studied, and not worked at all, as a consequence of the fact that the general status of this mineral industry in Peru has not aroused interest among private individuals. In recent years the government has made investigations to determine the possibilities and the conditions that commercial exploitation will have to meet. The following deposits have been the subject for these official studies: Tambo Grande, in the Department of Piura, about 5 deg. south latitude; Aija-Callaycancha, in the Department of Ancachs, 9 deg. south latitude; Huacravilca, in the Province of Huancayo, at 12 deg. south latitude; and Marcona, in Ica, at 15 deg. south latitude approximately.

THE TAMBO GRANDE

Examinations have shown that the industrial value of the Tambo Grande deposit is not large. Tambo Grande is situated 106 km. from the harbor of Paita, of which distance 62 km., from Paita to Sullana, is covered by railroad, and the remaining 44 km. must be traversed on muleback, by a level sandy road. The deposit consists of a small mountain, in whose shadow there is a village called Tambo Grande, and which forms a sort of cupola of elliptical base, about 1 km. long and 700 m. wide, with a maximum altitude of 15 to 20 m. above the plain which surrounds it. This mountain is formed by iron mineral, which, as a matter of fact, is nothing else than a conglomerate of rounded quartzite pebbles with a cement of red hematite; and its exposed portion above the plain contains a little more than a million tons.

Assays of the pure cement gave 51.5 per cent of iron, 18.5 per cent silica and 0.09 per cent alumina, with traces of oxide of manganese; and indicated absence of sulphur and phosphate. A sample of the conglomerate gave 26.2 per cent of iron and 59.2 per cent of quartz and clay.

In the region there are supplies and resources for subsistance. Lime can be found in the neighborhood of Sullana 10 or 12 km. from the railroad, and, as to fuel, there are known deposits of coal in the hills of La Brea, situated north of Sullana and a little more than 90 km. from this village, the analysis of which has given 67 per cent of fixed carbon, 28 per cent of volatile material, and a little more than 2 per cent of ash; but these deposits are not worked and should be studied before much dependence is placed upon them.

AIJA AND CALLAYCANCHA

The deposits of Aija are situated in the vicinity of the village of this name, and on the western slope of the Andes 100 km. distance from port of Huarmuy. Actually, there is no railroad in this district. It would have to be constructed, and it is estimated that to reach the mines, it would have an extent of 165 km., of which 108 would be in "slide" country; but there is being constructed a passable road for automobiles which will lead to the mines of Ticapampa, in the District of Recuay, and at the other side of the Cordillera, of which road one part is already finished. This road will pass very close to the mines.

The deposits of Aija consist of various veins of magnetite varying between 0.8 and 2 m., inclosed in walls of slate, sandstone, and quartzite. The mineral contains a small quantity of pyrite, which can be easily separated, leaving the pure magnetite, which gives an analysis of 42 to 70 per cent of iron and 1.73 of silica, the absence of sulphur and phosphoric acid having been proved. There are no deposits of fuel in the neighborhood, but on the other side of the Cordillera in the District of Recuay workable deposits of anthracite of good quality are found, with 86.2 per cent of fixed carbon and 7.9 per cent of ash. As for lime, there is a deposit in the same locality, although data with respect to it are not available.

LLAMA TRAIN

The deposits of Callaycancha are found a little farther north than those of Aija, and in the same situation with regard to the summit line of the Cordillera. Access is gained by way of the port of Casma, from which the deposit is distant 87 km., of which 62 are of road relatively easy and of little difficulty, and the 25 remaining in ground which is very much broken. There is no railroad, and, if one were built, it would have to be approximately 160 km. long, of which only the first 60 would be on level ground.

The deposit consists of three parallel veins, 1 m. 10 cm., 1 m. 50 cm., and 4 m. in width, whose outcrops can be followed for a distance of 600 m. and whose filling is formed by iron oxide. The assays of the mineral have given from 61 per cent to [illegible] per cent of metallic iron, 19 per cent silica, 0.25 per cent of phosphoric acid, and 0.02 per cent of sulphur. Good anthracite in veins of 1 m. 30 cm. width, with 84 per cent of fixed carbon and 10 per cent ash, are found in Marcos, 35 km. distance from the mine. It is worthy of note that these veins appear to continue to the Callejon of Huaylas, the valley which lies on the east of the Black Cordillera, which in this place will be at a smaller distance from the coal and from the lime, which are found in abundance in this region; are contiguous to the River Santa, which can supply abundant motor power; and are especially advantageously situated with respect to the railroad of Chimbote and Recuay, whose advanced state of construction leads to the hope that it will soon pass near the deposits.

HUACRAVILCA

The Huacravilca deposit is one of the most important of the country. Huacravilca lies in the Province of Huancayo and at a little distance to the east of the summit of the western Cordillera at the source of the River Mantaro, which waters the important valley of Huancayo. Direct communication with the coast is difficult and long, more than 200 km., but access is more easy by the Central Railway of Peru, which, leaving from Callao, crosses the Cordillera and reaches in Oroya the valley of the Mantaro, which it follows up to Huancayo, from which place, distant from the coast 346 km., up to the deposit, about 80 km. must be traveled by such means as are available, but as the Central Railway is actually in construction, to the south, and as, also, there will have to be constructed a branch to the coal mines of Jatunhuasi, near the deposit, the railroad line which will be necessary to develop it will not need to extend the mentioned 80 km. but only over a length which perhaps will not be more than 25.

PORT OF LOMAS NEAR THE MARCONA DEPOSIT

The deposit consists of two masses of segregation a short distance apart and separated by a ravine—which deposits are perhaps united underneath the ravine. The outcrops are visible for an extent of 1 km. in length by 200 m. in width in each one of the masses, and the natural cuts permit one to estimate a thickness of 50 m., which would give for the visible part a content which would exceed 60,000,000 tons of mineral.

The mineral, which is sufficiently homogeneous, is composed of red hematite, but contains in some places spots of pyrotite and as a gangue shows fragments of the eruptive acid rock which forms one of its slopes or of the sandstones and quartzites which are found on the other side. Analyses of the numerous samples brought out show a content in iron variable between 66 and 78 per cent; insoluble gangue 2 to 13 per cent; and sulphur 0.06 to 0.07 per cent, although this last, in the parts impregnated with pyrite, nears 9 per cent. Phosphoric acid has never been found in any of the samples. A conservative calculation of the content in metallic iron of the visible part of the deposit, using a figure of 64 per cent, reaches a total of 38,500,000 tons of metal.

The region abounds in lime and dolomite, which can supply the necessary flux, there being extensive bodies of calcareous tuffs of a high grade of purity. There are also sandstones and quartzites, which could be used for silica as well as for material for construction. Clays of various qualities, some of which are refractory, also are found in the immediate vicinity, forming part of an important sedimentary mass which constitutes almost all of the region. The broken topography of the terrain facilitates the access and economic working of these materials.

With respect to fuel, Huacravilca lies in the immediate coal fields of Jatunhuasi, which is one of the most important in Peru. The deposits of coal begin at 10 km. distance from the iron deposit and the outcrops continue for 35 km., representing various formations which appear in many places and whose average thickness may be stated as 60 cm., there being actually at work many mines, which, unfortunately, do not yield all that they might, on account of the difficulty of transport, which would be ameliorated by the construction of the railroad mentioned. The fuel is a fat coal, whose analyses give 54 per cent of fixed carbon, 33 per cent of volatile material, and 11 per cent of ash. The coke which this carbon produces is of good quality and contains 84 per cent carbon and 16 per cent ash, being produced, according to the studies made, at a possible cost of 5 soles ($2.50 gold) per ton at the pit.

Water power can be obtained in almost any quantity, both in the Virgin River, which passes at the foot of the mines, and in the Mantaro, which is not far distant; it having been estimated that the first can be made to generate 2,000 effective horsepower and that the Mantaro can supply almost any amount of power required, as it is a river of large drainage.

With respect to workers and the necessities of life, in the neighboring valley of Huancayo there are plenty of natives who are experienced in mining work, it being possible to easily obtain 2,000 laborers—a number which could be steadily increased—with pay of 50c. to $1 a day, gold, for the day workers and of $1.50 to $2 for mechanics. Foremen and timekeepers can be obtained at a rate of $40 to $60 a month. In the same valley there are abundant farm and cattle resources, for the village of Huancayo is the center of commerce of all the region and the extensive valley which surrounds it. Grain is cultivated in abundance, as in the high pampas of the region there are numerous small farms.

MARCONA

The deposits of Marcona are near the coast, in the dry pampas which extend from the mouth of the River Ica, to the south of the harbor of Pisco, to the harbor of Lomas. It is reached from the first of the harbors named, going by railroad to Ica and afterward to the deposits in automobile in nine hours of travel. Its distance from the port of Lomas, as also from the village of Nazca, situated farther inland, is 60 km., but from the shore of the sea it is only 10 km. distant, being near the bays of San Juan and San Nicolas, which can be used as harbors.

The deposit appears as a series of low hills which rise above the sandy surface of the pampas, and as stains which appear in the middle of the sand, which extend over a surface of a square kilometer and which appear to correspond to an extensive segregated mass inclosed in dioritic rocks, into which it passes gradually upon its edges. An approximate calculation of the quantity of mineral in sight reaches a total of at least 500,000,000 tons. The mineral is a very pure hematite. Analysis of more than twenty samples taken from different localities denoted contents of iron between 60 and 65 per cent; silica 1½ to 11 per cent, the general average being 3 and 4 per cent; phosphorus 0.05 to 0.02 per cent, and sulphur 0.01 to 0.05 per cent, part of the sulphur being found in a state of lime sulphate, which gives rise to the opinion that it is due to a superficial contamination with the lime with which the sands in the vicinity are impregnated.

The deposit offers facilities for exploitation on a large scale and in the open air, and for the convenient transportation of its product, on account of the short distance to the sea. Also, there are in the neighborhood limestones which can be utilized in smelting, but there is no fuel, motor power, or facilities for taking advantage of them, as the region is completely dry and a desert, and the village and cultivated lands that are nearest are 60 km. away. Proximity to the sea can overcome these difficulties, because it would permit the bringing of the necessary resources of life for the working population, and also the necessary fuel for smelting, or, perhaps better, the transportation of the mineral to a region which had better facilities.

PERUVIAN LABORERS HAVING LUNCH OF PARCHED CORN

Fuel can be brought from the coal fields of Huayday, where extensive exploitation is beginning, embarking it in the harbor of Malabarigo, which has recently been constructed with the development of these mines principally in view. The coal of Huayday is an anthracite of good quality which does not decrepitate and which contains from 83 to 88 per cent of fixed carbon and about 5 per cent of ash.

This deposit, by the good quality of its mineral, by its abundance and by its nearness to the sea, which can supply all the deficiencies of the region, may be considered as the best foundation in Peru for the establishment of the iron industry. The deposit of Huacravilca follows it in importance, and its interest lies in the fact that, being situated upon the trunk line of Peru, which will connect the city of Callao with Lake Titicaca, traversing all the interior of the country, it possesses the advantage of being able to serve the local market and all the Andes region and the neighboring Republic of Bolivia.

The development of the iron industry of Peru is favorably influenced by the existence in the country of deposits of the rare metals vanadium, tungsten, and molybdenum employed today in the fabrication of special steels—as these metals are found in such abundance as would almost permit the creation of a monopoly.

There is in Peru the most important vanadium deposit in the world. It is at Minasragra, in the Province of Cerro de Pasco, and yields 80 per cent of the world's production. There is also in a large area in the provinces of Pasco, Yauli, and Jauja a series of deposits of vanadium-bearing asphalt which gives an average of 1 per cent vanadium acid, and the ashes of which give a content of more than 50 per cent, according to the proportion in which they appear. An approximate calculation of the quantity of metallic vanadium which could be extracted from this source reaches the enormous figure of 100,000 tons.

MOLYBDENUM AND TUNGSTEN RESOURCES

The most important deposits of molydbenum in Peru now known are found in Ricrin, in the Province of Jauja, 30 km. distance from the city of this name, which is reached by a macadam road which is in poor condition. Some very rich veins are inclosed in granitic rock and with a filling of quartz which contains from 2 to 3 per cent of molybdenite. The mineral is very clean and pure, the climate of the region is cold and raw, and there are abundant workers and all kinds of food resources. Besides, there is molybdenum in Runatuyl, in the same valley of Jauja. It has also been found in many other points in the territory of the republic, but as yet these deposits have not been studied.

The provinces of Pallasca and Santiago de Chuco are separated only by the River Pelegatos, which serves as boundary between them. On both sides of this river are found the most notable deposits of tungsten known in Peru. Access to this region is by way of Salaverry or Chimbote. From Salaverry to the point called Menocucho is 40 km. by rail, and from Menocucho to the deposits is 170 km. of difficult road. The railroad from Chuquicara to Cajamba, which will pass the immediate vicinity of these mines and which will be finished in two or three years, is now under construction. This road will permit the exportation of products of the region by way of Chimbote.

The deposits are of two classes. Some have tungsten and quartz alone and others have it incorporated in a copper matrix. The deposits are very rich. The population of the region is dense, the daily wage is low, and resources of all kinds abound. The average tenor of the ore is about 2 per cent. Also, there have been found deposits of tungsten in the province of Angaraes, in the Department of Huancavelica, and in other parts of the country.

The deposits of coal which are most available and which might yield the necessary fuel for metallurgical treatment have already been mentioned.

There exists in the Cordillera of Peru a tremendous carboniferous zone which extends from the Ecuador boundary on the north to Huancavelica on the south; that is, between 5 deg. and 13 deg. latitude. Over a width varying between 100 and 200 km. there is encountered in all of this region a series of coal deposits, some of which are close enough to the coast to be accessible from that side.

LABOR

The School of Engineers of Lima has turned out many engineers who could be employed in the [illegible] of the mines, but there does not exist a personnel capable of directing metallurgical operations. Without doubt, the young engineers are sufficiently prepared to co-operate as aides and to prepare themselves in this manner to occupy situations of greater importance. The salaries which are paid to engineers, varying naturally with their capacity and experience, can be assumed as between 30 and 100 pounds Peruvian ($150 to $500) monthly.

Mechanics, carpenters, blacksmiths, and other artisans can be readily obtained, and their pay averages from $2 to $4 a day. Experienced miners are found principally in the interior, where the mineral industry is developed, and are paid from 75c to $2 gold a day.

TAXES AND FACILITIES GIVEN BY THE GOVERNMENT

The only tax which actually lies on the iron mines is the mining contribution of three pounds annually per pertenencia of two hectares (about five acres). The law of export duty on minerals expressly excepts the minerals of iron and products of this industry from export duty.

Although there is no law which authorizes the government to provide facilities for those who may establish the steel industry, it is certain that one would be enacted if there were assurances of development and that it would be possible to obtain a great reduction in the taxes imposed on mines, exemption from duty of importations of machinery and materials which are introduced for this object, facilities to obtain under favorable conditions fuel and water-power concessions, and also the right to hold, free of charge, the public lands which might be necessary for the development of the industry, and to expropriate, paying a just price, those which might be private property. Also, it might be possible, in compensation of other facilities, that the government could guarantee the interest and even the amortization of the capital actually invested, and that there might be obtained a customs protection for the products fabricated.

The mineral laws of Peru are very liberal, and permit foreignors to obtain mines, water for motive power, and land for installation on the same conditions as the Peruvians.

Decline in U. S. Quicksilver Production

From July 1 to Sept. 30, 1920, inclusive, 2,045 flasks of quicksilver, of 75 lb. net, was produced in the United States, according to figures obtained from producers by F. L. Ransome, of the U. S. Geological Survey. This is 1,640 flasks less than was produced in the second quarter of 1920. The total production reported for the first three quarters of 1920 is 10,629 flasks, and if the present rapid decline continues, as now appears probable, the total for the year will be less than 12,000 flasks, 9,000 flasks less than that for 1919. The stocks reported unsold at the end of the third quarter were large in proportion to the output, amounting to 3,834 flasks.

Only twelve mines were reported as productive in the third quarter, nine in California, one in Nevada, and two in Texas. California produced 1,356 flasks, Texas 615 flasks, and Nevada 74 flasks.

The average monthly price of quicksilver per flask in New York for the quarter, as quoted in *Engineering and Mining Journal*, was $90.33 in July, $85.36 in August and $75 in September. The average price in the third quarter was $82.66, compared with about $91 in the second quarter. The decline in price was apparently due to a smaller demand for the metal, to the return to the domestic market of quicksilver previously sold abroad, and to the offering for sale of surplus stocks. The poor market, with the continued high cost of labor and supplies, has naturally had a depressing effect upon the quicksilver-mining industry. Two of the most productive mines in California, the New Idria and the Cloverdale, which contributed to the production in the third quarter, are now reported to be idle.

Ontario's Gold and Silver Production Increasing

Ontario's gold output for the first three quarters of the year 1920 was 424,297 fine ounces, worth $8,735,768, an increase of $1,161,182, or 15⅓ per cent, over the corresponding period in 1919, according to the Ontario Department of Mines. During the period, 977,475 tons of ore was milled, distributed as follows: Porcupine, 903,945 tons; Kirkland Lake, 69,328 tons, and miscellaneous, 4,242 tons. As already pointed out, the disabilities under which gold mining has been carried on are gradually being removed, the power situation alone excepted. Details of gold production are presented herewith:

Porcupine		Kirkland Lake	
Hollinger.	$4,620,800	Lake Shore	$371,359
McIntyre..	1,603,376	Kirkland Lake	215,558
Dome Mines...	1,515,086	Teck-Hughes	182,152
Northcrown....	70,406		
Porcupine Crown	70,962	Total..................	$769,069
Dome Lake....	46,809	Miscellaneous mines.......	23,904
Davidson.....	11,210	Recovery from nickel-copper refining............	4,146
Total............	$7,938,649		
Grand total....	..		$8,735,768

Miscellaneous mines include the production by Argonaut Gold, Ltd., in the Township of Gauthier; Contact Bay Mines, Ltd., near Dryden, and W. E. Stone, of Mine Centre. In addition to gold output, 71,990 oz. of silver was produced, worth $80,420.

Silver production increased from 7,475,396 to 7,831,132 oz. during the period, as compared with 1919. With the exception of 32,073 oz. recovered from nickel-copper refining and 71.990 oz. from gold-refining operations, the output came from Cobalt, Gowganda, and outlying areas. Power shortage and a rapid decline in the price of silver will have their effect on the output for the last quarter of the year. The average price of silver was $1.33 per fine ounce in January and 94c. for September, with an average of $1.09 for the nine months' period. On Dec. 1 the price dropped to 69¾c. for foreign silver on the New York market. Mines shipping over a half million ounces are given in order: Nipissing, Mining Corporation, O'Brien, Coniagas, and Kerr Lake.

During the period, 426 tons of ore, 2,654 tons of concentrates and 2,117 tons of residues were treated in southern Ontario refineries, for a recovery of 2,406,880 oz. of silver, in addition to arsenic, nickel, cobalt, and compounds of the two last-mentioned metals. A small output at Welland of nickel and cobalt compounds is reported by Ontario Smelters & Refiners, Ltd., successors to Metals Chemical, Ltd. Copper sulphate was marketed to the extent of 98,918 lb., the metallic equivalent being included in the total copper production. Silver producers were paid for 18,202 lb. of copper recovered in United States refineries. A considerable increase is noted in the price of cobalt, but more recently the general slump in prices of metals has seriously affected the business of silver-cobalt refineries. The output of 203,953 lb. of metallic nickel and 20,711 lb. of nickel oxide from silver-cobalt ores is small compared with the product of Canadian nickel-copper refineries.

Selective Converting at Clifton, Ariz.

Advantage Taken of Tendency of Precious Metals To Go Into the Copper Rather Than To Remain in the White Metal—Scheme Applicable Where Gold And Silver Content Is Low

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Written for *Engineering and Mining Journal*

THE copper bullion produced from the ores mined by the Arizona Copper Co., Ltd., of Clifton, Ariz., contains so little gold and silver that under normal conditions it is not profitable to refine it. Prior to 1919 it had been sold almost entirely as casting copper, no revenue being derived from the small amounts of gold and silver contained in the bullion. The average analysis of the bullion produced during the last two years was as follows:

	Per Cent, Cu	Ounces per Ton	
		Silver	Gold
Year 1919	99.41	5.357	0.185
January to November, 1920	99.56	4.83	0.150

With silver at $1 per oz., this bullion contains between $8 and $9 in precious metals, and with a refining charge of $25 per ton, it would be necessary to sell electrolytic at about 1c. per lb. above casting, to net the same return to the company. As the normal differential in the price of these two grades of copper is less than this amount, bullion of the analysis given would normally be sold as casting copper, in which case no recovery or payment is made for the gold and silver contained.

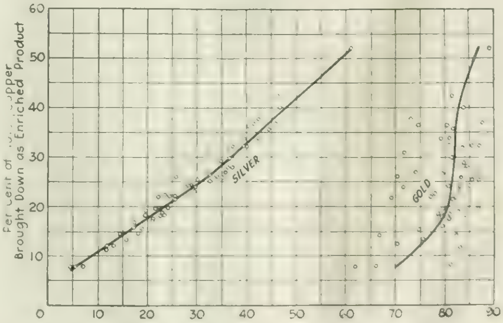
Experiments conducted in 1917 indicated that selective converting was feasible, utilizing the fact that copper has a greater affinity for gold and silver than has white metal. This is simply an adaptation of the old Welsh "best-selecting" process, in which impurities such as arsenic, antimony, bismuth and tin, as well as gold and silver, were collected in a certain small percentage of "bottoms," and "best-selected" copper was made from the remaining white metal free from such impurities. By performing a similar operation in the converter, two grades of copper would be produced—one, enriched in precious metals, to be refined, and the other, correspondingly impoverished, to be sold as casting copper.

To determine what percentage of recovery of the precious metals was possible by this method, a series of experiments was made, using full-size converter charges. The results, shown in the accompanying figure, cover the production of about 650 tons of copper in sixty charges, and show the variation in the recovery of the two precious metals, as the percentage of copper brought down as enriched product varies from 7 to 50 per cent of the total contents of the charges. These results indicate that whereas the silver recovery varies almost exactly according to the amount of copper brought down as enriched, a recovery of approximately 90 per cent of the gold is possible in as little as 7½ per cent of enriched product.

The actual procedure for the production of the two varieties of copper is as follows:

A charge consisting of about fifty tons of matte and the necessary siliceous ore and cleanings is blown in 12-ft. Great Falls type converters, of which four are available in this particular plant, to the white-metal stage as usual. The white metal is then blown until part of it is converted into copper, this blowing time being dependent on the amount of white metal in the charge, the percentage of enriched product desired, and other operating factors. The converter is then turned down, and the overlying white metal is poured off into a ladle. The copper remaining in the converter, which still contains a small amount of white metal and is enriched in gold and silver, is finished and poured as usual, this operation usually taking from three to five minutes, depending on how clean a separation has been made. The white metal which was poured off into the ladle is then poured into the same converter and finished, the copper produced being impoverished in gold and silver.

The principal difficulties encountered in operation are to control the percentage of copper produced as "enriched" and to obtain a clean separation when skimming the white metal from the enriched product. As a result of their experience, the operators at the plant can now estimate the percentage of enriched product with a fair degree of accuracy, but the results obtained are still entirely empirical. With a charge containing about fourteen tons of copper in total, the blowing time to produce 55 per cent of enriched product from the white-metal stage averages from fifty to fifty-five minutes under the conditions prevailing in this plant, but this varies with the size of the charge, cleanness of the skim, temperature of the charge, amount of cold scrap fed, temperature of the blast, and other operating conditions, and is still largely a matter of good judgment based on experience. The foremen in charge have developed a scheme for separating the copper and white metal, by observation of the appearance of the molten stream on a rabble blade, which is entirely satisfactory.



VARIATION IN PRECIOUS-METAL RECOVERY WITH DIFFERENT PERCENTAGES OF COPPER PRESENT IN THE ENRICHED PRODUCT

Owing to the small or non-existent demand for casting copper during the period of Government control, nothing further was done with the process until 1919, since when, however, it has been used to a large extent for the production of two grades of copper from the ores of this company. The normal production of the Arizona Copper Co., Ltd., since curtailment of operations in 1919 is taken care of by one converter stand, and the percentage of the enriched product to be made is determined entirely by market conditions. Although it would be feasible and profitable to conduct the operation even though there was a sale for all bullion produced as casting copper, in which case not over 10 per cent of enriched product would be made, at present more than half the production is expected to be sold as electrolytic, and the most economical procedure, which is at present in force, is to concentrate all the gold and silver possible in what copper must be refined in any event.

The operating results for a number of months are shown below:

OPERATING RESULTS, ARIZONA COPPER CO., LTD.

Month	Total Tons Bullion	Per Cent Enriched Bullion Produced	Per Cent Total Contained in Enriched Bullion Ag	Per Cent Total Contained in Enriched Bullion Au
Feb. to April, 1919	2,667	27.20	40.24	82.47
May	1,216	47.56	62.80	94.56
June	1,557	48.92	62.10	90.96
July	1,087	50.91	62.40	92.22
Sept., 1920	1,220	56.25	65.45	90.47
Nov.	1,386	56.92	66.69	92.17
June	1,362	59.93	71.66	92.58
Oct.	1,349	62.57	71.39	93.85
April	1,393	65.45	74.03	91.30
May	1,458	65.88	73.78	92.37
March	1,558	67.41	76.14	94.88
July	1,582	70.05	78.28	94.26
Aug.	1,661	76.85	83.27	95.10

Since the company's operators have become more skilled in the separation of the copper from the white metal, it is probable that the actual recovery will continue to come closer to the results shown in the cut, even though the plant should produce small percentages of enriched material. However, when running only one converter shell, as at present, a small amount of the enriched copper always remains in the shell when this part of the charge is poured out, and contaminates the impoverished copper that is produced later. It may be possible, when blowing more than one converter shell at a time, to finish each class of copper in a separate shell, in which event, this mixing of the materials after separation will be avoided and the percentage extraction increased.

The cost of the operation at present averages 85c. per ton of total copper produced, the cost including the extra time and incidental expense involved in making the separation, and the cost or re-treatment of additional byproducts produced which would normally be re-treated in the converters themselves, the latter item constituting the larger part of the expense. This figure was obtained by comparing the results noted during the lowest cost month when running straight charges, with an average month when separating the bullion, and is possibly a little higher than an average figure.

On the basis of the experiments made, and on the operating results covering a period of more than a year, it has proved both feasible and economical to conduct the separation as described. The calculation of the maximum profit to be derived under any given selling conditions is simple, and is used to govern the amount of enriched product made at any time. The percentage of enriched copper that is produced may be varied readily without disarranging operating schedules.

The scheme outlined was thought to be new at the time it was initiated. Later, it was found that a similar method had been used at the O.K. Mine, Australia,[1] but as a number of modifications have been introduced, particularly relative to continuity of operation, and as the operators at the Arizona company have had an opportunity to work the process for a longer period under varying operating conditions, the results are of interest. In comparatively few districts in the United States is the precious-metal content of the bullion as low as in the Clifton-Morenci district, but the process has been proved to be applicable, under certain market conditions, to bullions containing very small amounts of gold and silver. An incidental gain is that the impoverished bullion produced is of somewhat better grade in copper than that normally produced, as the small amounts of impurities originally present in the bullion collect in the enriched portion. The impoverished bullion produced in this plant has at times assayed as high as 99.75 per cent copper, and averages above 99.5 per cent.

The successful operation of the process, which still depends to a large extent on the skill of the operators, is due mainly to the interest taken in the matter by the converter organization of the company, of which C. O. Billingsley is general foreman.

Mineral Production of The Pas District

The mineral production of the prairie provinces of Cañada, according to Consul General J. G. Foster, shows a falling off in a few minerals required during the war, owing to lack of demand, and in the production of non-war materials the decrease is due to labor difficulties principally. The chief mineral supply of Manitoba lies in the northern part of the province, The Pas being the nearest point having continuous railroad connection with the markets. In 1919 the principal copper production came from the Mandy mine, northwest of The Pas. A total of 3,000,000 lb. of copper was taken out in 1919, as against 2,000,000 lb. in 1918. The metal was derived from about 25,000 tons of ore, containing 18 to 20 per cent copper, 2½ oz. of silver, and one-tenth of an ounce of gold per ton.

The rich ore in the Mandy mine has been exhausted, and operations were curtailed in the latter part of 1919 to await the construction of a railroad or the erection of a smelter in the near vicinity to permit the treatment of low-grade ores. In 1919 the production of gold in Canada amounted to 767,167 oz., of which 611 oz. came from The Pas district of Manitoba. In 1918 Manitoba's output was 1,926 oz. Silver production in Manitoba, in 1919, amounted to 20,760 oz., as against 13,316 oz. in 1918, from The Pas district.

Sulphur in Flotation

A recent English patent covers the use of elemental sulphur in the flotation of mixed sulphides, the patentees being T. H. Palmer, H. V. Seale, and R. D. Nevett. The sulphur is added in the proportion of one-half of 1 per cent of the weight of the ore, whereby one of the sulphides is removed. Acid or a frothing agent, or both, are then added, and the temperature is raised, under which condition the remainder of the sulphides may be floated.

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[1] *Eng. and Min. Journ.*, Feb. 11, 1911

Mining Engineers of Note

Robert Linton

FROM manufacturer to mine manager is not a long step when one is trained in both pursuits, for both involve the direction of productive industries. Robert Linton, president of the North Butte Mining Co., has made a record in both capacities. After studying at Washington and Jefferson College, and then at the Berlin Polytechnic, in Germany, he started on his engineering career in coal mining work and developing natural-gas properties in western Pennsylvania. This was more than twenty-five years ago. His father had been a prominent glass manufacturer, and it was but natural that the younger Linton, after a few years of mining work, formed a connection in this business and subsequently found himself with the American Window Glass Co. as manager of one of its factories. Eventually he became assistant to the chairman, with general supervision of operations in all the company's plants as well as of engineering work, making his headquarters at Pittsburgh. During this time the American Window Glass Co. developed the blowing machines for making window glass, an achievement that revolutionized the industry in that it substituted a mechanical process for work previously done only by hand and requiring a high degree of skill. Mr. Linton played quite an important part in the work which resulted in the ultimate success of these machines.

ROBERT LINTON

Mining, however, proved the greater attraction, and in 1906 Mr. Linton went back into mining engineering, and, with R. M. Atwater, Jr., and the late M. W. Atwater, formed the firm of Atwater, Linton & Atwater. Since then he has been engaged in mine examination and operation which has covered a wide field in this country and Mexico. When the Sierra Consolidated Mines Co. was organized to operate an important group of silver properties in the State of Chihuahua, Mexico, Mr. Linton was made manager, remaining in active charge until operations were suspended in 1912 owing to political disturbances. He then resumed general practice, with his office in Los Angeles. Early in 1917 he became connected with the North Butte Mining Co., and in the same year with the Consolidated Coppermines Co., of which company he is vice-president and managing director. Since then he has made his headquarters in New York, devoting the greater part of his time to the operation of these companies.

Mr. Linton is the kind of executive who attaches a great deal of importance to the human element in industry, and he has a record of more than usual success in combining efficiency and harmonious team work in the operations under his direction. He has given much study to organization and standardizing of productive operations, both in manufacturing and mining. In a recent paper contributed to the A. I. M. E. he described some new and important work in standardizing underground operations at the mines of the North Butte company, although the credit for this he insists is entirely due to the management and staff in Butte, which planned and carried it out. Operations under Mr. Linton's direction have always been characterized by progressive methods and policy, with occasional departures from the beaten path in search for means of improving results. It was in coal mines, when he was employed as engineer, that electric locomotives were first applied to underground haulage, displacing the more cumbersome tailrope system, and numerous other improvements leading to increased operating efficiency have been due to his suggestions. Keenly interested in the advancement of younger men with whom he is associated or brought in contact, he has found an outlet for such activities in the Y. M. C. A., which has claimed a great deal of his time and his interest for many years.

Mr. Linton is active in the work of the Institute and is chairman of its committee on industrial relations. He has contributed numerous articles to various technical publications, and is on the Library Board of the United Engineering Societies. He has also served as director and chairman of the publication committee of the Engineers' Society of Western Pennsylvania. At the recent convention of the American Mining Congress in Denver he was elected a director of that organization. He is a member of various other technical societies and of numerous clubs, both East and West.

HANDY KNOWLEDGE

Timber Sizes Used by Copper Queen Mine

The needs of a large mine in respect to timber required for supporting underground openings and for underground structures are many. Systematic design and standardization are essential for economy. Nevertheless, the number of different pieces is large, as is shown by the accompanying table, which represents the size of the prepared timber used in the underground operations of the Copper Queen mine, at Bisbee, Ariz. This table was prepared for use in the practical mining course maintained by the Copper Queen mine for its workers at Bisbee, and is here presented through the courtesy of the company.

TIMBER	SIZE	LENGTH	IN CLEAR	TENON	REMARKS		
Sq. set posts	10"x10"	7'5"	7'	5"x5"x2½"	Horn both ends		
" " "	8"x 8"	7'6"	7'2"	4"x4"x2"	" " "		
" " caps	10"x10"	5'	4'7"	5"x5"x2½"	" " " -4'2" between posts		
" " "	8"x8"	5'	4'8"	4"x4"x2"	" " " -4'4"		
Sill set posts	10"x10"	9'6"	9'3½"	5"x5"x2½"	" one end-		
" " "	10"x10"	8'6"	8'3½"	5"x5"x2½"	" " "		
" " "	8"x8"	9'6"	9'3½"	4"x4"x2"	" " "		
" " "	8"x8"	8'6"	8'3½"	4"x4"x2"	" " "		
Ties- 10"x10" set	6"x10"	4'7"	4'2"	Dapped one side both ends 1"x2½" - daps outside			
" 10"x10" "	5"x10"	4'7"	4'2"				
" 8"x8" "	5"x8"	4'8"	4'4"	" " " " " 1"x2" - " "			
" 8"x8" "	4"x8"	4'8"	4'4"				
				CAP		BATTER	
Tunnel posts	10"x10"	8'6"	4'	5'4"	Beveled 1¾" one end	17.6"	Caps have a 2"x10" or 2"x8" plank nailed to them 4' or 3'6" in the clear
" "	10"x10"	7'	3'6"	4'10"	" " " "	14.5"	
" "	8"x8"	8'6"	4'	5'	" " " "	21.8"	
" "	8"x8"	7'	3'6"	4'6"	" " " "	18.0"	
Long chute posts	10"x10"	9'4"	For 9'6" set - 10"x10" timbers				
" " "	8"x8"	8'4"	" 8'6" " - 8"x8" "				
Short " "		2'9"	Two posts 8"x8" and 8"x10" for 10"x10" timbers				
" " "		2'9"	" " " " " " " " " " 8"x8" "				
Chute girt	5"x8"	4'2"	For 10"x10" set				
" "	5"x8"	4'4"	" 8"x8" "				
" sill	8"x8"	4'2"	" 10"x10" " - One edge beveled back 4"- 45 deg. angle				
" "	8"x8"	4'4"	" 8"x8" " " " " " " " " "				
Chute lining	2" plank	7'8"	Plank 8", 10" and 12" wide				
" jaws	2" x12"	3'8"	Two pieces- 45 deg. bevel each end - measurement long corner				
" "	2" x12"	2'6"	" " " " " right and left- " through center				
" flooring	2" plank	9'3"	" "				
" "	2" "	7'	" "				
Timber slide lining	1"x12"	7'8"					
Cribbing-wall plate	8"x8"	10'8½"	Dapped one side both ends and center 1½"x8" -2cc 4'4" sq.				
" end "	8"x8"	5'8"	" " " " " 1½"x8"				
" wall "	5"x8"	10'	" " " " " and " 1½"x5"- 2cc 4'4½" sq.				
" end "	5"x8"	5'	" " " " " 1½"x3½"				
Spiling	4"x6"	8'	One end beveled 4" in 6"				
Foot-blocks	4"x10"	20"					
Drift braces	4"x6"	4'2"	For 10"x10" sets				
" "	4"x4"	4'4"	" 8"x8" "				
Flooring	2"&4"	5'	10" and 12" wide				
Matting	2"	8'	10" " 12" "				
Stringers			5"x8"x8'&12'- 8"x8" & 10"x10"x11'				
Split lagging		5'	Usually longer				
Track ties		3'6"	4"x6" and 5"x8" motor drift				
" "		3'	4"x4" ordinary drift				
Ladders	2"x4"	12'	Rungs 1"x2½"x14"-12" centers -dapped ½"x 2½"				
Blocks and Wedges			Various lengths				

TIMBER SIZES USED IN COPPER QUEEN MINE

Auxiliary Centrifugal Pumps Underground

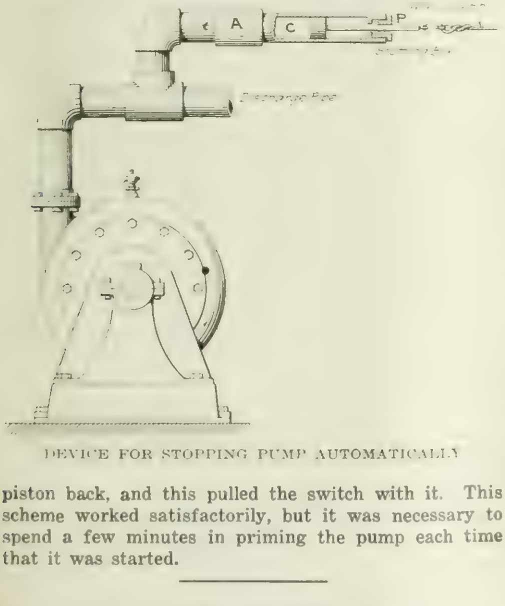
BY WILLIAM F. BOERICKE

Written for Engineering and Mining Journal

It is often necessary to install small centrifugal pumps underground where the "bottom" takes a sudden dip downward, allowing the water to collect over the haulage tracks unless conducted to a sump. These sumps are generally of small capacity, and it is usually cheaper, where electric current is available, to install a pump and motor and pump the water over the hump to the main pumping station, rather than to excavate dead bottom, or even to ditch the water if the distance is appreciable. Although a pump is a constant expense, on account of the power, unless a ditch has a good grade the sediment from dirty mine water will settle in it and gradually fill it up, necessitating a labor charge to clean it out at not infrequent intervals.

The pump installation should be as nearly "fool-proof" as possible and should require no labor attendance except to start it when the sump is full. An automatic device should be installed to cut out the power and stop the pump when the sump is empty. Here the pumpman has a chance to exercise his ingenuity. The simplest method is, of course, to put a float in the sump. The float is connected by a wire to the switch, and its movement down stops the motor. By properly adjusting the length of the wire, the sump need not be drained dry and there will be no need of priming the pump when it is started again, if it has a tight check valve on the suction pipe.

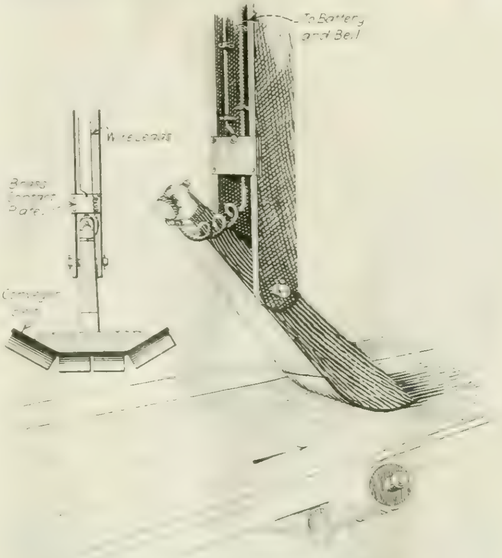
The method, however, is limited to those conditions under which the pump and motor are situated directly above the sump. It may happen that it is more convenient to have the pump and motor some distance away from the sump, with a long suction pipe running thereto. In that event another device can be used. The accompanying figure shows a satisfactory arrangement. The old pump cylinder *C* was threaded and screwed into the nipple *A*. When the pump was throwing water the pressure forced out the piston *P* to the end of the cylinder. The wire to the switch was then hooked onto the piston end. When the sump was empty and the pump started to run dry, the air pressure forced the piston back, and this pulled the switch with it. This scheme worked satisfactorily, but it was necessary to spend a few minutes in priming the pump each time that it was started.



DEVICE FOR STOPPING PUMP AUTOMATICALLY

Alarm Bell for Belt Conveyor

At the plant of the Tintic Milling Co. at Silver City, Utah, an ingenious device has been arranged to indicate by the sounding of an alarm bell the discontinuance of the stream of material upon a moving conveyor belt. At this plant the finely crushed ore is fed from different bins upon belt conveyors which discharge upon another conveyor. This in time discharges into a bucket elevator and this into a bin. It is necessary to mix the ores in definite proportions, depending upon the respective analyses, together with a fixed proportion of finely pulverized coal. This is done by regulating the feeder streams from the various bins. As long as the flow of material continues the final mixture will approximately reach the desired proportions. An interruption of any one feed stream would interfere with the proper mixture. The device is a short block of wood pivoted above its center of gravity. On the end is a simple electrical contact that completes an electrical circuit when the end of the block resting upon the ore stream falls, due to the absence of material. By means of an adjustible brass bolt the device can be regulated so as to give an alarm when the depth of material upon the conveyor belt changes even slightly. T. P. Holt, superintendent of the plant, states that the device serves its purpose exceedingly well.



DEVICE FOR RINGING ALARM BELLS

Oxy-Acetylene and Electric Arc Welding In Dredge Repair Plants

In the second annual report of the Canadian Klondyke Mining Co., Ltd., and the Canadian Klondyke Power Co., Ltd., attention is called to the value of oxy-acetylene and arc welding equipment, installed at a cost of $17,766. An additional arc welding unit of 1,000 ampere capacity was added to the repair equipment, at a cost of between $7,000 and $8,000. One of the major pieces of work accomplished by the oxy-acetylene and arc welding appliances was the reclamation from junk piles and scrap heaps of 68 buckets of 17-cu.ft. capacity which enabled an additional dredge to be operated. There were but few failures of the reclaimed buckets, and such as developed from time to time were replaced by other reclaimed buckets.

A large number of bucket pins were reclaimed by building up worn pins. Other worn parts offered opportunities for building up. By placing the welding equipment on the dredge considerable expense was saved by obviating the necessity for the removal of tumblers, plates, and other parts. On the hydro-electric pumping plant the failure of an important valve was remedied by putting an expansion joint in the pipe at a point near the pumping station to take care of the expansion and contraction in the pipe which had caused the failure of the valve. The valve was repaired and the expansion joint installed by the aid of the welding crew in forty-eight hours.

CONSULTATION

How Federal Reserve Notes Are Issued

"I presume there are a great many people who, like myself, are hazy about the modus operandi of the Federal Reserve banks. Will you kindly answer the following:

"1. Is there any limit in law as to the amount of Federal Reserve notes that can be issued? How are they put into circulation?

"2. How are they retired?

"3. Federal Reserve notes say they pay on demand, but do not say with what they will pay.

"4. What kind of collateral is back of the notes?

"5. In what way are they superior to the greenbacks that were issued after the Civil War?

"6. Is it not true that greenbacks were inferior in purchasing power to gold and silver?

"7. Are we not steered for the rocks with an unlimited issuance of Federal Reserve notes?

"These are questions which have agitated my mind for some time."

*1. Federal Reserve notes come into circulation chiefly in two ways: (a) Banks may bring other kinds of money into the Federal Reserve banks and take in exchange Federal Reserve notes. This was the case, for example, in 1917, when the banks, in order to centralize the country's gold reserves where they would be of the most service, deposited large amounts of gold and gold certificates in the Federal Reserve banks, the place of which in the country's stock of money was filled later by Federal Reserve notes. (b) Member banks rediscount their customers' paper with a Federal Reserve bank or borrow on their own notes from it, receiving primarily a credit in their deposit account. But they may draw on this account and receive Federal Reserve notes, if desired. The paper which they leave with the reserve banks becomes collateral for the Federal Reserve notes, as noted again below.

2. The chief way in which these notes are retired is through a reversal of the above process. Since the only legal reserve of a member bank is its balance with its Federal Reserve bank, it is not good business policy for it to keep more notes in its vaults than are needed for ordinary business. Any excess will be paid to the Federal Reserve bank to reduce its borrowings. In other words, notes not needed by the business of a community will find their way into the commercial banks and thence into the Federal Reserve banks and will be retired.

The Federal Reserve board has the right to reject in whole or in part the application of any Federal Reserve bank for these notes. Other limits imposed are, the amount of commercial paper offered to the Federal Reserve banks and the gold reserve requirement, as will be seen from the answer to the question 4.

3. The law provides that reserve notes shall be redeemed in gold on demand at the United States Treasury Department or in gold or lawful money at any Federal Reserve bank. A statement to this effect will be found upon the back of each note.

4. The collateral security behind the notes consists of gold and gold certificates to the amount of at least 40 per cent and the other 60 per cent drafts, notes, and bills of exchange which the Reserve banks have discounted for member banks, those banks' own notes, and bankers' acceptances bought in the open market. In order to be eligible for rediscount, commercial paper must be drawn for agricultural, industrial, or commercial purposes, and not for investment purposes nor for the purpose of carrying or trading in stocks and bonds. (except United States Government securities). Such paper must also have a maturity at time of discount of not more than ninety days, except in the case of agricultural or livestock paper, which may run not over six months. Promissory notes of member banks must have a maturity not exceeding fifteen days. Thus the intent of the law is that these notes should at all times have behind them dollar for dollar gold or liquid paper growing out of commercial transactions. As a matter of fact, there was on Dec. 30, 1920, one-sixth more eligible paper behind these notes than was required, besides 50.5 per cent gold, after setting aside the reserves required against net deposits. Federal Reserve notes are obligations of the Government, and, further, are, together with Federal Reserve *bank* notes, "a first and paramount lien on all the assets" of the issuing banks.

5, 6, 7. The greenbacks were mere promises of the Government to pay on demand unsupported by monetary reserve or collateral. Consequently, they fluctuated in their purchasing power or their relative value to gold according to the public estimate of the Government's present or future ability to pay. With the country involved in a war of which the outcome was often highly doubtful, every unfortunate event lessened public confidence in the country's credit and currency. Further, every increase in the amount of this currency decreased its value by making its repayment more doubtful or more remote. These were defects inherent in the nature of the greenbacks which made them inferior to such a currency as the Federal Reserve notes. In addition, the banking system of that day was inadequate to the strain, and specie payment was suspended for eighteen years (1861-1879). In contrast to that condition has been the generally strong position of our banks during the recent war, for which much credit it due to the system of central banking inaugurated with the Federal Reserve. It is generally recognized that it was most fortunate for the United States that the Federal Reserve system was organized in time to function during the war. It is expected that there will be an orderly deflation, during which the liquidation of loans at commercial banks will allow them to decrease their borrowings and their deposits with the Federal Reserve banks; also to return for retirement a large amount of Federal Reserve notes. The result will be a considerable increase in the percentage of the gold reserve to the notes.

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*This information was courteously supplied by the Federal Reserve Bank of New York, to whom grateful acknowledgment is hereby made.

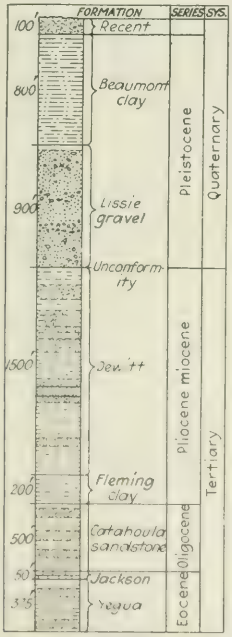
THE PETROLEUM INDUSTRY

Condition of the Spindletop Oil Field

BY F. J. S. SUR

Written for Engineering and Mining Journal

ON Jan. 7, 1901, Captain Lucas brought in the famous Lucas gusher in the Spindletop field. That production was not measured, but Captain Lucas and others gaged the output to be about 75,000 bbl. daily. Well after well was brought in thereafter almost daily, some of which produced as high as 96,000 bbl. a day. No field was ever so intensively drilled as was Spindletop, a total of 1,003 wells having been driven within an area of 144 acres. Lots that measured 32 ft. x 80 ft. sold for as high as $100,000. No attention was paid to side-line boundaries, and the rigs were braced against each other, so that visitors could walk 500 ft. in one direction by merely stepping from derrick floor to derrick floor.

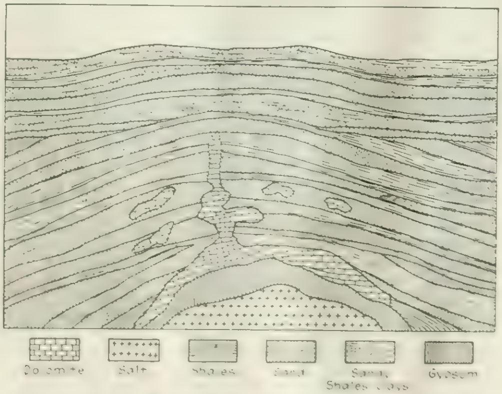


GENERALIZED COLUMNAR SECTION IN THE SPINDLE-TOP FIELD

A 9 ft. x 12 ft. holding was owned by a man named Mead. When he had placed his derrick floor it occupied land that was owned by five separate companies. This was in the northwest corner of the Lone Acre property. His well made 23,000 bbl. daily initial production.

Recently when I visited the old field, there were 130 derricks in place and 100 wells were producing a total of 1,000 bbl. daily.

S. B. Eddy, one of the last of the "old guard," is still drilling wells there. The data which he gave me are extremely interesting, and I have since proved the authenticity of the record. He has four wells averaging 10 bbl. daily now producing. Thirty-five wells have, up to date, been drilled in nineteen years on the Lone Acre, and all produced oil in commercial quantities. A year ago a well drilled on this property produced 125 bbl. daily for two months, and it is still producing 10 bbl. daily. Four wells are being drilled in the field all the time. It seems to be the only oil field that replenishes itself.



VERTICAL SECTION THROUGH A GULF COAST SALT DOME

Costs at present, compared with those of the old days of 1901, are interesting. The old wells took from six to nine months to drill, and costs were as high as $40,000 per well. Today, wells are being drilled in from fifteen to twenty-one days' time, at a complete cost of $4,000.

The price obtained from the oil in the old days was 10c. per barrel, and this is now $2.50 per barrel. The gravity of the oil is 22½ Bé. The shallowest producing well was 730 ft. and the deepest was 2,950 ft. The great production was from the top of the Salt Dome, and the deep well struck 125 bbl. in the Fleming formation on the west side of the dome.

All rigs used in the Spindletop field are of the rotary type. It was in this field that this particular type of rig originated, and it was evolved because of the fact that the use of the cable-tool type took so much time and entailed such a great cost to drill through the thick sand body. In the first producing well, the Lucas well, 373 ft. of sand was encountered in the first 598 ft. drilled. The derricks average from sixty-four to eighty-five feet high, with bases twenty feet square.

Technical Papers

Relief Map of the U. S.—The U. S. Geological Survey, Washington, D. C., has recently issued a new relief map of the United States, copies of which are available on request to the Director for 75c. each. The map measures 40 x 70 in., the scale being fifty miles to the inch. It is printed in brown and blue, and is a fine specimen of lithography. It makes an excellent wall map for home or office, as it indicates the state lines and principal cities, as well as making it easy to visualize the topography of the country.

Treating Complex Ore—A short review of an investigation into the low-grade complex-ore industry of Colorado is contained in U. S. Bureau of Mines *Reports of Investigations*, Serial No. 2,206, obtainable on request. A more complete account will be published as Bulletin 10 of the Colorado Bureau of Mines, and may be obtained by addressing Horace E. Lunt, State Museum Building, Denver, Col.

Iron and Steel Industry of India—In a paper presented at the eighteenth general meeting of the American Iron and Steel Institute, New York, on Oct. 22, 1920, Charles P. Perin has outlined the history and development of the iron and steel industry of India. It is estimated that Indian iron-ore reserves total 20,000 million tons of high-grade material, with fuel within 500 miles at the maximum, and at an average distance of 120 to 130 miles. There are also large deposits of dolomite, coal, manganese, magnesite, and wolframite. The paper deals principally with the activities of the Tata Iron & Steel Co., whose present development plans contemplate a total tonnage of 700,000 tons of pig iron and 580,000 tons of steel ingots converted into 425,700 tons of various finished products.

Potash From Alunite—"The Extraction of Potash From Low-Grade Alunite" from Marysvale district, Utah, is the title of Bulletin No. 13, obtainable on request from University of Utah, School of Mines, Salt Lake City, Utah. Potash has been produced from alunite commercially since 1915. The ore, containing approximately 10 per cent K_2O, is crushed, roasted in a pulverized-coal-fired cement kiln and leached with hot water. The residue is filter-pressed and stored for possible later recovery of alumina. The solution is evaporated and the K_2SO_4 crystals are dried, pulverized, screened and sacked. The bulletin describes experiments on ores containing [illegible] per cent K_2O.

Storage-Battery Locomotives—Technical Paper 264 of the U. S. Bureau of Mines discusses the use of storage-battery locomotives in mines containing combustible gas. Price 10c. from the Superintendent of Documents, Washington, D. C.

Copper in South Australia—The Wallaroo and Moonta Mining & Smelting Co., Ltd., Wallaroo, South Australia, has issued an attractive sixty-nine-page illustrated book in sepia, describing the works of that company. Copper sulphide ore is mined, most of it being concentrated by hand picking, Hancock jigs and flotation. At the smelter roasting is carried on in sintering pots and in pyrite burners, the gas being used for acid manufacture. There is one ten-foot blast furnace, two acid converter stands and a small reverberatory. Gold and silver are concentrated in the converters in the "copper bottoms," probably in the same manner as has been done at the Arizona Copper Co. smelter. Electrolytic refining is practiced, and there is also a leaching and precipitation plant. Most of the information given is general in character.

Iron Ore—"Tapping the Nation's Great Reserves of Lean Iron Ores" is the title of an article by A. J. Hain which appears in the Jan. 6 issue of *The Iron Trade Review* (Cleveland, Ohio; price, $1). A description of the plant and operations of the East Mesabi Iron Co. at Babbitt, Minn., is given. This company will mine and treat the low-grade magnetic iron ores of the Eastern Mesabi range and has already made excellent strides in the construction of the plant, which is to cost approximately $60,000,000.

Sand and Gravel—"Sand and Gravel in 1919," a thirteen-page section of "Mineral Resources," has just been published by the U. S. Geological Survey and may be obtained on application.

Mine Fires—Brief suggestions on preventing fires in metal mines are given in U. S. Bureau of Mines *Reports of Investigations* No. 2,194. (Free from the Bureau at Washington).

Manitoba Minerals—A fifty-five-page book, entitled "Mineral Prospects in Southeastern Manitoba," has just been issued. Among others, the gold deposits of Rice Lake and Gold Lake are described. Copies may be had on application to the Publicity Commissioner, Parliament Buildings, Winnipeg, Man., Canada.

Potash—"Potash in 1919," a twenty-page section of "Mineral Resources of the United States," has just been issued by the U. S. Geological Survey, Washington, D. C. (free). A bibliography of recent articles on potash and its extraction is included.

Mississippi Road-Making Materials—This subject is covered in a 139-page book issued as Bulletin No. 16 by the Mississippi Geological Survey, Jackson, Miss. (free).

Lead—"Lead in 1918," a thirty-four-page section of "Mineral Resources," has just been published by the U. S. Geological Survey and may be obtained on application.

Book Reviews

The Geology of the Gisborne and Whatatutu Subdivisions. Raukumara Division. By J. Henderson and M. Ongley Wellington. New Zealand Department of Mines: Geological Survey Branch. Bull. No. 21. (New Series); pp. 88; 1920.

This bulletin embodies the results of a geological survey of certain squares or arbitrary subdivisions embracing about 1,100 square miles situated on and near the New Zealand coast. The rocks of the region are, besides some probably Cretaceous, mainly Tertiary, followed by Pleistocene, and make up a sedimentary series about 10,000 ft. thick. A number of separate formations are distinguished, usually separated one from another by marked uncomformities. There are no solid igneous rocks in the district, but repeated layers of pumice and other volcanic aërial or submarine detritus occur in the series. Pleistocene elevation and depression, as shown by raised shore benches and other criteria, were repeated and covered a vertical range of hundreds of feet. An extension system of block faulting cuts all the rocks.

The region is of chief economic interest because of the indications of oil, which include actual oil-seepages. These have been known for a long time, and many attempts have been made to find oil in commercial quantities, but all have been unsuccessful. Many previous writers have described synclines and anticlines in the rocks, but the present writers conclude that the many changes of strike and dip of the beds are due to block faulting. The numerous faults in the Gisborne district are regarded as unfavorable for the occurrence of large oil pools. Specific suggestions for further exploration are given, the chief of which is to avoid drilling within the great fracture belts. J. E. S.

Pumping by Compressed Air. By Edmund M. Ivens. Second edition; Cloth; 6 x 9¼; pp. 266; illustrated. John Wiley & Sons, New York. Price, $4.

This edition has been slightly revised and contains several pages of additional text, together with formulæ and tables. The author has succeeded in making an excellent selection of material, and the arrangement is such that the book constitutes a valuable reference work for the student and those who are considering construction requiring the installation or use of compressed - air pumping machinery. Liberal references are made to the technical press, and the features of operating plants in various fields are described, some of them in detail. Mr. Ivens has included considerable data which he collected during the installation and testing of air lifts under a wide range of conditions.

D. E. A. C.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Bureau of Mines Issues Three New Cinematograph Stories

Asbestos and Sulphur Traced Graphically From Vein to Consumer's Hand—Ingot Iron Also Depicted

Two new educational motion picture films of the mining industry, "The Story of Asbestos" and "The Story of Sulphur," were ready for public distribution by the Bureau of Mines about Feb. 1.

"The Story of Asbestos," in six reels, was produced by the Bureau of Mines in co-operation with the H. W. Johns-Manville Co. This series illustrates in detail the methods employed in the mining of asbestos in Arizona and in Quebec, and also shows the manufacturing processes used at the Johns-Manville Co.'s plants in New Jersey and New Hampshire.

"The Story of Sulphur" was produced by the Bureau of Mines in co-operation with the Texas Gulf Sulphur Co. and shows in detail the methods of production, storage and transportation employed at the plant of this company at Gulf, Tex.

The Bureau of Mines has in preparation a film on the production of ingot iron, which is being made in co-operation with the American Rolling Mill Co. and soon will be completed.

These three films will have their first public showing at the meeting of the American Institute of Mining & Metallurgical Engineers in New York on Feb. 16. Inquiries in regard to the lending of these films for educational purposes should be addressed to the Pittsburgh station of the U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.

Report on First Aid and Rescue Classes in Globe-Miami District Shows Year's Growth

The Globe-Miami Rescue and First Aid Association, with its rescue station at Globe, Ariz., has for members the following seven companies: Inspiration Consolidated Copper, International Smelting, Miami Copper, Old Dominion, Iron Cap Copper, Arizona Commercial Mining and Superior & Boston Copper. The partial report of the association's work for December and the summary of training for the year 1920 reveal a healthy activity in this important work of training men in first-aid and mine rescue work. During 1920 the 220 first-aid classes had an attendance of over 4,000, there being 905 men receiving training in this branch. As the result, 251 men earned and received district first aid buttons, and 245 men secured Bureau of Mines first-aid certificates. The district "button" men now number 329.

The classes in mine rescue work showed an attendance of 734, there being 124 men under training, and an average attendance of over five men at each practice. By the end of the year seventy-one Bureau of Mines rescue work certificates had been earned and were awarded.

In addition to these training classes there were many inspections of first-aid boxes, supply bases, pulmotors, and other rescue apparatus distributed throughout the district. Perhaps the inspectors' activities find best expression in the annual mileage of the three motor cars in that service. These cars had a total average travel of over 700 miles monthly, and covered 19,306 miles in all during the year ending Dec. 31, 1920. The director, Orr Woodburn, says in his letter of transmittal recently received:

"Two calls to mine fires were answered during the year. One proved to be a false alarm and the other was out on arrival. Numerous incipient fires have been extinguished with facilities at hand, which demonstrates the possibility of fire and the advantage of extinguishers.

"It is worthy of note that a greater number of employees could be given first-aid training with the same time, effort and expense.

"The contest plan is progressing nicely. Some of the large departments are not yet represented by contesting teams."

Rocks Under Great Pressures To Be Studied at Madison, Wis.

W. A. Clark Presents Press and Thermometric Equipment for Experiments in Metamorphism

By the aid of funds given by W. A. Clark, of Butte, Mont., the geologic department of the University of Wisconsin at Madison, Wis., has acquired a compression testing machine capable of exerting a pressure of 400,000 lb. The university will use the machine in studying various problems in structural and metamorphic geology involving the behavior of rocks under pressures similar to the great pressures experienced in nature by the rocks of the earth and other planets.

The machine is equipped to maintain automatically a constant pressure over a long period of time. Means for heating the materials while under pressure, and for maintaining them at a constant temperature, as well as for accurately measuring the temperatures they undergo, also will be provided. The pressure is developed by an oil-operated hydraulic press.

Brazilian Consular Invoice May Not Carry Abbreviations

Many Consignees Pay Fines Because American Houses Forget This Rule—Tax Taker Profits

As a result of the failure of American shippers to comply fully with regulations regarding Brazilian consular invoices, receivers of American goods at Brazilian ports are frequently subjected to fines and put to considerable trouble. This matter has been called to the attention of the Chamber of Commerce of the United States in a communication just received from the American Chamber of Commerce at São Paulo, Brazil.

The São Paulo chamber points out the necessity of giving complete information called for in each separate column of the Brazilian invoice form, specifying that the use of abbreviations results in a fine being imposed on the consignee. The letter reads:

"Consignors of merchandise are failing to write out the country of origin of the goods and the country where the goods are purchased in full, in each of the columns provided for that purpose on the consular invoice, and are abbreviating along the top of each column the name of the country of origin, 'United States of America' or 'Estados Unidos da America,' to 'U.S.A.' or 'E. U. da A,' placing these initials across the two columns in question.

"This abbreviation is used of course, for convenience sake, but the consignees in Brazilian ports, on dispatching their goods, are fined because of such abbreviation.

"We might also call your attention to the fact that the custom-house officials discharging the goods receive 50 per cent of the fine levied on consignees taking their wares from the custom house, which fact encourages the fine for the slightest deviation from the Brazilian consular invoice regulations."

Prof. Leonard Hill's kata-thermometer, which was invented to measure the cooling effect of the air surrounding the human body, is being introduced into the mines of South Africa, according to a paper recently presented by H. J. Ireland before the Chemical, Metallurgical and Mining Society of South Africa. The remarks [illegible] made by A. J. Orenstein show that this instrument has a number of points of superiority over the usual mine anemometer. The instrument is new to [illegible] both here and abroad.

The Engineers' Club of Northern Minnesota held its regular meeting on Jan. 29, at the [illegible], Virginia, Minn. Ward Royce [illegible] on the use of underground loaders and slushers.

PERSONALS

R. P. Luke, mining engineer, who has been in Mexico during the last year, has returned to New York City.

Philip N. Moore recently addressed the Ohio Engineering Society on "The Engineer and a National Board of Public Works."

W. M. Tappan, of Hibbing, Minn., general superintendent of the Oliver Iron Mining Co. in the Hibbing district, is on an extended pleasure trip to California.

John H. Kennedy, of Buffalo, N. Y., superintendent of furnaces for the Rogers Brown Ore Co., was in Hibbing about Jan. 15 conferring with the officials of his company.

Joseph Houston, formerly manager of the Dome Mines, Porcupine, Ont., and more recently connected with the Orr mine of Kirkland Lake, is examining mining properties in Mexico.

Dwight Woodbridge recently made an examination of the Rowe mine, the Cuyuna Range property upon which lease has lately been surrendered by the Pittsburgh Steel Ore Co.

Theodore Pilger, mining engineer, formerly in Butte, Mont., and in Alaska, has accepted a position in the New York City sales office of the Allis-Chalmers Manufacturing Co., 50 Church St.

Walter A. Funk, mining engineer, has gone from Idaho Springs, Col., to Iola, Kan., where he will be engaged in oil geology work with Dr. H. B. Patton. His address is now Iola, Kan.

H. V. Hansell, of Hamilton & Hansell, Stockholm, Sweden, and New York, investigated the magnetic separation plant of the Mesabi Iron Co. on the eastern Mesabi Range during the week of Jan. 10.

E. E. Berliner and **S. F. McElroy** have severed their connection with the Michigan Smelting & Refining Co., Detroit, Mich., and have formed Berliner-McElroy & Co. at 1111 Superior Viaduct, Cleveland, Ohio.

E. W. Wagy, superintendent of the Bureau of Mines petroleum experiment station at Bartlesville, Okla., recently resigned to accept the position of production engineer with the Standard Oil Co. of California.

W. P. Wolff, who has been associated with the Oliver Iron Mining Co. at Ely, Minn., for the last two years, has been appointed chief engineer of the Vermilion district for the same company. Mr. Wolff formerly was chief engineer for the M. A. Hanna Ore Co., Crystal Falls, Mich.

M. J. Kirwan, recently in Japan for a year with the Nippon Oil Co., has been assigned to charge of drilling and production work of the Bureau of Mines petroleum station at Bartlesville, Okla. Mr. Kirwan was formerly state oil and gas supervisor for the California State Mining Bureau.

S. R. Smith, who has been superintendent for the Ahmeek Mining Co. for a number of years, has resigned. He is succeeded by **Ocha Potter**, formerly superintendent for the Superior Copper Co. and efficiency engineer for the Calumet & Hecla Mining Co. and its subsidiary mines.

Charles H. Claypool and **J. L. Sullivan**, of Hibbing, Minn.; **James Hildebrand**, of Biwabik, Minn.; **Thomas Mulvaney**, of Crosby, Minn., and **J. R. Boase**, of Duluth, Minn., are making an inspection of various furnaces in Chicago and Sharon, Ill., Youngstown and Cleveland, Ohio, and elsewhere.

Miss Addie Hughes is the new clerk of the House Committee on Mines and Mining. Miss Hughes is a native of southeastern Missouri, where she acquired a considerable knowledge of the manner in which certain phases of the mining industry are conducted. Since her appointment to the clerkship of the committee, she has been acquainting herself with the history of the activity in war minerals and the legislation which grew out of it. She also is familiarizing herself with other phases of mining legislation soon to come before the committee.

Harris & Ewing

MISS ADDIE HUGHES

H. H. Hill, assistant superintendent of the Bureau of Mines petroleum experiment station at Bartlesville, Okla., who has been with the bureau several years as chemist and specialist in refinery engineering, was appointed superintendent of the Bartlesville station on Jan. 1, vice E. W. Wagy, resigned.

Harold A. Linke mining engineer, recently of Salt Lake City, Utah, has accepted the appointment as chief field engineer on construction work, including mills, plants, and tramways, for Cia. de Real del Monte y Pachuca, Hidalgo, Mexico. He left Salt Lake City on Jan. 27, for his new field, and his family will join him there in April.

Clyde A. Heller, of Philadelphia, Pa., president of the Tonopah Belmont Development Co., recently spent several days in Tonopah inspecting the Belmont mine. It is authentically reported that Mr. Heller is to take the place of **George Wingfield**, who is resigning, on the board of directors of the Tonopah Divide Co., at the annual meeting of the company on March 2.

SOCIETY MEETINGS ANNOUNCED

The Canadian Institute of Mining and Metallurgy will hold its annual general meeting in the Chateau Laurier at Ottawa, Ont., on March 2, 3 and 4, 1921. The secretary-treasurer is G. C. Mackenzie, 503 Drummond Building, Montreal, Que.

The national council of **American Society of Mechanical Engineers** will convene at Syracuse, N. Y., on Feb. 15, instead of on the 12th, as previously announced. The newly elected president of the society, Edwin S. Carman, of Cleveland, Ohio, will preside.

American Engineering Council of F. A. E. S. will meet at Syracuse, N. Y., on Feb. 14, instead of on the 11th, as previously announced. The principal speaker will be President Hoover of the F. A. E. S., who outlines the council's plan for dealing with industrial relations and human waste as affecting the present host of unemployed.

OBITUARY

Benjamin Bowden Lawrence, consulting mining engineer, of New York City, died there on Jan. 21, after a short illness, at the age of sixty-three. Mr. Lawrence was graduated from the Columbia University School of Mines in 1878, and early took up mining in Gilpin and Summit counties, Col. After a few years he opened a consulting office in Denver, Col., and had carried on consulting work ever since. Some years ago Mr. Lawrence returned to his native state and began consulting practice in New York City. At this time he became interested in Cuban copper properties and in the gold fields of eastern Oregon. He became a director in the Horn Silver Mining, the Utah Metal & Tunnel, and the Cornucopia Mines companies of Oregon as well as a number of others. In 1909 Columbia University conferred on him the honorary degree of master of science, and several years ago he was elected a trustee of that university. Mr. Lawrence was a member of the A. I. M. E. and of the Mining and Metallurgical Society of America.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

Conkling - Coalition Lawsuit Involves Interesting Point

Do Monuments or Wording of Patent Define Claim?—Case Before Supreme Court

The litigation between the Silver King Coalition and the Conkling mining companies, of Park City, Utah, now drawing to a close, arguments having been concluded on Jan. 19 in the appeal of the former before the U. S. Supreme Court, brings up the interesting point as to whether a mining claim is defined by the wording of the patent issued by the Government or by the monuments on the ground. The case involves the ownership of ore alleged to have been taken out by the Coalition from the Conkling claim jointly owned by the two companies (three-quarters by the Conkling and one-quarter by the Coalition). The Conkling claim is defined in the patent as having a length of 1,500 ft., whereas as set forth by the attorneys for the Coalition, it is officially surveyed and monumented as being 1,364 ft. in length. The Coalition maintains that practically all of the ore mined was taken from beneath the surface of the 135½-ft. strip forming the difference between the length of the claim as monumented and as given in the patent issued and that the disputed strip belonged to itself, having been acquired by transfer from the Belmont mining company prior to the extraction of any ore; also the Coalition claims the ore as being on the Crescent fissure which apexes on adjoining claims owned by it.

When suit was brought by the Conkling company before the trial court in Salt Lake City, Judge John A. Marshall presiding, decision was rendered in favor of the Coalition. The circuit court of appeals, upon the appeal by the Conkling, reversed this decision and awarded the Conkling a judgment for $570,000. Then followed the appeal by the Silver King Coalition to the U. S. Supreme Court, the arguments in which have just been concluded. The Conkling company takes the view that the boundaries of the Conkling claim are, until altered by a decree of court, as set forth in the Land Office patent, and denies the claim of the Coalition to the ores through the Crescent fissure system. The decision of the Supreme Court is awaited with much interest both in regard to the possible establishment of a ruling or precedent for the definition of claims when future controversies arise and on account of the large sum involved.

WEEKLY RÉSUMÉ

With the exception of the U. S. Steel Corporation's subsidiary, the Oliver Iron Mining Co., all operators on the Lake Superior iron ranges have reduced wages 15 per cent. In Minnesota a proposal to put state mineral lands on the market has been made, and plans for leasing are being worked out. The Chateaugay Ore & Iron Co., in New York, has shut down owing to the depression in the iron industry. Three lawsuits involving mining property have drawn attention recently: The Rico Consolidated Mining Co., at Rico, Col., has won its apex suit from the Rico Argentine Mining Co. Arguments were concluded last month in the Conkling-Silver King Coalition case, in Utah, and the decision is awaited with interest. In the case of the Bluestone Mining & Milling Co., in Nevada, the recent demurrer was overruled by the court. The Western Pacific Railroad Co. has cut its freight rate on ore to Utah smelters and other roads have followed suit. In Mexico, the government has appointed a commission to inquire into the cause of the failure of the Xotol dam at Pachuca last month.

Cleveland-Cliffs Iron Co. Reduces Wages 15 Per Cent

The Cleveland-Cliffs Iron Co. reduced wages 15 per cent, effective Feb. 1. This reduction will effect the following mines on the Mesabi Range: The Meadow-Fowler at Aurora, the Wade-Helmer at Kinney, the Boeing mine at Hibbing, the Crosby mine at Nashwauk, and the Hill-Trumble mine at Marble.

Blue-Sky Law Substitute Drawn in Northwest

The Northwest Mining Association, with headquarters at Spokane, Wash., has directed the preparation of a "proposed Washington Securities Act." It is planned to present this to the Legislature as a substitute for the so-called "blue-sky" law now up for consideration. Its sponsors say that if enacted into law it will afford protection to the investor without injuring legitimate constructive effort. The measure is to be laid before the eastern Washington delegation.

Minnesota Mineral Lands May Be Put on Market

Senate Interim Commission Formulates Plans for Leasing of State-Owned Iron and Peat Areas

Findings of a special interim commission of the Minnesota Senate appointed two years ago to investigate facts relating to deposits of iron and peat on lands owned by the state were presented to the Senate Jan 26. The State of Minnesota owns many thousands of acres of so-called school and swamp lands on the iron ranges and peat areas of the northern part of the state, upon little of which extensive exploration or development has been done.

The commission recommends that an extensive soil and geological survey be made at once and formulates a complete mineral-leasing bill which it believes will effect speedy and proper exploration, leasing and development of these lands. The report is signed by Senators F. E. Putnam, J. D. Sullivan, George N. Sullivan, Ole Sagang and A. J. Rockne.

As regards the probable iron-bearing lands the principal recommendations of the committee are:

1. That such lands should be classified into the following divisions: Lands likely to have direct shipping ore; lands likely to have ores of a wash character, lands containing magnetite ores needing beneficiation, and land containing iron ores or ore material where a combination of two or more of the foregoing processes may be necessary.

2. That all permits for leasing of mineral lands be put up at public sales by the state auditor at specified intervals.

3. Prospective mineral lands should be divided into units not to exceed two government subdivisions per claim, aggregating eighty acres.

4. Bids to be on the amount of royalty per ton per [illegible] above the minima set out in the lease law.

5. That there should be a prospecting permit good for one year, with a fee of perhaps $50, providing for regular assessment work, reports to the auditor and the splitting with the state of every sample taken in exploration work.

6. The lease should run for fifty years, with provisions, in addition to the usual requirements, for furnishing full plans for mining and operating the mines, the reserving to the state use of the surface except that

portion reasonably necessary in the work of operating such mines, (c) a royalty payment on the iron content of the crude ore, designating a basis for determination of the grade of the crude ore, but leaving the details to be worked out between the operator and the state auditor so as to meet the varying conditions at the several mines, (d) a minimum annual output sufficiently large to encourage operations and discourage holding the property as a reserve, and yet small enough to permit the operator to suspend operations during poor market times without endangering his lease; the royalty paid when no ore was removed to be considered as advance royalty, provided the excess ore was shipped within a period of three or five years, and (e) all assignments of interest in such leases to be filed for record with the state auditor.

Merger of United Silver Copper With Copper King Proposed

Plans for the consolidation of the United Silver Copper Mining Co. and the Copper King Mining Co., which own contiguous claims near Chewelah, forty-three miles north of Spokane, Wash., on the basis of an issue of 1,800,000 shares of new stock at a par value of 25c. per share, were presented to stockholders of the United Silver company at a meeting held recently. The United company has been in operation the last fifteen years, and has produced $2,000,000 in silver and copper ore and paid $140,000 in dividends. It is incorporated for $1,000,000. The Copper King has a large deposit of low-grade copper ore.

Northwest Lead Co. Opens Office in Spokane

The Northwest Lead Co., of Seattle, Wash., in which the Bunker Hill & Sullivan Mining Co. recently acquired a heavy interest, has opened offices in the Paulsen Building, Spokane, Wash., which it will occupy jointly with the Bunker Hill & Sullivan Co.

Frank Smith, smelter director of the Bunker Hill company, is vice-president of the lead company. The latter company, the interests of which Mr. Smith will look after in this territory, uses Bunker Hill & Sullivan pig lead and manufactures a wide variety of lead products.

Western Pacific Cuts Freight to Utah Smelters

The Western Pacific [illegible] Co. has announced a general reduction in rates on ore from all points in [illegible] to the Utah [illegible] [illegible] also have announced [illegible] Specific points were given [illegible] No. 11 on ore from [illegible] a reduction of $1.[illegible] a ton [illegible] from Lane, $1.[illegible] per ton [illegible] Ruth and Kimberly, $1.50 [illegible] all shipments [illegible] Utah.

Rico Apex Suit in Colorado Decided

Court Finds in Favor of Rico Argentine Co., Plaintiff

The case of Rico Consolidated Mining Co. vs. Rico Argentine Mining Co., an apex suit for the recovery of ore alleged to have been removed from the plaintiff's territory, has been decided in favor of the plaintiff. Judge W. N. Searcy, of the Sixth Judicial District Court of Colorado, held that the trespass was not willful. Damages were awarded amounting to $29,946 against the Rico Argentine Mining Co. and $7,346 against the Marmatite Mining & Milling Co., lessee of the defendant. The judgment represents the net value of about 5,000 tons of ore. The decision is based on the assumption that the ore deposits in controversy were formed by east-west fissures rather than by the Blackhawk fissure, thus reversing theories held by mining men regarding the geology of the camp. The decision may affect claims held by other companies operating in the neighborhood.

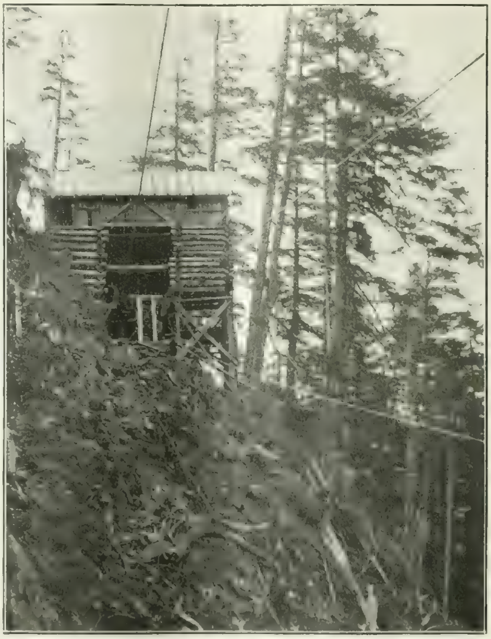
Northern Pacific, Great Northern and Oregon-Washington railroads lowered freight rates Feb. 1 on low-grade ore from the Cœur d'Alenes district, Idaho. The action was taken voluntarily by the railway lines, and follows similar action in Montana.

Dolly Varden Holds Up Silver Output of Province

New Power Plant Almost Ready—Development of Wolf Group Planned

By Robert Dunn

Contrary to general expectations, and notwithstanding the comparative inactivity of the Slocan mining camps during 1920 owing to labor trouble, the official estimate of the mineral production of British Columbia for the last year indicates that there will be a slight increase in the output of silver.



UPPER TRAMWAY TERMINAL AT DOLLY VARDEN MINE BRITISH COLUMBIA

In 1919 there was a production of 3,403,119 oz., valued at $3,592,673, and the 1920 production is placed at 3,404,926 oz., with a value of $3,265,324. It will be noted that the fall in the price has affected the valuation materially.

One of the chief reasons for this is the production of the Dolly Varden mine at Alice Arm. This property produced 1,170,000 oz. of silver from Sept. 1, 1919, to Sept. 30, 1920. From the time the management secured its staff, technical and non-technical, and got its plant in first-class running order, until about a month ago, operations have proceeded continuously at a pace that taxed facilities almost to capacity. Because of the exigencies of the winter it has been necessary to close down the property, but it is expected that work will be resumed on the same scale as heretofore as soon as weather permits.

COMPRESSOR BUILDING AND LOWER TRAMWAY TERMINAL AT DOLLY VARDEN MINE, BRITISH COLUMBIA

The railway from Alice Arm at the seaboard to the Dolly Varden mine is now complete. A. J. T. Taylor, managing director, has announced that the certificate of approval for operation has been granted by the Minister of Railways.

From the same source comes the information that three orebodies have been discovered on the No. 5 tunnel level, which is 230 ft. vertically below the lowest present workings, and that another orebody has been found on a continuation of the workings up the hill, 200 ft. distant from the highest upper workings.

It is planned to drive a lower tunnel from the railway level, which will be known as No. 6, and which is about 340 ft. vertically below No. 5. The management expects to be shipping from these lower levels next season.

As to development, it is stated that about 1,500 ft. of tunneling will be done at the Wolf mine, situated a short distance north of the Dolly Varden and on the Kitsault River. This is expected to prove up a large tonnage of shipping ore. A 500-hp. hydro-electric plant is almost ready for operation, and with its completion the properties will be fully equipped.

Branch of Zinc Institute Chooses President

Past Year Successful for Organization in Spite of Market Conditions

A. M. Gaines, general manager of the Kanok Metal Co. in the Joplin district, was elected president of the Tri-State branch of the American Zinc Institute at a meeting of the directors held Jan. 25. H. T. Hornsby and Lee L. Fillius, manager of the Anna Beaver Mining Co., were named vice-presidents and Richard Jenkins was chosen secretary-treasurer.

Mr. Gains succeeds F. C. Wallower, manager of the Golden Rod M. & S. Co., who was offered the honor of succeeding himself but declined. Under Mr. Wallower's leadership the organization has enjoyed a successful year, and, despite the slump in the zinc-mining industry, is considered stronger now than at any time in the past. Through its roads department it has collected and spent during the year an average of not far from $2,000 a month toward road maintenance in the district, and it also has continued its financial support for the continued operation of the Picher Hospital, which otherwise would have been closed.

Mr. Gaines, one of the popular operators of the field, who has taken a deep interest in the Tri-State organization since it was started, was formally inducted into office on Jan. 26.

Overrule Demurrer in Bluestone Lawsuit

In the suit of Martin J. Heller vs. Joseph R. Delamar, in which the property of the Bluestone Mining & Smelting Co., at Yerington, Nev., is involved, Judge Moran, of Reno, has handed down a decision overruling a demurrer on all grounds, with the exception of a subdivision of one section in the complaint which was stricken out on motion. The suit is for $300,000, which Heller claims is his share of the Bluestone property under an agreement entered into by himself and Delamar when the company was organized, whereby he, Heller, was to receive one-twentieth interest in each claim and 5 per cent of the capital stock. In addition to the 5 per cent interest in the property, which Heller says is worth $6,000,000, he claims 5 per cent of all the profits since 1905. The Bluestone Mining & Smelting Co. was made defendant on the death of Delamar.

Northwestern Smelters Shipping Metal via Panama Canal

Five hundred tons of Montana copper and 1,000 tons of pig lead from the Cœur d'Alene district, Idaho, were loaded last week in Seattle for shipment to New York via the Panama Canal. Several shipments of copper have already passed through the port of Seattle, but this is the initial shipment of pig lead from the Bunker Hill Smelter at Kellogg, Idaho.

It was recently announced at Butte by the Copper Export Association that plans had been made to ship metal to England via Tacoma and Panama. It is said that this will be slightly cheaper than shipping to Eastern seaboard.

Kennecott produced 10,599,480 lb. copper in December (including Braden's output), as against 11,146,000 in November.

PORTAL OF NO. 5 TUNNEL, DOLLY VARDEN MINE, BRITISH COLUMBIA

NEWS FROM WASHINGTON

By **PAUL WOOTON**
Special Correspondent

Little Hope for Further Relief Legislation

War Mineral Awards Recommended During Week Over $50,000—Justinicum Case Reconsidered

Practically no chance remains of liberalizing the War Minerals Relief Act at this session of Congress. It is doubtful if the incoming Congress would authorize legislation broadening the existing statute. The bare possibility exists of securing action on the Senate bill, which allows an appeal to the Court of Claims and to the U. S. Supreme Court. That bill has passed the Senate and has been reported favorably by the House Committee on Mines and Mining.

Awards aggregating $50,348.03 were recommended by the War Minerals Relief Commission during the week ended Jan. 22. The awards were as follows (the name of the claimant, the mineral, the amount recommended and its percentage relationship to the amount claimed are shown): W. Bulakn, chrome, $160, 26 per cent; Ashby, Long, Staples & West, manganese, $1,596.39, 26 per cent; Philipsburg-Chicago Manganese Syndicate, manganese, $2,853.65, 47 per cent; A. E. Westover, chrome, $1,156.66, 30 per cent. In addition, a number of claims were reconsidered and awards made. In the case of the Kromore Co. $2,645.50 was awarded Aug. 7. An additional $973.82 is now allowed. In the claim of B. Muscatelli, which had been disallowed, an award of $111.43, or 13 per cent of the amount claimed, was recommended. The Needles Mining Co. was awarded $4,561.66 on Oct. 27. An additional $4,446.92 now has been awarded. The claim of Paul J. Harding, which had been disallowed, was reconsidered and an award of $213.14 was recommended. This is 1 per cent of the amount claimed. The claim of the Cia. Minera de Justinicum, S. A., was disallowed Sept. 29, 1919. On reconsideration an award of $38,836.02 was recommended. This was 39 per cent of the amount claimed.

Tariff on Limestone Proposed in Amendment

Limestone and lime products are deemed by Senator Jones, of Washington, to be the proper subjects of emergency tariff legislation. He has introduced an amendment to the Emergency Tariff bill providing the following duties: Lime in cooperage, 50c. per 100 lb., gross weight; lime in bulk, 30c. per 100 lb.; hydrated lime, 40c. per 100 lb., gross weight; limestone, broken or crushed in bulk, 15c. per 100 lb.; ground limestone in bags, 7½c. per 100 lb., and ground limestone in bulk, 5c. per 100 lb.

Boron Deposits Should Be Under Leasing Act, It Is Thought

Proposed Also To Include Gilsonite in Bill Introduced by Representative Mays, of Utah

Bills intended to bring deposits of boron minerals under the terms of the general Mineral Land Leasing Act have been reported favorably to the Senate and to the House by their respective committees on Public Lands. The Secretary of the Interior recommends this legislation, as colemanite and priceite do not come under the provisions of the leasing act. The borates of potassium and sodium come under the act, but the minerals from which borax is derived are the borates of calcium. The secretary calls attention to the fact that the boron deposits are so closely allied with the sodium minerals that are covered by the leasing act that it is highly desirable to include boron deposits under that law.

Representative Mays, of Utah, has introduced a bill providing for the placing of gilsonite deposits under the general Mineral Land Leasing Act. Uintahite, or gilsonite, is a type of asphalt which occurs in Utah.

After extended debate the Senate on Jan. 14 passed the bill providing for the incorporation of the United States Fixed Nitrogen Corporation.

NEWS BY MINING DISTRICTS

Special London Letter

Metal Market Conditions Worrying Companies — Many Unable to Finance Carrying Unsold Metal

By W. A. Doman

London, Jan. 1[illegible]—The decline in the price of metals has greatly upset the mining world on this side. Programs of working and extensions were drawn up at a much higher level, so that the slump, accompanied [illegible] of demand, is creating considerable anxiety. Though the majority of the producing companies are ably managed, the position is such that many of them lack the financial resources to carry current production and hold stocks until such time as consumption increases. These observations are applicable to mining undertakings of almost every class. In copper there is the Arizona Copper Co. as well as some of the Australian mines. Many gold-mining companies in South and West Africa and elsewhere would be only too pleased if they could issue new shares or even debentures for working capital purposes. The decline in the dollar exchange this week administered a reminder to holders of Kaffirs that the gold premium is an unstable thing, and many of the mines have once again been brought to the point where revenue is only the merest shade above working expenditure. It is partly for this reason that the share market remains in such a dull condition; though it must not be overlooked that the "enemy" shares in the hands of the Home and Union Government are still unsold. The Transvaal gold output for December was very disappointing, being only 632,215 oz. For the last year the total was 8,153,625 oz., as compared with 8,330,091 oz. in 1919. The companies seem to have estimated that they will receive about £5 15s. per fine oz. for their gold of last month, though in addition they expect 4s. per oz. profit on exchange. This is exceptionally good if it be true.

At Broken Hill the position has become serious. It is reported that in consequence of the low prices of metals operations cannot be conducted at a profit. As great hardship would be caused by a total cessation, the larger companies have agreed to work on a reduced scale. The story is just the same where tin is concerned, if it is not even worse. Take the home industry first. Dolcoath shares are valued at something like 9d. each, and there is talk of reconstruction with a liability of 10s. a share. The directors want at least £120,000, and it is quite on the cards that they will ask shareholders to put up £150,000 or £160,000. Rather than be thrown out of work men at other Cornish properties are offering to assist the finances by contributing from their earnings.

Very few Nigerian companies are producing at a profit. The Northern Nigeria (Bauchi) reconstruction scheme has not yet been brought forward, because some large shareholders are suggesting that if the hydraulic scheme is postponed the company could get along without additional funds. The Jantar is asking its shareholders to subscribe £25,000 in five-year 10 per cent debentures, repayable at a premium of 20 per cent.

In normal times there would be a fair amount of excitement in anticipation of the striking of the reef in the Brakpan new area on the Far East Rand; today the market is quite apathetic. Results are looked for any day now, and if satisfactory will supply a much-needed fillip to Brakpan shares.

Erratic movements have taken place in Esperanzas again. A recent development cablegram showed values on the Descubridora vein on the 5th level to be over £50 to the ton. As a result the price advanced sharply, but speculators have since taken their profits.

In the matter of copper the Rio Tinto is again at work, though the principal output of this extensive property is pyrites. Perhaps the principal individual producer of the metal outside the American continent is the Union Minière du Haut Katanga, in which the Tanganyika Concessions is so largely interested. The report of the latter covering the eighteen months to June 30 last is issued today. It shows that in 1919 the total output was 23,004 tons of the metal, and last year about 19,000 tons, two labor strikes in the country having caused a cessation of operations in the latter period. The full capacity of the Union Minière plant is 40,000 tons annually. Hitherto only the high-grade ore has been treated. A concentrator for the treatment of the low-grade ore on a large scale—4,000 tons of ore a day—is now approaching completion and is expected to start work in the early part of this year. The company, it will be seen, is a formidable competitor to other copper-mining companies.

CANADA

Ontario

Goldfields, Ltd., Shareholders Approve Sale Conditionally—Rex Mill Started

Larder Lake—A meeting of the shareholders of Goldfields, Ltd., on Jan. 22 approved of the proposed sale of the assets to the Canadian Associated Goldfields, Ltd., on condition that the Associated Goldfields Mining Co. turns over its assets to the Canadian Associated Goldfields, and that J. Y. Murdoch, acting on behalf of some shareholders, is allowed full access to the books, reports and records of the companies to determine whether the proposed basis of the sale is a fair one.

Herb Lake—At the Rex mine the shaft is down 220 ft. and the mill was started Jan. 17. There are 20,000 tons of milling ore on the dump. The property has been electrically lighted.

British Columbia

Ainsworth—After negotiations extending over a period of several weeks, E. J. Edwards and associates, of Spokane, have secured a lease and bond on the Lakeshore group of claims from D. F. Strobeck.

Stewart—Two 5-ton Holt tractors have been delivered to the Premier company for use between the wharf and Nine-mile. Two large trailers have been ordered.

Trail—Ore shipments received at the Consolidated smelter during the week ended Jan. 21 totaled 6,621 tons. Shippers were as follows:

Mine	Location	Wet Tons
No. One Mine (Lease)	Ainsworth, ...	112
North Star,	Kimberley, ...	31
Paradise,	Lake Windermere,	32
Sutherland & Thompson	Beaverdell, ...	7
Company mines ..	....	6,439

AUSTRALIA

Mount Quamby Gold Strike Draws Attention — Cobalt Ore From Cloncurry Field Shipped to London

From Our Special Correspondent

Brisbane, Dec. 15—Much interest is being taken in the cobalt mine in the Cloncurry district. Over a dozen men are employed on the holding, and two shafts have been sunk, one to a depth of 90 ft. and the other down 120 ft., with a good lode all the way from the surface. In the shaft where most of the work is being done a level is being driven at a depth of 112 ft. An orebody has so far been developed 5 ft. in width, assaying approximately 4 to 5 per cent metallic cobalt. A 50-ton lot of ore is now being sent to London for treatment.

The gold discovery in the Cloncurry field is attracting much attention. The area called Mount Quamby has been visited by H. Phillips, a mining engineer on the staff of a Bendigo (Victorian) company. Mr. Phillips, whose company bought the mine from the original owners (Gulliver Brothers), has said that the show is one of the largest surface prospects in Australia. The orebody, he says, is 50 ft. wide on the surface. He added that the geological nature had not yet been definitely decided. Shares in the company paid up to 2s., it is reported, and have been already sold at 8s. The more cautious, however, want to know how the samples so far tested were taken. To afford this information the Mines Department has sent one of its most reliable geologists, L. C. Ball, to examine the field.

The Mount Cuthbert Co., operating in copper on the Cloncurry field, shows a loss of over £24,000 for the half-year ended Aug. 31 last. This is the company the manager of which stated the company could produce copper at a cost of £61 per ton, and while it was at work the market price ranged more than £20 above that figure. In fairness, however, it should be explained that the company operated during the term under exceptional handicaps, including a shortage of skilled miners, a seamen's strike, and a difficulty in obtaining explosives. During the half-year the smelter ran only 99½ days, producing 1,116 tons of blister copper from 17,912 tons of ore treated, of which practically a half came from the Kalkodoon mine. The general manager estimates the ore reserves at 193,500 tons, containing 13,185 tons of copper.

MEXICO

Sinaloa

Chichi Vanadium-Silver Mine Being Examined — Guadalupe de los Reyes Suspends; Also Copala Company

Mocorito—The Palmarito Leasing Co., in the Mocorito district, has started extensive development. Its purpose is to sink vertical shafts to get under the main orebodies. The vein is 90 ft. wide in places, and all work to date has been open cut. Eventually the 80-ton mill will be replaced with one of at least 500 tons' capacity. There will be a new power unit with wood for fuel. This is an enormous silver deposit carrying about 12 oz. per ton, and the ore is suitable for cyaniding.

Culiacan—The Chichi mine is being examined by Stanley A. Spellmeyer, for R. H. Townsend and associates, of New York. This is an old silver producer of fifty years ago out of which a large quantity of silver-lead ore was taken and treated by pan amalgamation. The property was abandoned about thirty years ago, on account of depth and consequent high mining costs. It was acquired again through denouncement by ex-governor Ramon F. Iturbe, in 1916. Since then ore has been found to contain considerable vanadium in the form of vanadate of lead. There is a twenty-ton concentrator on the property capable of making concentrates carrying about 11 per cent V_2O_5.

The Realito mine is a gold property in the Culiacan district, and is under option for purchase by Dr. P. B. Brooks and associates. This property has produced free-milling gold ore of a $12 grade for a number of years, and is said to have large ore reserves of the same grade. This is a cyaniding ore and is now being put in condition to work on a large scale. This property was abandoned during the revolution, and has not been worked for eight years.

Cosala—The Prieta mine is being worked by E. A. Montgomery and associates, from Los Angeles. This mine is said to have extensive ore reserves of a silver-lead ore carrying about 30 oz. silver. A thirty-ton flotation mill was installed last year but proved inadequate, and a new mill is now being installed with larger capacity and it is predicted that big silver returns will be shown on the resumption of operations with the new mill. J. C. Bone is in charge of operations at the mine.

The famous Guadalupe de los Reyes mine, also in the Cosala district, has been obliged to suspend on account of the low silver market. This is one of the most famous of the old Spanish mines, and has a history dating back about 300 years. This property belongs to the Spanish house of Francisco Echeguren, with offices in Mazatlan and San Francisco, Cal. It has been worked in recent years by the cyanide and flotation processes, but the combination of deep mining and low silver market has made it necessary to suspend temporarily.

The Copala company, belonging to Charles Butters and associates, has also been compelled to suspend on account of the value of foreign silver. This is supposed to be one of the big silver deposits of Mexico, and is said to have a 500-ton mill which was without equal in completeness at the time it was built about twelve years ago.

The Nuestra Señora mine, in Cosala, is operating at full capacity. This is a large silver-lead property belonging to San Francisco capitalists. E. H. Hoag is manager. The company is operating a 100-ton flotation mill.

Hidalgo

Commission Cause of Dam Failure at Pachuca

Pachuca—Since the breaking of the Xotol dam, inundating several of the contiguous mines and flooding the country around, causing the death of over one hundred persons, numerous letters and petitions have been forwarded to Mexico City accusing the Maravillas Mining Co. as responsible for the catastrophe. President Obregon has named a commission of engineers to study the accident to determine the cause.

VENEZUELA

Outlook Poor for Gold Mining in Venezuelan Guiana

There was no progress of importance in gold mining in Venezuelan Guiana during the last year. The Callao Co. started crushing after being stopped since 1914, but again stopped owing to want of development. The Goldfields of Venezuela continued to produce on a small scale, most of their attention being centered on development. The Bottanamo mine is reported to have been sold to an American syndicate.

A new mine code was again passed by Congress, but the only alterations were in connection with petroleum, a great many concessions for which were taken up by different oil interests. All these concessions are situated north of the River Orinoco, the best known being in the Maracaibo district in the northwestern part of Venezuela.

The output of alluvial gold fell off to a few hundred ounces per month, work on the Alto Cuyuni River being more or less at a standstill as the owners of concessions are unable to make them pay and have not the capital to put them on a modern basis.

A new find is of some interest locally (situated about fifty miles south of El Callao), where owing to scarcity of water no washing can be done at present. However, over 400 oz. of coarse gold, including many nuggets, were recovered last month, working with pick and shovel only, the dirt being stored until there is rain.

Speaking generally, the outlook is not bright as regards gold mining. No new capital has been put in apart from the Callao Co., despite there being several new prospects of considerable promise. The chief obstacles to development of the district have always been the want of good transport facilities; namely, roads and the high cost of the inefficient labor. Freight to the mines costs at present $80 per short ton. The high cost of power may also be included. Corporations with capital sufficient to overcome these difficulties are required.

GUIANA

About 30,000 Tons of Bauxite Shipped From Demerara to U. S. Last Year

In British Guiana the bauxite crushing and drying plant of the Demerara Bauxite Co., Ltd., was completed and put into operation last fall and a small tonnage of bauxite was shipped to the United States. During the summer shipments of undried ore were made, but in the late fall several cargoes of dried ore were shipped. The company's plant is situated at Mackenzie, about fifty miles inland from Georgetown, and mines are being operated near that place. A total of about 30,000 tons of bauxite was shipped from British Guiana to the United States during 1920.

Construction work was continued during the year on the crushing and drying plant of the Surinaamsche Bauxite Maatschappij at Moenge, Dutch Guiana, about 100 miles inland from Paramaribo. Bauxite deposits near this place are being opened up, but no ore has been shipped from them up to the present.

ARIZONA

Copper Queen's Southwest Shaft Completed to Surface

Bisbee—Pumping equipment has been installed on the 1,800 level of the Calumet & Cochise shaft of the Copper Queen. The installation consists of two electrically driven 500-gal. pumps. The power is obtained from the company's new power line from Douglas.

The new Southwest shaft has been completed from the Queen Tunnel level to the surface. The shaft was raised from five different levels and has a total length of nearly 800 ft. A hoist will be installed on the surface.

The Junction shaft of the Calumet & Arizona Mining Co. has resumed operation after a five-day shutdown, during which time a new air line has been installed.

The Irish Mag Leasing Co. has struck ore in a raise from the 10th level.

The Boras Leasing Co. has paid its eighth monthly dividend of 10c. per share.

Oatman—The Snowball Miners' Union of this camp and the only one active in Arizona has refused to accept a cut of wages to $5.50 a day for shaft men, $5 for miners and $4.50 for muckers, this being a drop of $1 a day, which also applies to mill hands and other employees. A notice of this reduction, effective Feb. 15, was recently posted by the Oatman Mine Operators' Association. Oatman is exclusively a gold-producing camp through two mines, the Tom Reed and United Eastern. The camp is suffering from an epidemic of smallpox, and the union has warned against the coming of more workmen.

Silverbell—El Tiro has cut commercial ore on the 300 level. At present it averages about 5 per cent copper and is easy to mine.

Humboldt—Robert McMurchie, attorney for G. M. Colvocoresses, receiver for the Consolidated Arizona Smelting Co., states: "We are working toward a reorganization of the company to protect the creditors and to prevent the mining property, mill and smelter from being junked in the bankruptcy court."

Duncan—Excavation is about completed for the new 100-ton mill at the Ash Peak mine. One car of machinery has arrived.

COLORADO

Old Wanakah, at Ouray, To Be Reopened—National To Dredge in McNulty Gulch

Leadville—Though the National Mining & Development Co.'s holdings in Lake County are idle, the properties controlled in and near Kokomo are active, and the company is planning much work in that territory. A compressor, hoist, motor, and other equipment have been shipped into Kokomo from Leadville, and will be installed immediately on the Golden Queen property, which adjoins the Queen of the West claim. Arrangements have also been made to secure power. In McNulty Gulch, churn drilling of a large piece of the company's ground has shown the installation of a dredge there to be practicable. The ground is said to run from $1.05 to $4.10 per cu.yd. The dredge has been purchased.

The company recently bought the Hercules placer, on which the townsite of Kokomo is situated, and the manager, Paul Maurer, intends to sink on this property.

Ouray—The old Wanakah, formerly known as the Bright Diamond and Ironclad, is to be reopened by the Union Mining & Milling Co., under R. E. Myers, of Ouray. Mr. Myers announces that he has bought a Ruth flotation machine, besides other equipment. The company intends to remodel the Wanakah mill, flotation never having been practiced there formerly.

The mine is in good condition to resume work, being a large nearly flat or "contact" orebody, with little caving ground. The property is well equipped. The last operations, which included rather extensive pyritic smelting at the Ouray smelting plant, were down to heavy pyrite carrying low values in gold and copper.

UTAH

Ontario at Park City Increases Pumping Capacity

Park City—Shipments of crude ore and concentrates for the week ended Jan. 22 amounted to 1,930 tons, as compared with 1,911 tons the week before. Shippers were: Judge companies, including Judge, Daly West, Daly and Park-Utah, 899 tons; Ontario, 499, and Silver King Coalition, 541. At the Ontario the work of installing the electric pump on the 1,700 level is completed, and the total pumping capacity brought to 2,500 gal. per min., sufficient for all possible needs. Increased development on the 2,000 level will now be undertaken and shipments increased.

The Silver King Cons. is driving a three-compartment raise from its Thaynes Canyon tunnel to follow a group of fissures in the quartzite to the contact with the overlying limestone. The raise is up 130 ft. and the distance to the contact is estimated to be 200 ft. The tunnel when completed will extend under the California-Comstock workings acquired some time ago and eventually make available low-grade ore here accumulated and partly developed.

Eureka—Shipments from the Tintic district for the week ended Jan. 22 were 177 cars, as compared with 184 the week before.

At the Tintic Drain Tunnel work is being done on a raise, which will connect the tunnel with the surface 600 ft. above. Lessees are shipping from the Iron Blossom. The company is doing development work on the 2,200 level.

At the Dragon Consolidated iron ore for fluxing is being taken on by one of the Valley smelting companies.

IDAHO

Over 3,000 Employed in Cœur d'Alene District

Wallace—All mines in the Cœur d'Alene district except two are working with almost normal forces. The two idle are the Callahan and the Gold Hunter, the former employing 350 men and the latter 175. According to careful estimate the companies now in operation employ the following number of men: Bunker Hill & Sullivan, including smelter, 1,200; Morning, 500; Hecla, 400; Hercules, 500; Tamarack, 200; small mines, leases and development companies, 500; total, 3,400. The standard wages is $4.50 and $4.75 per day for muckers and miners respectively. Some of the smaller companies and lessees pay higher in order to secure good all-round men. There are plenty of men for the jobs, a situation that has resulted in a notable increase in efficiency.

Burke—Marsh Mines has two shifts working in the Russell tunnel, the purpose being to extend it to the east end line and there raise on the vein to surface to secure physical proof that the apex of the vein crosses the end line.

MONTANA

Anaconda Suspends All Zinc Operations Owing to Large Stocks

Butte—The payroll of the Anaconda Copper Mining Co. has 4,500 names on it approximately, according to an official of the corporation. In the decision of the U. S. Supreme Court setting aside the sale of the Alice Gold & Silver company to Anaconda, as told in the issue of Jan. 29, the Anaconda was held to be a combination not in restraint of trade. It is said that the company may purchase the Alice minority interest.

On Feb. 1 Anaconda announced the suspension of all zinc operations, owing to large stocks of the metal. Seven hundred men were affected.

High-grade silver ore has been opened in a raise on the 600-ft. level of the Hibernia mine, of the Davis-Daly company, and the grade of shipments for January, in addition to showing a larger tonnage, it is expected, will record a higher silver content. Shipments for the last month aggregated 103 carloads, with the average silver assay 18 oz., as compared with the returns now of about 36, which it is expected will bring the average for the month around 25 oz. The airshaft being raised from the 1,700-ft. level of the Colorado to the surface has been completed.

Station cutting is under way at the 2,500-ft. level of Butte & Superior's Black Rock mine, the No. 3 shaft now being more than 50 ft. below this level. The shaft is now in the Rainbow vein, and is showing a good tonnage of zinc ore, ranging from 10 to 40 per cent of the metal.

At the Butte Western Silver mine, sinking from the 200-ft. level is under way. At a depth of another 100 ft. ore shoots in evidence on the 200 level will be crosscut.

Champion District—The larger part of the development work in the Champion mine of the Butte Jardine has been suspended, and efforts are being devoted to getting the 150-ton mill under way as early as possible. Within forty to sixty days it is expected to be possible to start operations. Sufficient tonnage for three years is reported.

OREGON

War Eagle Starts Quicksilver Furnace —Bartons Win Chrome Suit

Gold Hill—In spite of the low price now ruling for quicksilver, the War Eagle Mining Co., in the Gold Hill district, has started its new Scott furnace, recently completed. This mine was first open and operated in 1916, and the present equipment and development work to date represents an outlay of over $50,000. The total output of the mine to date with two 12-pipe mercury furnaces [illegible] pounds or 565 flasks.

Grants Pass—A decree in the Circuit Court of this county in the suit of Rowan vs. Barton et al., over a Government contract for the delivery of chrome, has been decided in favor of the defendants.

CALIFORNIA

Uankee Hill Gold Dredging Co. Suspends Operations

Oakdale—Work started a few weeks ago has been suspended by the Uankee Hill Gold Dredging Co. as a result of a fight over control. E. R. Healy owns 51 per cent of the company's stock.

Placerville—The financing of the Duncan-Adams property by employees of the Western Pacific is about completed. The property consists of 740 acres, known as the Duncan Ranch, situated on the Mother Lode in El Dorado County.

Grass Valley—On Jan. 21 a strike was made on the 600 level of the Allison Ranch mine, where persistent search for new orebodies has been under way for many months. Approximately $800,000 has been spent by the Grass Valley Consolidated Mines Co. in reopening the Allison Ranch.

The Alcalde mine, in the Rough and Ready district, has been closed temporarily pending a readjustment of the affairs of the company.

NEVADA

Consolidated Mayflower Resampled—Con. Virginia's Capitalization Increased

Tonopah—The latest reported bullion shipments from the mills of this district, representing the clean-up for the first half of January, indicate a gross production for January of about $600,000 in gold and silver. The Tonopah Belmont shipped $91,300, West End, $53,460, Tonopah Extension, $56,000, in bullion, with the Tonopah Mining Co. and MacNamara shipments not yet announced.

Divide—In the Tonopah Divide mine drifting and crosscutting of the vein on the 800 and 1,000 levels have disclosed no changes.

Pioneer—The mine of the Consolidated Mayflower has been resampled, and the management announces that there is considerable ore of milling grade in sight. Development during the last year has been satisfactory, and under improved operating conditions the mill is to resume in March.

Virginia City—The capitalization of the Consolidated Virginia has been increased from 216,000 shares to 2,160,000 shares, exchange basis for stock to be ten new shares for one old.

Eureka—Ore shipments to Utah smelters from this district during the last week were as follows: Eureka Holly, 4 cars; Eureka-Croesus, 2 cars; and Richmond Eureka, [illegible] cars of speiss. The Logan shaft of the Ruby Hills Development Co. is being unwatered, and progress is satisfactory.

Kimberley—The Consolidated Coppermines, which closed down recently to a caretaking basis, [illegible] commissary supplies at [illegible].

Nevada Consolidated is [illegible] at reduced capacity, and has accomplished reduction of wages without difficulty.

Arrowhead—The [illegible] district

is not booming, but considerable mining is being done, with prospects of future activity. Other camps that do their business through Ely are quiet. Ward is closed down. A rich strike was recently made at the Silverton mine, near Ely. Assays gave 247 oz. of silver to the ton. Little work has been done, but the find created much interest.

Pioche—Ore shipments from the Pioche district for the week ended Jan. 20 were below normal, on account of severe weather, totaling 2,750 tons. Shippers were: Prince Con., 1,550 tons; Virginia-Louise, 750; Bristol Silver, 255; Black Metals, 145; and Lee-Mathews Lease, 50.

Battle Mountain—The Copper Canyon Co. has reduced miners' wages $1 per day, at the same time reducing board 25c. The Betty O'Neal reduced wages 75c. and board 25c. per day. The Nicklas Mining Co. will cut wages 50c.

SOUTH DAKOTA

Anchor Mountain Resumes—American Minerals Installing Mica Stamping Equipment

Galena—The Anchor Mountain Mining Co. has resumed work on its property and the plant is being put in readiness. The company hopes to have the mill in use early in the summer. It plans to enlarge the mill.

Keystone—The American Minerals Co. is installing machinery for stamping mica. It is proposed to cut considerable of the material at the plant and the company will also later install a mica grinding mill. The concern is a new incorporation and has already started work at its property. It owns considerable mica ground near Keystone and has also taken options on additional claims.

WISCONSIN

Zinc-Lead District

Wisconsin Zinc Co. Again Closes Mines —Nightingale Shaft Completed

Benton—The Nightingale company, which is developing the Pedelty, Sherry and Buxton lands at Leadmine, has completed a new shaft and mill immediately east of the old Drum property. Joseph Piquett, of Platteville, is general manager.

Cuba City—The Connecting Link has struck a rich vein of blende on the Coulthard lease where it is operating mill No. 1, recently completed. Shaft and mill No. 2 have just been closed due to low market. C. M. Treat, of Cuba City, is general manager.

Livingston—Levi Pollard and others are sinking a new shaft on the Ross land two miles west of the Yewdall; the property was proved by drilling.

Platteville—The Wisconsin Zinc Co. has again closed its mines but has resumed operations at its roasting plant, where it has accumulated 4,500 tons of green blende during two months' shutdown.

C. O. Anderson, assistant metallurgist for the U. S. Bureau of Mines, has arrived in Platteville and will be followed soon by Will H. Goghill, metallurgist. Their laboratory apparatus and machinery is now being installed in the ore-dressing laboratory of the Wisconsin Mining School and full preparations are being made to make the preliminary tests on the ores of the Wisconsin zinc district. The first tests will be flotation tests on sludge from the various mills.

Missouri-Kansas-Oklahoma

Vinegar Hill Company Takes Up Option on Texas Lease, After Drilling

Picher—The Vinegar Hill Zinc Co. has closed its option on the lease and mill of the Texas Mining Co., east of Picher, after careful prospect drilling, and is beginning to sink a shaft and will drive a prospect drift immediately.

The Vinegar Hill Co. had a successful year at its Barr mine, north of Picher, in Kansas. With only one mill at this property it produced 10,080 tons of zinc concentrates and 4,709 tons of lead concentrate.

NEW YORK

Chateaugay Iron Mines Shut Down

Owing to depression in the steel market the Chateaugay Ore & Iron Co. has closed its big iron mines at Lyon Mountain, in the Adirondacks, for an indefinite period. During the shutdown a new shaft is to be sunk which will give employment to a small number of the miners at reduced wages.

MINNESOTA

Mesabi Range

St. Paul Mine May Be Reopened—Oliver Starts New Trestle

Hibbing—It is rumored but cannot be definitely ascertained that the St. Paul mine of the McKinney Steel Co., which has been idle for several years, will be reopened this spring.

The first 600-ft. section of a new trestle which will ultimately be about two miles long is being built by the Oliver Iron Mining Co. to afford new dump grounds for stripping from the Hull-Rust pit.

Duluth—Total shipments of iron ore to the Minnesota Steel Co. and the Zenith Furnace Co. at Duluth were 757,425 tons. The ore was shipped from five of the iron ranges, with the greatest amount from the Mesabi.

MICHIGAN

Efficiency of Labor Much Improved in Michigan Copper Country

Houghton—J. Parke Channing, president of the Seneca Mining Co., recently visited the property, and was highly pleased with recent developments, especially the block of ground being developed by the two raises at the south end of the 13th level of the Gratiot shaft. Sinking in this shaft will start at once and continue until the 33d level is reached.

The present surface equipment at the Seneca shaft is large enough to continue sinking to the 10th level, which will be done. The Gratiot and Seneca shafts will then be connected with a drift at what is the 33d level of the Gratiot.

The three mines of the Copper Range Cons. Mining Co. have been much undermanned for some time, due to the labor shortage. Although the management has not practiced voluntary curtailment of production, the effect on the metal market has amounted to much the same thing.

Labor in general throughout the Copper Country has shown a marked increase in efficiency during the last few months, amounting in some cases to fully 80 per cent. This, together with the increasing use of mechanical equipment, such as power shovels at the Copper Range and stope scrapers in the mines with flat veins, are all tending to reduce mining costs.

Gogebic Range

Wages Cut by All Operators Except Steel Corporation—Anvil Shaft Down

Ironwood—The Steel & Tube Co. has shut down the Anvil shaft of the Anvil-Palms-Keweenaw mine until business conditions improve. The Palms will probably continue on a reduced scale.

Ogleby-Norton, McKinney Steel, Pickands-Mather, and Republic Iron & Steel have all announced cuts in wages amounting in most cases to 15 per cent, effective immediately or on Feb. 1. Aside from the Steel Corporation the other range operators have reduced wages.

Menominee Range

Dunn and Tobin Mines Down—Pioneer Furnace at Gladstone Blown Out

Crystal Falls—The Dunn and Tobin mines have been closed for the winter, and the Odgers has reduced its working force owing to market conditions. These companies have little ore in stock.

Gladstone—The Pioneer furnace of the Cleveland-Cliffs company has been blown out and 275 men are out of jobs as a result. There are big stocks of charcoal pig in the furnace yards that cannot be disposed of, the market being demoralized. An operation providing hardwood for charcoal purposes has also been stopped, releasing 175 men.

Marquette Range

Surplus of Labor in All Mining Camps

Ishpeming—A shortage of water at the hydro-electric plants of the Cleveland-Cliffs company has forced the use of coal for operating the mines in the Ishpeming, Negaunee, Gwinn, and Princeton fields. An unusually dry fall and winter is the cause. More storage capacity is being planned that will obviate this trouble.

All iron-mining organizations in the Lake Superior region, except those of the Oliver company, have reduced wages 15 per cent. There is a surplus of labor in all mining towns.

The M. A. Hanna company is removing buildings from the American mine location to Wakefield, on the Gogebic Range.

THE MARKET REPORT

Daily Prices of Metals

Jan.	Copper, N. Y. net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
27	12.50	31.00	34.75@35.00	4.75@4.85	4.70@4.75	5.20@5.25
28	12.50	29.50	33.50@33.75	4.75	4.65@4.70	5.10@5.20
29	12.50	29.50	34.00@34.25	4.75	4.60@4.70	5.10@5.20
31	12.50	30.00	33.50@34.00	4.70	4.60	5.05@5.15
Feb 1	12.50	29.50	32.75@33.00	4.65@4.70	4.60	5.00
2	12.50	28.75	32.00@32.25	4.60	4.50	5 00

*These prices correspond to the following quotations for copper, "delivered": 12.75c. for the week.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Jan.	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
27	69½	70⅛	77	174½	180½	23¼	23¾	24	25
28	67¾	68¼	76	167½	173	23¼	23⅝	24	25
29									
31	67¼	68¼	75½	168½	174½	23⅛	23¾	24¾	25¼
Feb. 1	69½	70	76	168½	173¾	23¼	23½	24½	25½
2	69¼	69¾	76	162½	168¾	22¾	23¼	24	25

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Jan.	Sterling Exchange	Silver New York, Domestic Origin	Silver New York Foreign Origin	Silver London	Jan.	Sterling Exchange	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
27	386	99½	66⅜	39¾	31	385	99½	59⅞	35⅛
28	386¼	99½	64½	37¾	Feb. 1	378½	99½	57¼	34½
29	385¾	99½	62¾	36¾	2	382¾	99½	61½	36¼

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, Feb. 2, 1921

No improvement in the domestic demand for any of the metals has taken place during the last week. The prices of lead and zinc have continued to sag, but copper has remained stationary and seems to be scraping bottom.

Copper

Demand for prompt metal is almost non-existent, and our prices, therefore, represent offerings rather than sales. Orders for delivery as late as April have been accepted on a 12.75c. delivered basis, but 13@13.25c. is the usual figure for forward delivery.

The most interesting feature of the copper market in the last week was the plan announced in today's morning papers for financing foreign sales. This news leaked out prematurely, and the scheme has so far only been proposed. Definite action may be taken at a meeting to be held on Friday. The plan essentially is as follows: Four hundred million pounds of copper now in stock in the hands of those who enter into the agreement is to be set aside for export. Debentures will be issued against this metal, guaranteed by the large producing companies and by banks, which will pay 8 per cent, and will be sold to the public. As the metal is sold these debentures will be retired. It is also rumored that a curtailment of production will be guaranteed until the stocks are marketed, though whether this means that present curtailments will be continued or that production will be further decreased, we do not know. The plan is merely a method whereby present stocks can be carried by offering an attractive investment to the American public, and apparently will in no way aid European buying. It will, however, relieve the producers of the onus of carrying their large stocks, and will tend to avoid forced sales and cut-throat competition.

Lead

Lead is weaker again, owing to a pronounced drying up of demand. The only sale of any magnitude of which we heard was one of 500 tons to one of the electrical companies, which aroused considerable competition. There is some inquiry for forward delivery, but most producers feel that the price is likely to go up again in two or three months, and are not willing to quote beyond March. In fact, some interests are not anxious to sell even current production at present prices

Zinc

The continued price recessions are resulting in further reductions in production. Anaconda shut down its electrolytic zinc plant yesterday, and several other plants will run only a few days longer, or until present ore stocks are exhausted. The galvanizing business is reported improving somewhat, but demand for zinc is still weak and confined generally to single cars or fifty-ton lots. Zinc for forward delivery commands a slight premium, but sellers are not interested in futures, as sales now made are the result of a need for ready money.

Monthly Average Prices for January:

Copper:	
New York Electrolytic	12.597
London Standard	70.964
London Electrolytic	79.119
Lead:	
New York	4.821
St. Louis	4.747
London	23.387
Silver:	
New York, foreign	65.950
New York, domestic	99.500
London	39.985
Sterling Exchange	372.650
Zinc:	
St. Louis	5.413
London	25.262
Tin:	
99 per cent	31.470
Straits	36.000
London	190.464
Antimony	5.258
Quicksilver	48.440

Tin

Tin has fluctuated with London and sterling exchange, rather than with local demand, as usual. Business is fair for small lots. Reports of large stocks in this country are almost certainly erroneous, and no considerable quantities of any grade of tin seem to be immediately available.

Straits tin for future delivery: Jan. 27th, 35.50@36c.; 28th, 34.50@34.75c.; 29th, 34.50@34.75c.; 31st, 34.25@35c.; Feb. 1st, 34@34.25c.; 2d, 33@33.25c.

Arrivals of tin, in long tons: Jan. 27th, London, 25; 28th, London, 275. Total for January, 1,245.

Gold

Gold in London: Jan. 27th, 106s. 3d.; 28th, 105s. 7d.; 31st, 106s. 1d.; Feb. 1st, 107s. 2d.; 2d, 107s.

Foreign Exchange

The recent strength of sterling is well maintained, but the general opinion seems to be that even if $4 is reached that will be a hard point to pass. Other foreign money is, in general, slightly stronger than a week ago. On Tuesday, Feb. 1st, francs were 7.04c.; lire, 3.64c.; and marks, 1.58c. New York funds in Montreal, 12⅝ per cent premium.

Silver

Since our last report there has been a steady decline in the London price from 40d. on Jan. 26 to 34½d. on Feb. 1. Selling by China and the Continent has been responsible for the weakness. During the same period the New York market dropped from 66⅝c. to 57¾c., moderate business only being done. Today London advanced sharply to 36¼d. on the strength of Indian bazaar and China buying, New York also advancing to 61½c. Buying inquiry for China account also developed in the local market on the advance.

Mexican Dollars—Jan. 27th, 50¾; 28th, 49¼; 29th, 48; 31st, 45½; Feb. 1st, 44⅛; 2d, 46⅞.

Other Metals

Aluminum—List prices of 28.3@28.5c. are nominal. Outside market 24@25c.

Antimony — Chinese and Japanese brands, 5⅛@5⅜c.; market quiet. W.C.C. brand, 6¼@6½c. per lb. Cookson's "C" grade, shipment from England, 9⅜c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony[1] (200 mesh), 7@7½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 7c.

Bismuth—$2.30@$2.40 per lb., 500-lb. lots, and $2.42 per lb., 100-lb. lots.

Cadmium—Nominal, $1.40 per lb., in 1,000-lb. lots.

Cobalt—Metal, $4.50 per lb.; black oxide, $3@$3.10 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $325 per oz.

Magnesium — Crude, 99 per cent, $1.25@$1.35 per lb., f.o.b. Philadelphia.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Ingot, 43c.; shot, 43c.; electrolytic, 45c., f.o.b. Bayonne, N. J. Virgin metal in open market 38@40c.; remelted, 35@37c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—Firm at $70@$75 per oz.

Quicksilver—Nominally $50 per 75-lb. flask. San Francisco wires $49. Quiet.

[1]**Rhodium**—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 50@55c. per long ton unit, f.o.b. Atlantic ports.

[1]**Manganese Ore**—38@40c. per unit, seaport; chemical ore (MnO_2) $60 per gross ton, lump; $65@$70 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

[1]**Tantalum Ore**—Guaranteed minimum 60 per cent tantalic acid, 40c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¾@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3 $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Jan. 29—Zinc blende, per ton, high, $30.55; basis 60 per cent zinc, premium, $25; Prime Western, $25@$22.50; fines and slimes, $22.50@$17.50; average settling price, all zinc ores, $28.63 per ton.

Lead, high, $53.30; basis 80 per cent lead, $50@$51; average settling price, all lead ores, $51.39 per ton.

Shipments for the week: Blende, 5,173; lead, 1,403 tons. Value all ores the week, $220,210. Shipments for January: Blende, 25,293; lead, 3,581 tons. Value, all ores the month, $977,370.

The larger tonnage of the week was purchased on $25 basis. Thursday the market was very weak, but recovered Friday after about 600 tons was sold on $22.50 basis, sellers declining to sell more on that basis. Limited purchases on $25 basis were again made on Friday, but as only one buyer was offering over $22.50, sales were only 4,550 tons at noon today.

Platteville, Wis., Jan. 29—No base price for zinc or lead ores. Shipments for the week: Zinc ore, 301; lead ore, 30 tons. Shipments for the year: Zinc ore, 1,199; lead ore, 390 tons. Shipped during the week to separating plants, 502 tons.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $2,000@$3,500; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, $23; ground (white), $45; ground (off color) $30@$32 per net ton, less than carload lots, f.o.b. New York. Crude, first grade, $10 per ton, f.o.b. cars, Missouri; floated, $28 per ton in bbls.; $26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis.

Chalk—English, extra light, 5@5½c.; light, 5@6c.; dense, 4½@5c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$12; washed, $12@$15; powdered, $18@$22; bags extra, per net ton, f.o.b. mines, Georgia; crude, $8@$12; ground, $15@$40, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $25@$35; powdered, $30@$35, f.o.b. New York.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $25 per ton, f.o.b. Illinois mines, and $25.50, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, $60; lump, $15, f.o.b. Tonuco, N. M. In Canada

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

85 per cent calcium fluoride sells for $20 per ton, f.o.b. Madoc; output limited. Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines.

Fuller's Earth—$16 per ton, carload lots, f.o.b. mines.

Graphite—Ceylon lump, first quality, 8@9c. per lb.; chip, 7c.; dust, 5½c. No. 1 flake, 7½c.; high-grade amorphous crude, 3c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Dolomite, 1@2 man size, $1.60@$1.65; 2@8 in., $1.55@$1.65 per net ton, f.o.b. Plymouth Meeting, Pa.; fluxing, $1.65@$1.75 per net ton, f.o.b. Howellville, Pa.

Magnesite, Calcined — High - grade caustic calcined, lump form, $35@$40 per ton, carload lots, f.o.b. California points. In Chicago district, $57.70; Atlantic seaboard, $61@$63.

Dead - Burned — $38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 50c.; No. 5, $1.20; No. 4, $2@$3; No. 3, $3.25@$3.50; No. 2, $5.50@$7; No. 1, $8. Clear block: No. 6, 55c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $10; extra large, $25; ground, $60@$150 per ton (depending upon quantity); all f.o.b. New York. Ground mica in Philadelphia, $150 per ton.

[1]**Monazite**—Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $13; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $8.35; 68 per cent, $7.85; 68@66 per cent, $7.60. Finely ground Tennessee rock sells for $8.50 per net ton for 13 per cent phosphorus content, agricultural application; for acid-making, 14 per cent, $9; both prices f.o.b. Centerville, Tenn.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 16½c.; Spanish lump, 14@16c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Sand (Glass)—Dry glass sand, $4 per net ton, f.o.b. cars Mapleton, Pa. Sand, f.o.b. Ottawa, Ill., is $3 per ton; $2.50 on annual contracts. Sand at Klondike, Gray Summit and Pacific, all in Missouri, is $2.50 on contract; some outside sales have been made at $4. St. Louis, open market, at $3.50; contract price on large quantities, $2.50; on small quantities, $3.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $12@$22 per ton; roofing grades, $9.50@$15; rubber grades, $12@$18; all f.o.b. Vermont. California talc, $20@$45, talcum powder grade. Southern talc, powdered, carload lots, $12@$15 per ton; less than carload, $25, f.o.b. cars; freight to New York $5.25 per ton, carload lots; less than carload lots, $9.25. Imported, $40@$50; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 10¾@11c. per lb.; sulphide, powdered, 15@15½c. per lb. in carload lots.

Sodium Nitrate—$2.85@$3 per cwt. ex vessel, Atlantic ports. Market quiet.

Sodium Sulphate—For 95 per cent material, $22 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract.

Potassium Sulphate—Domestic, $220@$230 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrocarbontitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 16@17c. per lb. of chromium contained; 4 to 6 per cent carbon, 17@18c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $110, f.o.b. seaboard bases; resale, $100; English, $110, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $45, f.o.b. furnace.

[1]**Ferromolybdenum**—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $55@$60; 50 per cent, $78@$80; 75 per cent, $140@$145.

[1]**Ferrotungsten**—Domestic, 70 to 80 per cent W, 55@60c. per lb. of contained tungsten, f.o.b. works. Foreign, 60c.

Ferro-uranium—35 to 50 per cent U, $7 per lb. of U contained, f.o.b. works.

[1]**Ferrovanadium**—Basis 30 to 40 per cent, $5.75@$6.75 per lb. of V contained, according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York list price, 21¼c. per lb.; wire, 15⅝.

Lead Sheets—Full lead sheets, 8½c.; cut lead sheets, 8¾c. in quantity, mill lots.

Nickel Silver—33½c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets, 19⅝c.; sheathing, 19¾c.; rods, ⅝ to 3 in., 16⅝c.

Zinc Sheets—$11.50 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $80 per net ton, shipping point; arches, keys, wedges, $85; splits, soaps, $100.

Fire Brick—First quality, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $45@$50.

Magnesite Brick — 9-in. straights, $100 per net ton; 9-in. arches, wedges and keys, $105; soaps and splits, $120.

Silica Brick—9-in., per 1,000: Chicago district, $65@$70; Birmingham, Ala., $56@$61; Mount Union, Pa., $50@$60.

Iron Trade Review

Pittsburgh, Feb. 1, 1921

A more hopeful sentiment pervades the iron and steel trade, particularly in the east, but no material increase in the volume of business can be traced, thus far at least, to the improvement. The independents had no back orders to fill at the beginning of the year, but the Steel Corporation had a large volume of specified business, and naturally the unfilled business is diminishing. The Carnegie Steel Co. still operates at about 96 per cent of capacity, and the National Tube Co. is running full, but the wire subsidiary, together with the subsidiaries at Chicago and Birmingham, is gradually tapering off in operations. The Steel Corporation's operations as a whole, however, are probably nearly if not quite 90 per cent.

Rumors of price cutting in most finished-steel products continue, but are not usually verified, and it is to be noted that if there was as much cutting two or three weeks ago as was then reported some of the market would probably have broken open by this time. On the whole, the market can be reported steady at the Industrial Board schedule.

An actual increase in demand is expected by April 1, though no one predicts even moderately full operation for the mills before next October.

Pig Iron—Foundry pig iron has been offered by furnaces at $30, Valley, or $1.50 under the previous quotation, without important tonnage being moved. Bessemer and basic remain at $32 and $30, Valley, with no inquiry.

Semi-finished Steel—Nominal asking prices remain at $45 for billets and $47 for sheet bars, with consumers showing absolutely no interest.

Charcoal and Coke

Charcoal—Willow, 7c. per lb. in bbls., hardwood, 5½c. per lb., in 250-lb. bbls. Barrel charge is [illegible]al.

Connellsville—[illegible] $6.25@$7; foundry, $5@$5.50.

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[1] Furnished by [illegible] Foote Mineral Co., Philadelphia, Pa.

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York 1920	New York 1921	London 1920	London 1921	Sterling Exchange 1920	Sterling Exchange 1921
January	132.827	65.950	79.846	39 985	367.082	372 650
February	131.295		85.005		337 466	......
March	125.551		74.194		370 870	......
April	119.779		68.848		392 438	......
May	102.585		60.010		383.360	......
June	90.957		51.096		393 663	......
July	91.971		53.736		385 538	
August	96.168		59.875		360 404	......
September	93.675		59.476		350 370	......
October	83.480		54.197		346 460	......
November	77.734		50.952		342 333	......
December	64.774		41.845		348 101	......
Year	100 900		61 590		364 840	......

New York quotations cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York Electrolytic 1920	New York Electrolytic 1921	London Standard 1920	London Standard 1921	London Electrolytic 1920	London Electrolytic 1921
January	18.918	12.597	118.095	70.964	123.238	79.119
February	18.569		120 188		126 950	
March	18 331		109 533		118 348	
April	18.660	......	103.025	......	111.500	
May	18.484		96.750		109.200	
June	18.065		87.864		101.909	
July	18.576		90 148		106.455	
August	18.346		93.935		111.143	
September	18.144		96.381		111.905	
October	15.934		93.327	......	104.905	
November	14.257		84.807	......	94.614	
December	13.188		75.702	......	85.905	
Year	17.456		97.480		108 839	

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York 1920	New York 1921	St. Louis 1920	St. Louis 1921	London 1920	London 1921
January	8.561	4 821	8.300	4.747	47.095	23 387
February	8.814	......	8.601	......	50.256	......
March	9.145	......	8.894	......	46.054	......
April	8.902	......	8.618	......	39.225	......
May	8.576	......	8.352	......	38.488	
June	8.323		8.169	......	34.330	
July	8.338	......	8.283	......	34.960	
August	8.687	......	8.725	......	36.304	
September	8.177	......	8.160	......	35.452	
October	7.070	......	7.018	......	35 238	
November	6.159	......	6.127	......	32.489	
December	4.727	......	4.717	......	24.089	
Year	7 957	......	7 830	......	37 832	

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton

Tin

	New York 99% 1920	New York 99% 1921	New York Straits 1920	New York Straits 1921	London 1920	London 1921
January	61.596	36 000	......	36 000	376.512	190.464
February	58 466		59 932		395.750	
March	61 037		61 926		369.489	
April	61 120		62 115		345.450	
May	53 230		55 100		294.813	
June	46 125		48 327		250.614	
July	45.798	......	49.154		261 886	
August	43.856	......	47.620		274 048	
September	41.940	......	44.465		270.120	
October	39.310	......	40.555		258.190	
November	[illegible]		36 854		241.080	
December	[illegible]		34 058		212 440	
Year	[illegible]		49 101		295 866	

New York quotation[illegible] lb. London pounds sterling per long ton

Zinc

	St. Louis 1920	St. Louis 1921	London 1920	London 1921
January	9.133	[illegible] 413	58 643	25 262
February	8.708		61 338	
March	8.531		53 467	
April	8 184		47 388	
May	7.588		45 088	
June	7 465		41.193	
July	7 720		41 886	
August	7 835		41 220	
September	7 [illegible]		39 690	
October	7 [illegible]		39.756	
November	6 247		35 028	
December	5 824		27 762	
Year	7.671		44 372	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Antimony and Quicksilver

	Antimony (a) New York 1920	Antimony (a) New York 1921	Quicksilver (b) New York 1920	Quicksilver (b) New York 1921
January	10.577	5.258	90.192	48.440
February	11 588	......	84 432	......
March	11.056	......	92 611	......
April	10 500	......	102 192	......
May	9.655	......	89.560	......
June	8 289	......	90.154	......
July	7.500	......	90 333	......
August	7 177	......	83 806	......
September	7.113	......	75 000	......
October	6.723	......	67 200	......
November	6.109	......	58 417	......
December	5.534	......	49.577	......
Year	8.485	......	81 123	......

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask.

Pig Iron, Pittsburgh

	Bessemer 1920	Bessemer 1921	Basic 1920	Basic 1921	No. 2 Foundry 1920	No. 2 Foundry 1921
January	$40 47	33 96	$39.88	31.96	$39.86	33.88
February	42 95		42.61		43.40	......
March	43 40		42.90		43 40	......
April	43 72		44.22		43 90	......
May	44 00		44.88		45.36	......
June	44 89		45.41		46 40	......
July	47 21		47.42		46 56	......
August	48 90		49 88		49 35	......
September	50 46		50.46		51.96	
October	49.21		44.38		48.58	......
November	41 26		39.20		42.61	......
December	36 96		34 90		37.73	......
Year	44 45		43.85	......	44.93	

In dollars per long ton

Monthly Crude Copper Production, 1920

	September(a)	October(a)	November	December
Alaska shipments	1,635,677	4,984,219	12,802,696	6,631,700
Arizona Copper	3,000,000	2,800,000	2,800,000	2,650,000
Calumet & Arizona	4,292,000	3,802,000	3,486,000	3,300,000
Con. Ariz. Smelting	950,000	865,000	750,000	476,000
Inspiration	6,500,000	7,000,000	5,350,000	5,000,000
Magma	663,219	750,814	671,752	600,000
Miami	4,549,140	4,582,293	4,505,232	4,373,123
New Cornelia	3,314,000	3,450,000	2,670,000	2,688,456
Old Dominion	1,957,000	2,912,000	2,563,000	2,655,000
Phelps Dodge	6,381,000	5,309,000	5,492,000	5,850,000
Shattuck Arizona	166,513	206,772	6,063	....
Ray	4,502,000	3,990,800	3,975,000	2,975,000
United Verde	4,837,000	5,858,000	4,030,000	3,260 000
United Verde Extension	3,327,644	3,864,756	2,642,812	3,204,258
Calumet & Hecla	7,278,215	7,945,502	7,326,763	7,507,712
Other Lake Superior	6,000,000	6,000,000	6,000,000	6,000,000
Anaconda	11,100,000	11,000,000	11,100,000	10,500,000
East Butte	1,634,260	1,626,980	1,658,860	1,538,760
Nevada Cons	4,650,000	3,850,000	3,950,000	3,000,000
Chino	5,161,894	3,933,435	4,000,000	2,999,000
Utah Copper	8,420,000	8,000,000	9,120,000	7,500,000
Eastern Smelters	1,600,000	1,600,000	1,600,000	1,600,000
Others, estimated	13,000,000	10,900,000	10,200,000	11,400,000
Total United States	104,919,262	105,231,571	106 700.178	95,709,009
Imports: Ore and concentrates, etc	10,132,777	9,626,502	7,143,610	6,331,559
Imports in blister, etc	20,428,866	24,559,763	31,148,088	34,619,919
Grand total	135,480,905	139 417 836	145,291,876	136,660,487
British Columbia:				
Granby Cons	2,239,174	2,293,500	2,465,585	2,665,018
Mexico				
Boleo	440,720	617,200	771,680	1,014,160
Cananea	3,500,000	3,500,000	3,500,000	3,700,000
Phelps Dodge Mexican properties	1,617,000	1,817,000	2,666,000	2,468,000
Other foreign:				
Cerro de Pasco	4,360,000	4,698,000	3,612,000	4,258,000
Chile	9,496,000	9,420,000	8,859,984	....
Katanga	[illegible]	2,697,696	3,174,624	....
Backus & Johnston	[illegible]	1,740,000	1,548,000	1,604,000

Comparative annual copper production follows:

	1918	1919	1920
January	165,431,568	135,733,511	121,903,744
February	160,011,364	111,649,512	117,450,000
March	185,525,168	102,040,460	120,309,316
April	163,207,096	98,808,998	116,078,871
May	181,070,350	92,652,975	114,964,207
June	166,723,599	95,856,570	116,107,856
July	159,329,031	100,369,247	109,729,510
August	[illegible]	107,994,040	116,460,654
September	157,992,487	108,703,075	(a) 104,919,262
October	168,638,775	115,143,143	(a) 105,231,571
November	159,217,588	117,289,735	106,700.178
December	161,801,916	102,997,633	95,709,009

(a) Revised

COMPANY REPORTS

Cape Copper Co., Ltd.

Copper; South Africa, India.

A report of the Cape Copper Co., Ltd., covering operations for the year ended April 30, 1920, in the Cape Colony, and to Aug. 31, 1920, in London and India, states that the revenue of the year has been derived chiefly from the small output of the incomplete plant at the Rakha Hills mines, in India, which was expected, according to the report, to be ready to produce the full output of 250 tons of copper per month before the end of 1920.

Mining operations in Cape Colony were suspended in May, 1919. Production for the three weeks prior to the suspension amounted to 520 tons of 16.2 per cent copper ore and 198 tons of 5.2 per cent ore from the Ookiep mine. The output of the Nababeep mine was 2,333 tons, assaying 4.7 per cent copper. Reserves at the mine are estimated to be 90,000 tons of 5 per cent ore and those at the Rakha Hills mines at 354,688 tons of 3.66 per cent ore. The accounts show a deficit of £163,627 18s. 10d. as follows:

PROFIT AND LOSS ACCOUNT

DEBITS

Mining costs, viz.:	£	s.	d.
Ookiep mine, including depreciation	14,264	9	4
Nababeep mine, including depreciation	6,589	2	5
Narrap mine, including depreciation	151	19	4
Relief of distress fund, Namaqualand	1,000	0	0
Rakha Hills mines	100,078	14	1
Trial mines and cost of inspections	406	15	5
Transport and shipping in the colony	9,489	5	8
	131,980	6	3
Management in London	6,502	18	4
Interest and discount	20,570	0	7
Miscellaneous expenses	9,232	5	5
Total	168,285	10	7

CREDITS

	£	s.	d.
Copper ores and metal	3,127	12	4
Rent and stores	1,529	19	5
Balance carried down	163,627	18	10
Total	168,285	10	7

DEBITS

	£	s.	d.
Balance brought down	163,627	18	10
Balance from profit and loss account 1918/19	51,501	0	7
Taxes outside the United Kingdom	514	12	7
Total	215,643	12	0

CREDITS

	£	s.	d.
Transfer from income tax provision	25,972	12	11
Balance	189,670	19	1
Total	215,643	12	0

The company is capitalized at 400,000 ordinary shares of £2 each, of which 360,000 have been issued, and 75,000 6 per cent cumulative preferred shares of £2 each, of which 45,000 have been issued and fully paid. An issue of £120,000 of 8 per cent convertible debentures has been made.

Sulphide Corporation, Ltd.

Lead, Zinc; New South Wales

A report of the Sulphide Corporation, Ltd., for the year ended June 30, 1920, states that the net profit after payment of income taxes, London expenses, royalties, and other items amounted to £2,874 6s. 8d. Mining and milling operations at the Central Mine were suspended throughout the year because of labor troubles. At the Cockle Creek works, smelting and refining operations were continued on a restricted basis.

The acid and superphosphate plants worked intermittently throughout the year, the production being 13,222 tons and 17,398 tons respectively, compared with 15,524 tons and 25,448 tons in the previous year.

The Seaton Carew Zinc Distilling Works, in England, felt an ore shortage due to the difficulty of obtaining supplies from Australia. A total of 8,362 tons was treated, yielding 2,817 tons of zinc. The working account follows:

DEBITS

	£	s.	d.
Ore, concentrates and other products on hand in England and Australia, June 30, 1919	227,149	9	11
Central Mine			
Wages, maintenance, etc	73,523	13	7
Cockle Creek			
Wages, purchased ores, fluxes, freight, maintenance, etc.	374,762	2	11
Central Zinc Works			
Wages, purchased ores, maintenance, etc	151,687	5	6
Freight and charges on produce	2,411	8	7
Total	829,534	0	6
Balance, transferred to profit and loss account	32,394	12	0
	861,928	12	6

CREDITS

	£	s.	d.
Sales of produce	810,023	18	9
Less in transit, June 30, 1919	57,326	11	3
	752,697	7	6
Products in transit at June 30, 1920	5,952	18	7
Ore, concentrates and other products			
On hand June 30, 1920			
England	27,561	15	0
On hand June 30, 1920			
Australia	75,716	11	5
Total	861,928	12	6

The company capitalization consists of 600,000 preference shares of £1 each and 600,000 ordinary shares of 15s. each. During the year an interim dividend of 5 per cent was paid upon the preference shares (£30,000), and a final dividend of 10 per cent on the preference and 15 per cent on the ordinary shares (£127,500). Accumulated profit on June 30, 1920, amounted to £437,006 10s. 4d.

Mining Dividends for January, 1921

The following is a partial list of dividends paid by mining companies during January, 1921:

Mining and Metallurgical Companies in the United States	Situation	Per Share	Totals
Am. Smelters, "A"	U. S.	$1.50 Q	$146,071
Am. Smelters, "B"	U. S.	1.25 Q	39,855
Caledonia, l. s	Ida.	.01 M	26,050
Gold Chain, s. l. g	Utah	.01 K	10,000
Grand Central, g.	Utah	.01 K	6,000
Miami Copper	Ariz.	.50 Q	373,557
North Star Mines, g	Cal.	.03 K	7,500
Phelps Dodge, c	U. S.	2.50 Q	1,125,000
Tamarack & Custer, l. s	Idaho	.04 K	75,091
Tonopah Belmont, s. g	Nev.	.05 Q	75,000
Tonopah Extension, g. s	Nev.	.05 Q	64,140
United Eastern, g	Ariz.	.15 Q	204,455
U. S. Sm., Ref. & Mining	U. S.-Mex.	.50 Q	175,557
U. S. Sm., Ref. & Mining, pfd	U. S.-Mex.	.87½ Q	425,55[illegible]
Vanadium Corporation	Col.	1.00 Q	373,334
Mining and Metallurgical Companies in Canada, Mexico and Central America			
Asbestos Corp	Que.	$3.50 Q	$105,000
Asbestos Corp., pfd	Que.	3.75 Q	150,000
Dome Mines, g	Ont.	.25 Q	[illegible]
Hollinger Consol. Gold	Ont.	.05 M	24[illegible]
Howe Sound, c	B. C.-Mex.	.05 Q	[illegible]
Kerr Lake, s. cobalt	Ont.	.12½ K	[illegible]
Lake Shore, g	Ont.	.02 A	[illegible]
McIntyre-Porcupine, g	Ont.	.05 Q	182,014
N. Y. & Hond. Ros., s. g	C. A.	.30 Q	60,000
Nipissing, s	Ont.	.50 QX	[illegible]
Silversmith (Slocan Star), s. l. z	B. C.	[illegible] K	25,000

A, annual; K, irregular; M, monthly; Q, quarterly; X, includes extra.

Alvarado Mining, Inspiration Consolidated, McKinley-Darragh, and Portland Gold mining companies all announced passing of dividends due at this time, but the U. S. Smelting, Refining & Mining Co. only reduced its common dividend to 50c. from the $1.50 paid since September, 1919. Gold Chain, Grand Central, North Star, and Tamarack & Custer companies reappear after intervals ranging from six months to eight years.

De Beers Consolidated Mines paid [illegible] on the "American" shares on Jan. 27; Rand Mines, Ltd., English and American shares are now interchangeable, at rate of one American for five English shares, through the Bankers Trust Co.

MINING STOCKS

Week Ended January 29, 1921

COPPER

Stock	Exch.	High	Low	Last	Last Div.	
Adventure	Boston	..	..	*60	....	
Ahmeek	Boston	53	50	53	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	9/16	7/16	9/16	....	
Allouez	Boston	21	20	20	Mar. '19	1.00
Anaconda	New York	39½	37⅜	39¼	Nov. '20, Q	1 00
Arcadian Consol	Boston	2½	2¼	2½	....	
Ariz. Com'l	Boston	8¾	8½	8½	Oct. '18,	.50
Big Ledge	N. Y. Curb	7/16	5/16	7/16	....	
Bingham Mines	Boston	....	....	8⅞	Sept. '19, Q	.25
Calumet & Arizona	Boston	49½	48½	49½	Dec. '20, Q	1.00
Calumet & Hecla	Boston	249	245	245	June '20, Q	5.00
Canada Copper	N. Y. Curb		...	*13	....	
Centennial	Boston	10	10	10	Dec. '18, SA	1.00
Cerro de Pasco	New York	32¼	30⅛	30⅜	Dec. '20, Q	1.00
Chile Copper	New York	12½	11¾	12⅜	....	
Chino	New York	22¾	22¼	22¾	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*34	*33½	*34	....	
Con. Arizona	N. Y. Curb	..	..	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	2¼	2⅛	2⅛	....	
Copper Range	Boston	34	33⅛	33⅞	Sept. '20, Q	.50
CrystalCopper (new)	Boston Curb	*50	*35	*48	....	
Davis-Daly	Boston	7	6⅞	6⅞	Mar. '20, Q	.25
East Butte	Boston	9¼	9⅛	9¼	Dec. '19, A	.50
First National	Boston Curb	*90	*80	*85	Feb. '19, SA	.15
Franklin	Boston	2⅝	2⅝	2⅝	....	
Gadsden Copper	N. Y. Curb	..	....	*25	....	
Granby Consol	New York	25	22⅝	23½	May '19, Q	1.25
Greene-Cananea	New York	23	22¾	22¾	Nov. '20, Q	.50
Hancock	Boston	3¼	3¼	3¼	....	
Howe Sound	N. Y. Curb	3½	3	3½	Jan. '21, Q	.05
Inspiration Consol	New York	35½	34½	34½	Oct. '20, Q	1.00
Iron Cap	Boston Curb	....	....	7	Sept. '20, K	.25
Isle Royale	Boston	21½	20	21	Sept. '19, SA	.50
Kennecott	New York	20⅛	19¾	19⅞	Dec. '20, Q	.50
Keweenaw	Boston	...	....	1¼	....	
Lake Copper	Boston	3	3	3	....	
La Salle	Boston	2	1¼	2	....	
Magma Chief	N. Y. Curb	.	....	*21	....	
Magma Copper	N. Y. Curb	23	23	23	Jan. '19, Q	50
Majestic	Boston Curb	..	....	*8	....	
Mason Valley	Boston	2	1¼	1⅝	....	
Mass Consolidated	Boston	2¾	2¾	2¾	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	4¾	4¼	4⅝	....	
Miami Copper	New York	19⅛	18½	18⅞	Jan. '21, Q	.50
Michigan	Boston	..	....	3	....	
Mohawk	Boston	46½	44½	46	Nov. '20, Q	1 00
Mother Lode (new)	N. Y. Curb	5½	5½	5½	....	
Nevada Consol	New York	11½	11⅛	11½	Sept. '20, Q	.25
New Baltic	Boston Curb	..	....	3	....	
New Cornelia	Boston	16⅜	15⅝	15⅝	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	..	....	*5	....	
North Butte	Boston	12	11¾	11⅞	Oct. '18, Q	.25
North Lake	Boston	½	½	½	....	
Ohio Copper	N. Y. Curb	..	....	3/16	....	
Old Dominion	Boston	20	19⅛	19½	Dec. '18, Q	1.00
Osceola	Boston	29	29	29	June '20, Q	.50
Phelps Dodge	Open Mar.	...	†165	...	Jan. '21, Q	2.50
Quincy	Boston	40	39	40	Mar. '20, Q	1.00
Ray Consolidated	New York	13⅞	12⅞	13⅞	Dec. '20, Q	.25
Ray Hercules	Boston Curb	....	....	*50	....	
St. Mary's Min. Ld.	Boston	33	31	33	June '20, K	2 00
Seneca Copper	Boston	19	18½	19	....	
Shannon	Boston	1½	1	1½	Nov. '17, Q	.25
Shattuck Arizona	New York	6¾	6	6	June '20, Q	25
South Lake	Boston	1	1	1	....	
Superior Copper	Boston	4	3½	3¾	Apr. '17,	1 00
Superior & Boston	Boston	1½	1¼	1½	....	
Tenn. C. & C.	New York	9	8½	9	May '18, I	1000
Toulumne	Boston	*55	*55	*55	May '13,	.10
United Verde Ex.	Boston Curb	*29	*27	*28	Nov. '20, Q	.50
Utah Consol	Boston	4½	4½	4½	Sept. '18,	.25
Utah Copper	New York	57⅛	55	57	Dec. '20, Q	1.50
Utah M. & T.	Boston	2 1/16	1½	2⅛	Dec. '17,	30
Victoria	Boston	...	...	2	....	
Winona	Boston	*75	*60	*75	....	
Wolverine	Boston	13	11½	13	....	

NICKEL-COPPER

Stock	Exch.	High	Low	Last	Last Div.	
Internat. Nickel	New York	15⅞	15	15⅞	Mar. '19,	.50
Internat. Nickel, pf.	New York	.		75	Nov. '20, Q	1 50

LEAD

Stock	Exch.	High	Low	Last	Last Div.	
National Lead	New York	73	72	72	Dec. '20, Q	1.50
National Lead, pfd	New York	104	104	104	Dec. '20, Q	1.75
St. Joseph Lead	New York	12¼	12	12¼	Dec. '20, QX	.50
Stewart	Boston Curb			*6	Dec. '15,	05

ZINC

Stock	Exch.	High	Low	Last	Last Div.	
Am. Z. L. & S.	New York	9	9	9	May '17,	1 00
Am. Z. L. & S., pfd	New York	29½	26½	26½	Nov. '20, Q	1 50
Butte C. & Z.	New York	5¼	5	5	June '18,	50
Butte & Superior	New York	13½	13	13½	Sept. '17,	1.25
Callahan Zn-Ld	New York	6	5½	6	Dec. '20, Q	50
New Jersey Zn.	N. Y. Curb			157	Nov. '20, Q	4 00
Success	N. Y. Curb	*3		*2½	July '16,	03
Yellow Pine	Los Angeles			*45	Sept. '20, Q	03

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

GOLD

Stock	Exch.	High	Low	Last	Last Div.	
Alaska Gold	New York	⅞	⅞	⅞	....	
Alaska Juneau	New York	1¼	1⅛	1⅛	....	
Carson Hill	N. Y. Curb.	..	....	22¾	....	
Cresson Consol. G.	N. Y. Curb	.	...	1¼	June '20, Q	$0.10
Dome Extension	Toronto	*50	*50	*50	....	
Dome Mines	New York	12¼	11⅝	12¼	Jan. '21, Q	.25
Golden Cycle	Colo. Sprgs.	‡....	....	*73	Dec. '20, Q	.02
Goldfield Consol	N. Y. Curb	*8	*6	*7	Dec. '19,	05
Hollinger Consol	Toronto	6.72	6.30	6.65	Dec. '20, BM	.05
Homestake Mining	New York	50	50	50	Sept. '19,	50
Kirkland Lake	Toronto	*50	*47	*50	....	
Lake Shore	Toronto	1 21	1 20	1.21	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	1 90	1 83	1 85	Jan. '21, K	.05
Porcupine Crown	Toronto	*21	*20	*20	July '17,	.03
Portland	Colo. Sprgs	‡....	....	*60	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*5	*4½	*4½	May '19,	05
Silver Pick	N. Y. Curb	*10½	*8½	*9	....	
Teck Hughes	Toronto	*11	*10½	*10½	....	
Tom Reed	Los Angeles	1.16	1.13	1.15	Dec. '19,	.02
United Eastern	N. Y. Curb	2 7/16	2 5/16	2⅜	Oct. '20, Q	.15
Vindicator Consol	Colo. Sprgs	‡....	....	*18	Jan. '20 Q	.01
West Dome Consol	Toronto	*10⅜	*9	*10¼	....	
White Caps Mining	N. Y. Curb	*10	*8	*8½	....	
Yukon Gold	Boston Curb	....	....	*60	June '18,	.02½

SILVER

Stock	Exch.	High	Low	Last	Last Div.	
Arizona Silver	Boston Curb	*33	*26	*29	Apr. '20, M	.03
Batopilas Mining	New York	....	....	¾	Dec. '07, I	.12½
Beaver Consol	Toronto	*36¼	*35	*36	May '20, K	.03
Coniagas	Toronto	....	....	1.90	Nov. '20, Q	12½
Crown Reserve	Toronto	....	....	*18	Jan. '17,	.05
Kerr Lake	Boston	3	3	3	Jan. '21, Q	.12½
La Rose	Toronto	*31	*31	*31	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*29	*28	*28	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.10	1.09	1.09	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	10	7	9	Jan. '21, QX	.50
Ontario Silver	New York	5¼	5	5¼	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	¾	⅝	⅝	Jan. '12,	10
Peterson Lake	Toronto	*11	*9¾	*10	Jan. '17,	.01¾
Temiskaming	Toronto	*24½	*24	*24	Jan. '20, K	.04
Trethewey	Toronto	*19¾	*19	*19¾	Jan. '19,	05

GOLD AND SILVER

Stock	Exch.	High	Low	Last	Last Div.	
Atlanta	N. Y. Curb	*2	*1½	*2	....	
Barnes-King	Butte	‡....	...	1.11	Aug. '20, Q	.05
Boston & Montana	Boston	....	....	*63	....	
Cashboy	N. Y. Curb	*9	*7	*8	....	
El Salvador	N. Y. Curb	½	⅜	½	....	
Jim Butler	N. Y. Curb	*18	*16	*18	Aug. '18, SA	07
Jumbo Extension	N. Y. Curb	*8	*6	*6	June '16,	05
Louisiana Con.	N. Y. Curb	....	....	¼	....	
MacNamara M.& M.	N. Y. Curb	*18	*15	*17	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Oct. '20, QX	.50
Tonopah-Belmont	N. Y. Curb	1⅝	1½	1 9/16	Jan. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1 3/16	1⅛	1⅛	....	
Tonopah-Extension	N. Y. Curb	1⅝	1⅜	1½	Jan. '21, Q	.05
Tonopah Mining	N. Y. Curb	1½	1⅜	1 7/16	Oct. '20, SA	05
West End Consol	N. Y. Curb	1 1/16	1	1 1/32	Dec. '19, SA	.05

SILVER-LEAD

Stock	Exch.	High	Low	Last	Last Div.	
Caledonia	N.Y. Curb	*17	*15	*15½	July '20, M	.01
Cardiff M. & M.	Salt Lake	1.25	1.25	1.25	Dec. '20,	.15
Chief Consolidated	Boston Curb	2⅞	2⅝	2⅝	Nov. '20, Q	.10
Consol. M. & S.	Montreal	19⅜	18½	19	Oct. '20, Q	.62½
Daly Mining	Salt Lake	....	....	2 50	July '20, Q	.10
Daly-West	Boston	3⅞	3¾	3⅞	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	..	....	2⅛	Dec. '20, K	.25
Electric Point	Spokane	*7	*7	*7	May '20, SA	.03
Federal M. & S.	New York	8½	8½	8½	Jan. '09,	1.50
Federal M. & S., pfd.	New York	29½	27¼	29½	Dec. '20, Q	1.75
Florence Silver	Spokane	*16	*14	*16	Apr. '19,	.01¼
Grand Central	Salt Lake	....	....	*37½	June '20, K	.03
Hecla Mining	N. Y. Curb	4¼	3⅞	4⅛	Dec. '20, QX	.15
Iron Blossom	N. Y. Curb	3/16	3/16	3/16	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	....	....	3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*10	*7	*9	....	
Prince Consol	N. Y. Curb	5/16	5/16	5/16	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*8	*7½	*8	Feb. '19,	.01
Rex Consol	N. Y. Curb	*5	*5	*5	....	
South Hecla	Salt Lake	*70	*65	*70	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	3/16	3/16	3/16	Oct. '17,	.05
Tamarack-Custer	Spokane	2 05	1 95	1.95	Jan. '21, K	.04
Tintic Standard	Salt Lake	3.30	3 20	3.25	June '20, Q	.10
Utah Apex	Boston	2½	2½	2½	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*4	*2	*4	Nov. '17,	.01

QUICKSILVER

Stock	Exch.	High	Low	Last	Last Div.	
New Idria	Boston	...	...	*95	Jan. '19,	25

VANADIUM

Stock	Exch.	High	Low	Last	Last Div.	
Vanadium Corp.	New York	38¼	36½	37½	Jan. '21, Q	1 00

ASBESTOS

Stock	Exch.	High	Low	Last	Last Div.	
Asbestos Corp.	Montreal	82	82	82	Oct. '20, Q	1 50
Asbestos Corp., pfd.	Montreal	95	93	95	Oct. '20, Q	1 75

MINING, SMELTING AND REFINING

Stock	Exch.	High	Low	Last	Last Div.	
Amer. Sm. & Ref.	New York	40⅛	37⅞	40⅛	Dec. '20, Q	1 00
Amer. Sm. & Ref. pf.	New York	81	80	81	Dec. '20, Q	1 75
Am. Sm. pf. A.	New York	65½	65¼	65½	Jan. '21, Q	1.50
U. S. Sm. R. & M.	New York	43¼	43	43¼	Jan. '21, Q	50
U. S. Sm. R. & M. pf.	Boston	43½	42½	42½	Jan. '21, Q	87½

INDUSTRIAL NOTES

Power Trucks Valued as Winter Road Breakers

With the coming of winter and the heavy snowfalls in various parts of the country, the motor truck will assume the added duty of keeping these roads open for transportation. To warrant the expenditures which states and counties are making in their program of building and improving roads, thoroughfares must be kept open the year round, so that the business houses of the country, which are becoming more and more dependent on motor transportation for the conduct of their business, may obtain uninterrupted service during the winter months.

More than 2,000 FWD trucks, formerly government owned, are being used for road construction throughout the country. The FWD has proved itself unusually well adapted for snowplow work, because of the four-wheel-drive principle, which gives it power on all four wheels.

In conjunction with the use of snowplows on trucks for clearing miles of public roads, private concerns are also adopting this medium to facilitate transportation between particular points. During the heavy snows of last winter the Pride Pulp & Paper Co. of Tomahawk, Wis., kept four miles of road cleared from the railroad to the company's factory through the use of one of the FWD trucks with snowplow equipment. The Midwest Refining Co., Casper, Wyo., one of the largest operators of trucks in the West, is devoting a number of its FWD trucks to keeping roads open with the aid of snowplows.

Wahl Dewatering Machine Illustrated

Is Easy of Adjustment—Little Power Required—Large Tonnage Handled

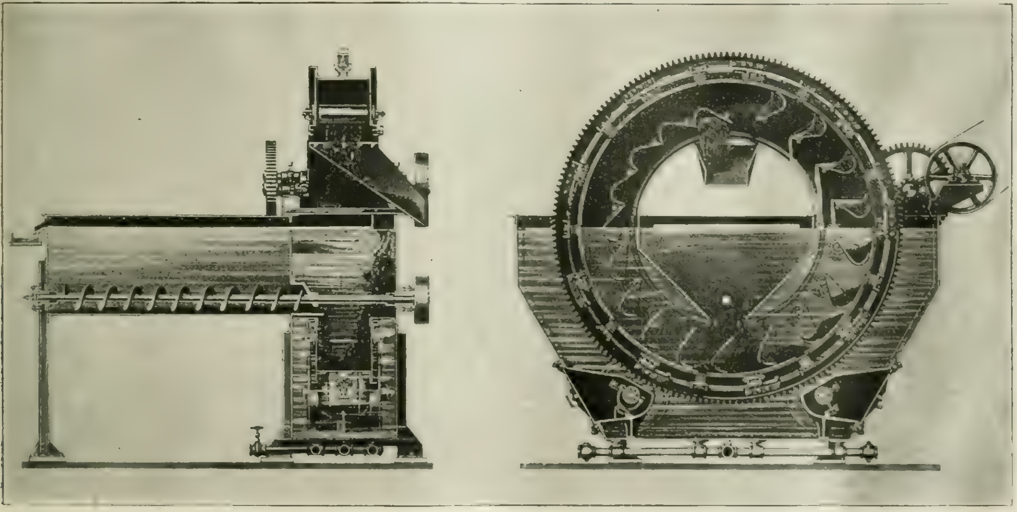
A new dewatering device has been designed by H. R. Wahl, mining and construction engineer and mill designer, First National Bank Building, Chicago, Ill. This machine is the outgrowth of Mr. Wahl's experiences in the lead mines of southeastern Missouri, where he had the problem of dewatering and disposing of large tonnages of concentrates and tailings.

The machine consists mainly of a deep, narrow water tank, containing a primary settling chamber within its upper central portion, and a feed inlet trough at one side. A supplemental elongated settling tank of V-shaped section joins the main tank at right angles to its side, and receives the overflow from the primary settling chamber through a narrow slotted opening in the upper part of the partition wall. Partly submerged within the main tank, and supported on two pairs of rollers, is a narrow-faced, open-end cylinder or rotor, of U-shaped cross-section, equipped with tires upon which it rotates, encircling the primary settling chamber. The rotor receives on the lower portion of its periphery the solids which have settled through the bottom outlet of the chamber.

Following the interior periphery of the rotor, a number of buckets are supported between its side plates, with sufficient clearance at both sides and end to allow the buckets to swing freely within proper limits, determined by adjustable stops at the bearing located on the outside of the rotor. When in operation, both rotor and buckets revolve together about the settling chamber, and thereby elevate, dewater, and discharge the solids from the machine without attrition.

The feed enters through the inlet trough at the top of the settling chamber. The coarser solids immediately sink through the bottom outlet of the chamber to the periphery of the rotor. The solids are then carried along by the revolving of the rotor. When the slope of the surface becomes too steep to retain them, they slide into the buckets. As the bottom of a bucket gradually assumes a horizontal position, the water is drained off over the inner edge.

At their uppermost position the buckets are automatically tripped and turned over, the outer edge of each bucket in turn striking the overturned edge of the preceding bucket, thereby completely discharging its contents into the discharge spout. The machine has a capacity of fifty tons of solids per hour and has a fourteen-foot rotor, but requires only two horsepower to operate.



LONGITUDINAL AND TRANSVERSE SECTIONS OF WAHL DEWATERING MACHINE

Industrial Housing a Factor in International Competition

"The significant feature about industrial housing is, that no amount of industrial prosperity, and, moreover, no leadership in international industrial competition, can be secured without giving proper consideration to the working classes. Upon the well being of these classes, including the farmers, mechanics, the skilled and unskilled workmen and the small shopkeeper, depend the economic strength and prosperity of the nation at this time." This is a conclusion reached by many others also, but the General Fireproofing Co., in whose journal it was published, is actively at work illustrating the many ways in which it may be accomplished to the satisfaction of all concerned, including the general public of the industrial communities of this country.

Liquid Type vs. Magnetic Contractor Type Control

By A. J. Nicht, Jr.

The Davis Coal & Coke Co. had in operation an Allis-Chalmers double-drum hoist equipped with 350 hp., 550-volt, 60-cycle, 3-phase wound rotor induction motor. The control equipment was of the magnetic contactor type, manufactured by the Cutler-Hammer Mfg. Co. The hoist operated two cages in balance in a vertical shaft, the approximate hoisting distance being 500 ft., and a trip was made every thirty seconds. The power for the hoist was supplied from the coal company's central station, where a 2,500-kw. turbine carried the load of all the mines. In addition to hoisting load, there were some fairly large pump motors and eight rotary converters.

On account of the rapidity of the trips, the accelerating peaks on the hoist motor were naturally high, amounting to approximately 850 hp. torque. This caused considerable line disturbance, which was further augmented by the action of the magnetic controller being amplified as each successive switch closed.

About a year ago, it was decided to increase the output of the Kempton line by speeding up this hoist to a trip in twenty-two seconds. Calculations showed that the new conditions would require a 600-hp. hoist motor and that the peaks at acceleration would amount to a little over 1,000-hp. torque. On account of the greatly increased peak load, serious consideration was given to the advisability of using an equalizer set instead of an induction motor for the new conditions. This change would have involved a large first cost. After carefully analyzing the operating conditions, the use of a 600-hp. induction motor with liquid controller was recommended, and paradoxical as it may seem, the engineers advised that although the average and peak loads were considerably higher, the line fluctuations would not be greater than obtained with the 350-hp. motor and magnetic controller. After carefully considering all of the facts presented, the company finally decided to install the 600-hp. induction motor with liquid controller.

The marked regularity of operation obtained with the liquid controller was particularly noticeable. This is due to the gradual and uniform acceleration with the liquid type. The actual peaks at acceleration under the new conditions amount to very nearly 1,100 hp. torque, and even with this greater peak, the voltage fluctuation is decidedly less than obtained with the 850 hp. peak with the smaller motor. In fact, with the hoist operating in connection with the liquid control, the flickering of the incandescent lamps has been entirely eliminated. The results obtained indicate the possibility of connecting fairly large induction motor hoists to central station lines without causing serious line fluctuations, provided these motors are supplied with liquid controllers.

Automatic Mine Car Has No Projecting Devices

Practical experience has shown that 75 per cent of the repairs on mine cars are the result of damage to locking devices which project from the car body. The master mechanic and shop foreman of a large mining company in the West set out to overcome these defects, and the result is the M-Z automatic mine car now being built by the Colorado Iron Works Co., of Denver, Col., and shown in the accompanying figure.

The body and hinged end are automatically, positively locked when in normal position. By pressing a foot pedal they are easily released for dumping, while the operator has his hands free for rotating and tilting the car. The all-steel construction, roller-bearing chilled iron wheels and spring drawbars are a few of the items of an all-round rugged and appropriate construction conforming to long experience in operating mine cars. The manufacturers have demonstrated the truth of the claim that repairs to locking devices have been eliminated.

M-Z AUTOMATIC MINE CAR

Pacific Coast Branch Established by Engineering Business Exchange

The Engineering Business Exchange, whose home office is at 30 Church Street, New York City, announces the opening of a Pacific Coast branch with James T. Whittlesey as director and with offices in the Claus Spreckels Building, San Francisco, Cal. This will make available to the engineers and engineering industries of the Western coast states the same service in bringing together the buyers and sellers of engineering and technical business properties that is being rendered by the New York office of the exchange.

Mr. Whittlesey is a Yale graduate and has long experience in the street railway field, notably with the Brooklyn street railways. For a dozen years also he was chief engineer of the Public Service Electric Co. of New Jersey. He developed a comprehensive ten-year program for the unification of the various plants and systems in New Jersey. Since moving to California eight years ago he has been engaged in general consulting practice.

TRADE CATALOGS

Concentrators; Separators.—The Stebbins Engineering Co., Los Angeles, Cal., has issued a series of illustrated pamphlets describing the company's dry concentrator and the treatment of placer deposits. This company maintains a research department and ore-testing plant.

Oxy-acetylene Torches—Davis-Bournonville Co., Jersey City, N. J., has issued a very interesting description of its "Oxygraph," which is a combination of a motor-driven pantograph mounting with an oxy-acetylene torch, adapting the latter to the rapid, accurate cutting of pattern shapes out of tool steel up to 20 in. thick.

Pumps—The Aldrich Pump Co., Allentown, Pa., recently sent out its illustrated folder "Pump Data 48," describing its "pot-chamber water-end type" of pumps. The separate, interchangeable pots and direct waterways, hence no reversal inflow, are particular features of these machines. They should be specially efficient about mines, quarries and the like where large quantities of water, often of a corrosive composition, must be handled.

Pipe Fittings; Tools.—The Walworth Manufacturing Co., Boston, Mass., manufacturers since 1842 of a complete line of valves, fittings and tools for steam, water, air, and gas, has prepared and is now distributing a particularly interesting export catalog. This covers the company's entire line, including the genuine Walworth Stillson wrench, and is printed in four languages, English, French, Portuguese and Spanish. Each page of the catalog carries parallel text in the four languages named. It is distributed only in countries where British threads are standards. The domestic catalog (78) is used where American threads are standard.

Flotation Oils and Reagents—The Barrett Co., with headquarters at 17 Battery Place, New York City, and Salt Lake City, Utah, is one of the largest producers of coal-tar products in the world, and for some time has done a considerable business in flotation oils and reagents, and a special flotation oil department is maintained. A very intelligently written pamphlet describing the Barrett flotation products and their application has recently been issued. These products run all the way from a carefully standardized crude coal tar to the more advanced and complicated chemicals, such as alpha napthylamine xylidine and thiocarbanilid. Small samples for laboratory testing are furnished free. The wood oils are not handled by this company. "Very thorough investigations" according to the brochure, "have demonstrated. . . that coal-tar oils and products can replace other oils in most cases."

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Organization Versus Competition

ANYONE who looks over the metal prices for the last few years will be interested and instructed in observing the relative irregularity of the curves—the violence of the periodic fluctuations, for the different metals. These ebbs and flows, of course, reflect corresponding surges in the whole business and industrial world—they represent periods of prosperity exaggerated into periods of overinflation, overexpansion, and speculation, which are presently offset and neutralized by periods of quiet and stagnation, which in their turn are exaggerated into hysterical deflation, forced sales, bankruptcy, and panic.

So the débris is cleared from the stage for a fresh cycle. But in inspecting the behavior of the various metal prices it is significant to note that aluminum, a necessary and widely used metal, has responded only slightly to these abnormal peaks and troughs in general business. The tops of the waves are smoothed out, and the hollows filled in. With nickel, also a fundamental necessity, we observe the same phenomenon. Compare these with copper, with its free movements and wide swings. What is the reason?

The aluminum industry is a monopoly. The Aluminum Company of America controls the business in this country; the British Aluminium Co. that of England; l'Aluminium Française that of France. The nickel industry is closely held, the International Nickel Co. predominating in the world situation. There are economic reasons for this in each instance. The manufacture of aluminum from bauxite requires immense hydro-electric power and the investment of great capital. The ownership of mines is a necessary precaution, and mines, smelters, and marketing organizations are under one direction. In the case of nickel, the vast resources of the Sudbury district in Canada, unparalleled in the world, dominate the situation, and unlimited supply has naturally led to a statistical study and the necessary limitation of output, and more or less centralized control.

These industries do not leap into sudden immense profits during periods of inflation; nor do we ordinarily hear of their mines, smelters, and factories being closed down in dull times. The intermittent employment of labor, with the economic waste involved, the most injurious act against the wage earner, is obviated or diminished. The closing down of mines and mills, with the irremediable injury and loss to invested capital, is likewise minimized.

Compare this condition with the situation in copper mining, for example. There is a very large class of copper mines whose operation is intermittent; which are closed down or even abandoned when copper is low, and are opened up, often by a new enterprise (the early one having foundered), when copper is scaling the heights. What a ruinous speculation for capital is here involved; what an affront and injury to labor! The copper industry is centralized in relatively few hands, but there is active competition between great mining and smelting organizations (except at present for export trade).

Were there any suspicion in our minds that there existed a secret and efficient "trust," the curve of copper prices would dispel it. Indeed, we suspect, following out this idea, that the degree of organization and effective control in any industry may be decided from a study of the price curves. Note, for example, the gentler curve for zinc, as compared with that for copper. And, on reflection, we remember that the zinc industry is actually far more "controlled" than in the case of copper. Copper, as we pointed out editorially in our issue of Dec. 18, is a sensitive barometer of industrial conditions: as sensitive, apparently, as the stock market; and a more extreme exemplar cannot be given.

We have always been accustomed to believe that competition was "the life of trade," and that control and the elimination of competition were ruinous or iniquitous. But when we inquire into some of our mining industries, like the graphite industry or the barite industry, we often find them almost hopeless because of competition; and it is easy to diagnose that they need scientific and statistical studies, standardizing of product, and central marketing, if they are to find markets and maintain themselves in competition with foreign products.

The tariff is the remedy usually clamored for to offset wastefulness and lack of the best technical methods, but even where such an economically extravagant remedy is obtainable it is often ineffectual. In other industries the remedy of organization has been found necessary. The California Fruit Growers have changed from bankruptcy to prosperity by a centralized control over supply, grade, and marketing. The Eastern farmer sorely needs such centralized and scientific methods of marketing. Labor has found centralized organization better for its welfare than competition. The organization of banks into a Federal Reserve system has recently avoided a panic.

The United States is in itself a combination in restraint of competition—a vast commercial and political combination entered into by many states. Compare the advantages of this plan with free competition and the principle of the survival of the fittest as exemplified in the Balkan States, or, on a smaller scale, in the republics of Central America.

Standardization of Metallurgical Equipment

STANDARDIZATION is one of the main reasons for the success of many large American manufacturing industries. A certain design of machine or part is found after careful test to be more generally desirable than another, and is thenceforth made exclusively.

Types and models are reduced to the fewest possible number, not only in one plant but in a whole industry, to secure the utmost efficiency in manufacturing. A considerable advance is being made in the standardization of mining methods, too, although by reason of the varying shapes, kinds, and locations of orebodies, as well as the different character of gangue encountered, the problem is a difficult one.

Metallurgists seem more backward, and a vast number of different tools, machines, and processes are used to treat similar ores under similar conditions. This in itself makes for progress if not persisted in too long, but we often find the same variation in the same processes continuing for years. There are several reasons. One is that an engineer who has installed a certain type of machine feels that to admit another to be superior reflects on his judgment. It takes a big man to admit that he has made a mistake. Another reason is that too many engineers dislike to make public the results of their work, being afraid that their methods will be shown in an unfavorable light by the publication of reports of work done at other plants. Particularly, there is to be noted an indisposition to describe experiments which have resulted negatively or unsuccessfully. As a result, one company duplicates the work which another company did years ago, instead of starting off where the former experiments ended.

We were particularly interested in a paper recently prepared by E. A. Wraight for the Institution of Mining and Metallurgy in London. The author attempted to give specifications of steel which would be the most satisfactory for the drills used in mining and for the various grinding media used in crushing and grinding ore. The data on which Mr. Wraight based his conclusions were derived from decidedly scattering published articles, wherein operating results covering two or more varieties of steel used in similar work are given, and are conspicuous by their scarcity. Mr. Wraight emphasizes the necessity for the collection of reliable data and the whole-hearted assistance of steelmakers and mine and mill managers. In this we heartily concur.

Consider balls and ball-mill liners, for example. (We will except, for the time being, a discussion of the various types of ball mills as being too controversial a topic.) Hardly a millman but has tried at least two and usually many more kinds of balls and also various types of liners. He is generally satisfied that certain kinds are either not suitable for the work in hand or are worthless for any purpose. On talking to several millmen recently we were impressed by the almost universal condemnation of a ball of a certain analysis for primary grinding in mills of large diameter; apparently they had all tried it, with unsatisfactory results. Probably others are trying it now. For some kinds of work it may be very suitable. How much of this unnecessary expense could be saved by a little publicity!

As a starter we suggest to our readers who have had experience with various balls and liners that they take a little time to give us their conclusions on the subject, amplified as much as possible by details as to the character and size of ore, size of mill, analyses of steel, cost for power and steel, and other germane details. Such data can, if necessary, be published without the author's name or the name of the mill where the work was done, provided this information is given to the editor, so that he may have some check on the authenticity of the figures submitted. A compilation of the results from many mills will be highly valuable. Should the response warrant it, we will also be glad to take up other fields where the opportunity for standardization exists.

How Not To Succeed in Latin America

SOUTH AMERICA, as we have before quoted with approval, is the "New West." There lie our chief opportunities for the expansion of our mining industry, and the trail has already been plainly blazed. In this great field of future opportunity for our sons, they will, however, have to compete on an equal footing with the capital, enterprise, and engineering ability of European nations. At the moment that is possibly not so threatening, what with the far greater financial depression in those countries; but in five years the pressure from Europe will probably be stronger than from America. It will take not only push but tact if we are to fulfill our destiny and carry the blessings of capital and enterprise to Latin America, to their great advantage and ours, rather than have other nations perform that function.

We have had a long experience in Mexico, and have not been successful in dealing with that country, either privately or officially. There are many exceptions to the rule, but we all know the type (not sufficiently rare) of swaggering American in Mexico, who despises and damns the whole country from which he gains his livelihood, and derives a mean kind of enjoyment from lording it over ordinarily docile laborers in a way that he would not dare to do at home. He will not learn Spanish, or is so ignorant that he thinks he knows it with a few words, or is not intelligent enough to acquire it: and holds that the workmen would be able to understand English if they were not so obstinate. We once observed an Irish-American foreman in Mexico bossing a gang of Mexicans. "Hey, you," he said; "bring me that McCarty—*McCarty*—McCARTY" (macate, a rope). Then, turning in disgust, he confided to us, "The damn fools don't know their own language."

Nor has our governmental contact, as is well known, been more adept or fitting with Mexico, Colombia, or elsewhere. Blundering, bluffing, stupid—all this, and more. We need presidents and diplomats who understand the people with whom they have to deal; and diplomatic and consular agents who inspire respect and esteem by their personalities—a prime requirement which has often been lacking.

We have before us a private letter (not sent to us) which was written by an American engineer in charge of important mine construction work in South America, and he puts one angle of the case so clearly that we quote:

"The United States citizen here, as in every country but his own, is not very popular, and if one looks closely the reason is not hard to find. He is continually flaunting his superiority and making odious comparisons, which are naturally resented. I find these people willing to like us if we will let them; they are a sensitive people, very polite and hospitable, and sometimes our methods are pretty crude, and jar their sensibilities. Their workmen are easily taught and are fairly efficient; many of the craftsmen compare favorably with our own. They are clever and only lack opportunity to develop."

The campaign of which this engineer speaks is simply the campaign for decency. American companies should send to South America only men of innate personal decency, refinement, and tact. We can only despise, fully as much as do our Latin-American friends, the American who is forced to be democratic at home, but expands gladly into a snob and an autocrat when he gets into a foreign country and is charged with a position of some little responsibility and trust. And American mining men should see that our official representatives are also of the type described. If these are unsuited or disreputable, our private American citizens abroad should not hesitate to make a din in Washington about it, at the State Department and through their representatives in Congress. It is their business, more even than it is that of the State Department.

Let all of these remember that the history of the dealings of the United States with our Southern neighbors in the past has not been by any means immaculate, and that there are important passages of which no unprejudiced historian or fair American can approve. The principle of might makes right has shown through too often to now allay the ever-present suspicion. As a nation and as individuals, therefore, we must, in the future, "lean backward" in a fair, generous, and courteous treatment, and what we say we must never forget to make good.

Could Brass Prices Be Reduced?

INTERESTED as we are in the high retail prices charged for copper products, and why, our eyes are attracted by a statement of the net earnings of the American Brass Co. for the last few years. This company is capitalized at $15,000,000, and in the year 1920, half of which was an era of general business depression, earned $3,354,564, a modest 22 per cent. In the last four years, 1917 to 1920, the net earnings have amounted to more than the capitalization. Holding no American brass stock ourselves, we are tempted to inquire if the prices of that company's products could not be lowered a little. The uses of brass might thus be widened. Dividends should not suffer unduly, and copper could be made to go a little faster into consumption.

Possibly, of course, the company is under-capitalized. It is usually the other way, and corporations are often accused of watering stock, but in these days of complex taxes, complexly determined, perhaps an under-capitalization may be more desirable in some circumstances. As a classical example of our idea of an unwatered stock we might cite the Temiskaming & Hudson Bay Mining Co., in the Cobalt district, which, capitalized at $25,000, of which only $7,761 was outstanding, paid, during its life, $1,940,250, or dividends of 25,000 per cent!

We had expected that the earnings of the brass companies might be satisfactory when we were dissuaded, the other day, from buying some brass screws for which our retailer asked at the rate of $1.35 per lb. Instead we bought some iron screws at 45c. per lb.

As the American Brass Co. is reputed to be the country's largest consumer of copper, we are naturally interested in having its sales as large as possible, and we believe they would be considerably extended by lower prices of those products which must meet active competition with iron. Possibly C. H. Dodge and A. C. James, who are members of the board of directors of both the Phelps Dodge Corporation and the American Brass Co., are the best qualified to fight the battle.

Fishing for Suckers

SILVERSIDES for snappers and platinum for suckers! Better bait cannot be had by an Izaak Walton in the case of the former or Wallingford himself in the latter. With platinum bringing nearly four times as much as gold, and with the public properly educated to know its uses and value, it is to be expected that once in every moon or so bonanza deposits of it would be discovered even in the most unlikely places. Sulphur Rock, in Independence County, Ark., is the scene of the latest boom, which, according to our most recent information, has not yet collapsed.

As usual, the assay returns secured by the principals, Pat Adams and H. C. Stratton, are said to be generously large. No one-ounce stuff for them, but, rather, ore running $500 in platinum, with ample amounts of gold and silver. This report does not quite agree with that of an engineer of our acquaintance, whom we know to be reliable. Samples which he privately secured were first analyzed at a laboratory in which he happened to be financially interested. The results were small amounts of gold and silver and no platinum at all. Not content with this, he sent another sample to a well-known firm of assayers and chemists in New York, who reported it to contain none of the metals of the platinum group, and only traces of gold and silver.

The Mr. Stratton referred to claims to be a metallurgits and chemist who has a secret process of discovering and extracting these elusive platinum values. He is manager for what he calls the New American Ore Concentrator Co., and it is by his patent concentrator that he claims to recover the platinum. According to our informant, he set up a small laboratory at the "mine" near Sulphur Rock, and the place has been a Mecca for local citizens ever since, drawing crowds of 1,000 or more people every Sunday. The platinum and gold are in chloride form, says Mr. Stratton, and he even claims that the mine water is charged with platinum chloride. One tale is that he recovered a large amount of the metal by boiling down a couple of gallons of water.

According to our engineer friend, the rock is simply the carbonaceous shale that is prevalent in the district. Development work consists of a 30-ft. tunnel, from which visitors are now barred by gate and lock to prevent them from taking samples. A firm of manufacturing jewelers in Chicago is said to have given Mr. Adams, the promoter, his fancy assays. Fishes are reported to be biting at the proposition. Poor fishes!

The geology of the region is interesting. In a signed article in the *Batesville Guard* Mr. Stratton says:

> In the first place these hills are situated with[illegible] hundred miles of the Gulf of Mexico and have an [illegible] of about 200 ft. The Gulf Range is very prom[illegible] between the Gulf and these beautiful hills, whic[illegible] in a basin of an area of some twenty by fifty miles. [illegible] very small portion of this area contains these [illegible] which resemble a round-bottom kettle turned up[illegible] and each one containing a water flow from the [illegible]. The up shoot comes from volcanic eruptions of [illegible] the writer has seen three extinct volcanoes.
>
> The whole would resemble hasty pud[illegible] could one have seen the action going on [illegible] at the time of its submergence, which [illegible] of the China Sea at present.
>
> In addition, some fine diamonds are [illegible] around the ore shoots as already op[illegible]

We suggest a psychopathic ward at least for Mr. Stratton, or else that he be thrown into the China Sea with one of these diamonds about his [illegible]

WHAT OTHERS THINK

Credit Conditions

The United States Government will not grant further credits to foreign governments. Foreign business men will obtain credit from American business men. These statements seem to be contradictory, though in fact they are not.

A large export and shipping concern and a war baby made many millions of dollars during and shortly after the war. These millions, together with their millions of capital and other millions supplied by their backing bank, have been dissipated as credits granted to business men in Europe, Asia, Africa, and South America. (The fact that these credits were not granted voluntarily is not pertinent.)

Another similar firm, but much larger, older, and more serious, has employed its entire capital, surplus, assets, and line of credit in carrying its foreign buyers; and to such an extent is this true, that only by the most strenuous efforts, and by borrowing on nearly every shipment, cargo, and steamer, has the company been able to continue.

These are two prominent examples. New York has thousands of similar ones. Many if not most of our commercial banking institutions are loaded with acceptances based on shipments to foreign countries, which will *never be liquidated at more than half the invoice value.* Banks which even during the war did not touch export business have been tempted by the apparently easy and good profits.

And so, though our Government will find it a banking impossibility to lend to individual merchants abroad, this lending can and will continue to be done by merchants here, who, in turn, will borrow from the Federal Reserve Bank through their own bankers. This individual lending will be the result of two conditions. First, in consequence of decreased domestic business, manufacturers and producers are attempting to sell abroad. Second, there are so many manufacturers and producers, that if each one of them tries it once, even on a small scale, and fails to collect, sufficient credit to finance Europe will be the result.

This may sound incredible, but we have Cuba, near at hand, which is being financed this way. Exporters, manufacturers, and merchants in America are providing the money for Chile, Peru, Argentina, and many other countries in quantities such that, if collections could be forced, all these countries would be bankrupt. This simply means that, in the same way that the Federal Reserve Bank is carrying the export banks, these carry the exporter, who carries the foreign importer.

It is not a bad method, so long as the exporter uses judgment in his choice of customers. If loans were made by our Government to other governments, these in turn would have to loan to their banks, which would finance the foreign importer. Our Government would have no control over the ultimate beneficiaries of the loan. By the present method, the exporter's success depends upon his judging correctly his customers. It is true that at present few customers in any corner of the world are "good." It is for this reason that the proposed Credit Bureau of the World will have to go very slow now. Old records are useless. Firms reported at 1,000,000 fr. are refusing shipments and dishonoring drafts calling for the payment of $100.

Nevertheless, such a bureau is vitally necessary, and the exporter, the merchant, and the manufacturer realize it and are sending their reports as fast as they get new data, particularly when the data are unfavorable.

Although it is true that credit is not being granted at present, many foreign buyers continue to express indignation at offers on cash terms, so probably sooner or later American exporters will again begin to extend foreign credit accommodation—say after the first of the year, when inventories are completed and frozen credits thawed.

In the same way that exporters here are dropping by the wayside, so merchants and importers abroad will surprise their friends. Credit information is now much more important than ever before, and the vast accumulation of data and reports will have to be verified, and even fresh information from bankers and commercial agencies must be verified where more than a week old.

Credits must be granted with extreme caution. It would not be unfair to be almost as careful in granting credits abroad as our banks are in granting credits to their American customers. In this way, though some buyers abroad will be disappointed, fewer exporters will liquidate.

MARK R. LAMB.

New York City.

Correspondence School Mining Engineer

I have read your editorial "Lenine and Washington B. Vanderlip" in the issue of Dec. 25, and have been quite interested in your reference to Mr. Vanderlip as "a correspondence school 'mining engineer'" and your comment "we are relieved to know that Mr. Vanderlip is *only* a correspondence school mining engineer," from which the natural inference is that you do not consider that one who lays the foundation of his professional knowledge on a correspondence course is a credit to the profession that he seeks to follow.

If we assume as an essential requirement to becoming an engineer that one must stand up in cap and gown before a faculty and receive a sheepskin engrossed in a language that he does not understand, we are in the position of denying that such men as James B. Eads, who conquered the Mississippi River with his jetties and the St. Louis bridge and left many other monuments to his extraordinary ability, and Thomas A. Edison, "the wizard," were not "engineers" until their achievements had become so notable that leading universities were proud to confer honorary degrees upon them.

Similar instances could be multiplied indefinitely. All of us have known men whose standing as engineers is beyond question, but who have never received a degree or had the benefit of a single day of college education. Conversely, all of us have known men with engineering educations as good as money can buy who will never be worth the traditional tinker's dam as real engineers, no matter how they are placed, and even if they live to be as old as Methuselah and grow whiskers down to their knees.

I know a man who now has a profitable consulting practice. Within a year of his graduation from one of the best mining schools in the country he was unceremoniously fired from a job at day's pay because of his utter ignorance of the most elementary practical principles of the work. When did that man become an engineer? Was it when he received his degree or was it when he acquired such practical experience as to enable him to qualify under Webster's definition of an engineer as "A person skilled in the principles and practice of engineering"?

Engineering is very largely a profession of overcoming obstacles. Does not the man who, having put in his eight hours in the mine or mill, buries himself in his books for another two or three hours while the other fellows are reading the magazines or playing cards exhibit that spirit of the true engineer which wins through in spite of obstacles? Many employers are only too glad to get correspondence school men for that very reason.

And how about those who have secured sufficient credits by correspondence study of a university extension course to entitle them to a degree? Are they *"only* correspondence school mining engineers," or will you admit them to the elect? LEROY A. PALMER.

San Francisco, Cal.

Will the McFadden Bill Make Bandits?

A number of years ago a New York wildcat promoter was operating a small silver property in northern Sonora. To raise more money and to gain the confidence of his directors he considered it most advisable to show a good production for the property. In view of the fact that silver was an extremely scarce article at the mine, and there being little chance that it would produce, he forthwith purchased Mexican pesos on a wholesale scale. The same he melted up and shipped as bullion produced at the mine. Unknown to him, the directors finally learned of these operations and accused him of this practice at their next meeting. Whereupon the wily promoter admitted the fact and told them that every time he had advance information of a bandit raid upon the camp he immediately collected all of the silver coin and melted it into a bar which was too large to be easily carried off, thereby saving the company's money.

Will melted United States gold coin bring a 50 per cent premium? M. J. ELSING.

Bisbee, Ariz.

Concerning the Recent Annual Review Number

Congratulations on the Annual Review Number of *Engineering and Mining Journal*, which is a decided improvement over past annual reviews of the same publication. The most valuable feature of the issue is that it devotes a consistent amount of space to each subject, so that the reader who is reasonably busy can absorb the most important facts regarding a metal, substance, or industry in the short space of time that may be at his disposal. HARRY J. WOLF

New York City.

The Artificial Production of Precious Stones

I notice on p. 1131 of the Dec. 11 issue of the *Engineering and Mining Journal*, under the title "Nature Still Supreme in Making Diamonds," one or two misstatements, which, although relatively unimportant, should not have appeared in a journal devoted to the mineral industries. I refer to the statement that reads as follows:

> "However, the ruby, topaz, sapphire, amethyst, and emerald, precious stones of the corundum class, are often made by artificial methods. The product is in many cases superior. . . ."

Of course, ruby and sapphire are corundum, but ordinary topaz is either quartz or precious topaz (a silicate of aluminum with fluorine). It is true that yellow corundum is sometimes called Oriental topaz, but it is more frequently termed golden sapphire. It is, it is true, now made artificially. Ordinary amethyst is a variety of quartz, and neither it, quartz topaz, nor precious topaz has ever been made artificially on a commercial scale. Purple corundum, sometimes called Oriental amethyst, has been made artificially, but there is little of the product on the market, as there is not much demand for it.

The principal mistake, and the one to which I wish to take exception, is the statement that emerald is a variety of corundum and has been artificially produced. Not only is ordinary emerald not corundum (it is a variety of beryl, beryllium-aluminum silicate), but emerald-green corundum, sometimes known as Oriental emerald, has never been made artificially. All artificial green corundum is of a rather unattractive yellowish-green shade, and has been sold to some extent under the misnomer of synthetic peridot. Many attempts have been made to manufacture emerald-green corundum, but they have been failures. Equally unsuccessful have been all efforts to make true synthetic emerald on a commercial scale. In spite of the fact that synthetic emeralds are offered for sale by many jewelers, such objects are not true synthetic emerald, but are either nothing other than a green glass, or else are some form of doublet. G. M. BUTLER.

Tucson, Ariz.

[We are glad to publish Dean Butler's intelligent criticism. We should have said Oriental topaz, Oriental amthyst and Oriental emerald. Our statement would then have had the authority of the Encyclopedia Britannica, as follows:

"The Oriental emerald has been produced artificially in the same way as the ruby, by adding a larger amount of chromium to the alumina bath and regulating the temperature."

"The Oriental topaz . . . consists of clear crystalline sapphire colored with a small quantity of ferric oxide. It has been produced artificially by adding iron instead of chromium to the matrix from which the white sapphire crystallizes."

"The sapphire . . . is found occasionally of a beautiful violet color; it is then called the Oriental amethyst. . . . If, to the igneous bath of alumina, some coloring matter, such as manganese, is added capable of communicating a violet color to the crystals of alumina, the Oriental amethyst will be the result. Oriental amethyst has been so formed artificially.—EDITOR.]

THE VULTURE MINE AND CAMP, FROM THE MILL, IN 1914

The Vulture Mine

An Excellent Example of the Effect of Faulting Upon the Development Of a Southwestern Gold Deposit—Discovered in the Sixties, the Property Had a Good Record of Production Until 1917, When It Was Closed Down

BY W. SPENCER HUTCHINSON
Written for *Engineering and Mining Journal*

THE VULTURE, a gigantic tooth of gold-threaded quartz on the rim of the desert, watched century by century the seasonal migration of the Apaches, who crossed the mountains and the forty miles of desert between the waters of the Hassayampa and the Gila. In the sixteenth century it beckoned the adventurous Spaniard from the beaten trail to reveal its gold and to take his brass-poled and steel-edged axe for a token. It was not until 1862 that any attempt was made thoroughly to explore central Arizona; no one had before essayed more than a hurried passage through the country, although all believed it to be rich in minerals. The Territory of Arizona was organized by act of Congress, Feb. 24, 1863, and about the same time Weber, Walker, Wickenburg, and other veteran pioneers came into the district.

Henry Wickenburg, with several companions, was prospecting upon the Hassayampa in October, 1863, and discovered a butte or small isolated mountain of quartz which they recognized as containing gold, but to which they attached no great value at first, so that all but Wickenburg were reluctant to go to even the small trouble of posting notices, claiming the lode. It was, however, taken up, and the Vulture mine by 1867 became the best-known and most profitable property in central Arizona, if not in the entire territory. The main quartz outcrop, a tooth-like butte, was 500 ft. long, 400 ft. wide, and 100 ft. high.

The Vulture mine is in Maricopa County, fourteen miles south of Wickenburg, a station on the Prescott & Phoenix branch of the Santa Fé Ry. about fifty miles northwest of Phoenix. The mine is reached by automobile road, which surmounts a pass at an altitude of 2,700 ft., just north of Vulture Peak. The mine itself is at an altitude of 2,000 ft. It was not so accessible in the early days before the railways were built, when Ehrenburg, on the Colorado River, was the nearest supply point and whence all the machinery for the first mill was hauled 168 miles across the desert. In 1880 the railroad reached Phoenix and in 1893 it was extended to Wickenburg. The Hassayampa is a "dry" river the greater part of the year, but its sub-channel stream is unfailing, and at Wickenburg abundant water is found by shallow wells. Of these waters, it is alleged, "He who drinks thereof shall never afterward tell the truth, have a dollar, or leave Arizona."

The first mills for working the Vulture ore were built on the Hassayampa, one a short distance above Wickenburg, and sixteen miles from the mine, the other considerably further down the river and ten miles from the mine. Wells were drilled at the mine in 1909, and a watercourse in gravel was found under the lava at 400 ft. depth. Two wells were equipped with pumps, but the water nearly failed in 1912, and one of the wells was deepened to 1,003 ft., where more water was found. This water rises to 450 ft., whence it is pumped with a standard well rig, and for four years, as long as the well was used, the flow showed no diminution, and there was never any lack of water for the mill at the mine or for other needs.

Wickenburg himself seems to have been possessed of initative, for within six months of his discovery he had built arrastras on the Hassayampa River, to which he hauled ore yielding $80 to $100 in gold per ton, and in 1865 built a five-stamp mill, which he worked steadily until 1867, when he sold the mine to an English company. The new owners built a new mill of forty stamps about a mile above the town of Wickenburg. Tailings in excess of 200,000 tons accumulated here from the ores hauled from the Vulture mine. The treatment at this early time was, of course, by amalgamation, and although the accounts refer to some concentration by bumping tables, it appears that the concentrates were not shipped away, but were piled up for future treatment. At any rate, after the cyanide process was developed and in the early 90's, this tailing pile was worked over by cyanidation with great profit.

THE VULTURE MINE, SHOWING THE VEIN IN THE WEST END OF THE EASTERLY OPEN CUT

The ownership of the mine was divided, and this fact accounts for another mill of twenty stamps built in 1871 at a point on the river known as Smith's mill, ten miles east of the mine and fifteen miles below Wickenburg. There was a third mill at Seymour some time later, about three miles above Smith's mill and about the same distance from the mine and on the old stage road between Vulture and Phoenix. Frequent mention is made of the excessive cost of operation, due to the long wagon haul from the mine to these mills, which made it necessary to sort the ore at the mine and put into stockpiles for later treatment everything that yielded less than $20 per ton. The practicability of building a mill at the mine and also of laying a pipe line from the Hassayampa River was considered early in the progress of the work. This plan, however, waited until 1879 for its realization, when the Arizona Central Mining Co. acquired all of the different claims on the deposit. An eighty-stamp mill was then built at the mine and a six-inch pipe line was laid from Seymour, whence water was pumped from wells sunk in the bed of the river. Power was provided by a steam plant burning wood, and during the operation of the mill, which continued for seven or eight years, all of the scanty growth of desert trees was cut off for twelve miles around the mine.

During the twenty years from 1888 to 1908, the mine was worked only in a small way by lessees. In 1908 it was reopened by the Vulture Mines Co. The mine was pumped out and the shaft sunk deeper. Milling began in 1909 from ore mined in the upper levels and milled in twenty stamps of the old mill repaired for that purpose. The ore was amalgamated in the mortars and on plates in approved California style, with very good results and a metallurgical efficiency of 70 to 80 per cent. The tailings were piled for later treatment by cyanide. Water was developed by the deep wells, and a new mill built in 1910. The latter was of twenty heavy stamps, with supplementary grinding pans, having a capacity of 100 to 120 tons of ore daily, and was driven by a gasoline engine. The mill worked steadily, with the exception of an interruption of a few months, until the end of 1915. All activity ceased in 1917. The mine was allowed to fill with water, and in 1919 the equipment was advertised for sale.

Only the most meager records of the production of the Vulture mine between 1864 and 1908 are to be found, but it is known to be very large. Published reports credit it with as much as $16,000,000, and some claims are made of even larger production. In *Mineral Resources* for 1869 a record is given of 15,474 tons milled at Wickenburg, which yielded $399,743, which is at the rate of $25.83 per ton. Whatever uncertainty there may be regarding early production, there is none concerning that since 1908, which amounted to a total of $1,839,375, of which about 30 per cent came from concentrates shipped to smelters and the remainder was from bullion derived in nearly equal proportion by amalgamation and cyanidation. Complete records of tonnage are not at hand, but there was milled during the years 1912 to 1914, inclusive, 82,091 tons of ore of an average assay of $18.94 per ton, which was treated with a metallurgical efficiency of about 82 per cent.

The mine is in the foothills of the Vulture Mountains at the edge of a broad, gently sloping desert valley. The country rocks are schists, probably pre-Cambrian, with dikes and irregular masses of granite, all antedating the mineralization. Vulture Peak, at an altitude of 3,500 ft. and five miles northeast of the mine, is a volcanic neck with radiating dikes whose prominent outcrops form striking topographic features. This neck and the dikes are assumed to have been the source of the lavas which filled an old valley and buried the easterly extension of the Vulture mineral zone.

THE OFFICE AND ASSAY LABORATORY AT THE VULTURE MINE

These buildings date back to the very beginning, and [illegible] built of mine boulders, some of which show free gold. The [illegible] was taken in 1908. The buildings are still standing.

The vein strikes east and west and dips northerly 42 deg. It presents two characters: next to the foot wall, a vein five to six feet thick of rich mineralized quartz but without admixture of schist, and above this, and separated from it by chloritic schist, a big quartz vein thirty to fifty feet thick. In some parts this vein is of clean, white quartz, which is invariably low-grade and cannot be worked at a profit. In some parts, the body of this vein is made up of fragments of schist with quartz between, and is rich. The hanging wall is of chloritic schist, the foot wall being of [illegible] schist. The outcrop was 1,000 ft. long, but it [illegible] disappeared now, the upper parts of the vein having been quarried in two large open pits. The westerly pit is 300 ft. long and the easterly one 500 ft., with low-grade vein matter, which consists mostly of white quartz too poor to mine, remaining between them.

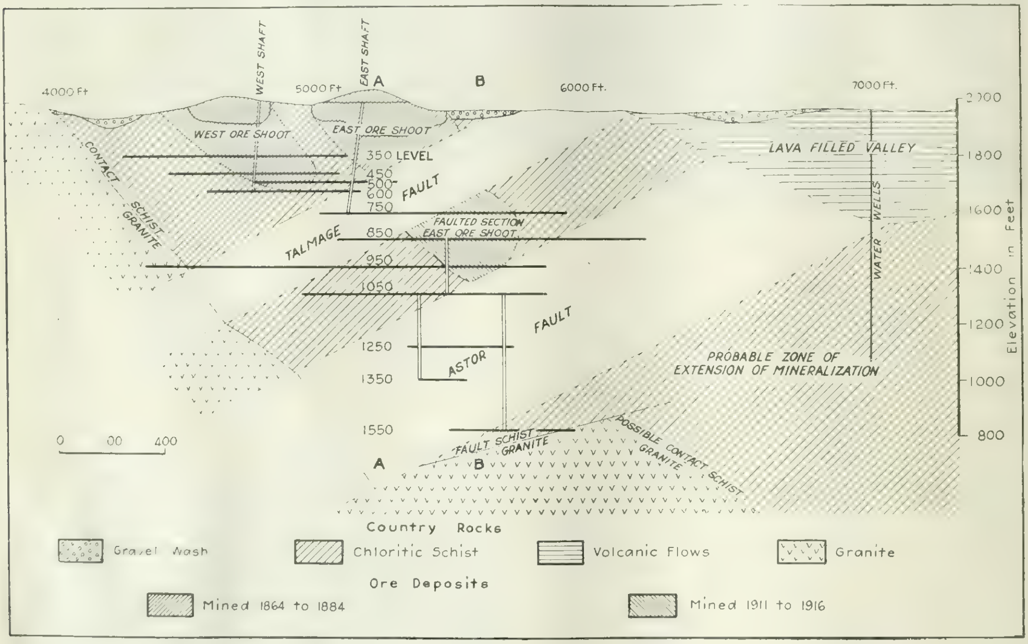

FIG. 1. LONGITUDINAL VERTICAL PROJECTION OF THE VULTURE MINE WORKINGS

In the oxidized zone the quartz is stained with iron oxide, and some wulfenite in characteristic tabular crystals with razor-sharp edges is found in openings in the quartz. Vanadinite is reported to have been found, but it must be rare, for none was seen during the recent operations. Below the zone of oxidation the vein minerals, other than quartz, are pyrite, galena, blende, and chalcopyrite. The proportion of these is indicated by the ratio of concentration, which was about 30 to 1, and the assay of the concentrates, which was 12 to 15 per cent of lead, 8 to 12 per cent of zinc, 1 to 2 per cent copper, and from $120 to $200 in gold. Metallic gold was found in all parts of the mine, and even in the deeper workings, where the ore was not oxidized but was made up of characteristic quartz with associated sulphides, coarse gold was present, and thus some pieces weighing half an ounce or more accumulated in the mortars of the stamp batteries. This gold had a fineness of 760 to 780.

The association of gold with galena is an interesting characteristic. The gold thus associated appeared not to be metallic, and proved, upon experiment, to be peculiarly obstinate to cyanidation, but the galena was usually rich, so that when the average mill concentrates assayed $150 per ton the clean galena concentrate assayed $600. These characteristics of the ore led to the adoption of a rather unusual metallurgical treatment, a combination of amalgamation, concentration, and cyanidation.

Just beyond the ore shoot on its westerly extension extensive outcroppings of granite are found, occurring as an intrusive mass in the schist. The vein extends into the granite, but pinches out within a short distance after splitting up into several smaller veins, which have, however, yielded some high-grade ore. Granite of identical character was encountered in the westerly end of the 950 level, in the easterly end of the 1,550 level, and in a diamond-drill hole put down from the latter. These points of exposure of granite in the zone of mineralization indicate a probable easterly pitch of the contact and perhaps also an easterly pitch or rake to the ore zone.

The position of the stoped areas is shown in Fig. 1, representing the longitudinal section. Characteristic silicification is found throughout, but mineralization, instead of being uniform, is segregated in two well-defined ore shoots. The easterly orebody, which is the one furthest from the granite, was the larger in every dimension, and the position of the two suggests the conception of a succession of ore shoots *en echelon.* Thus, the next one should be further east and deeper, and the faulting would have carried it to some such position as is indicated on the drawing as "probable zone of extension of mineralization." Evidence of easterly extension of the ore zone would naturally be looked for on the surface, but near-by exposures are lacking, for the reason that the schists are buried by volcanic tuffs and lavas. The schists emerge again 3,000 ft. to the east, where they show characteristic structures and some mineralization.

The geological feature which has been a controlling factor in the history of the Vulture mine is the extraordinary development of faulting. There are a great number of small faults, with displacement, however, of a few feet only. These have been of little consequence and have interfered neither with development nor mining. Besides these, there are two major faults, which are known as the Talmadge and Astor faults. The Talmadge fault cuts the orebody off on the easterly end and on the dip, crossing the vein on its strike at an acute angle. The dip of the fault is 80 deg. to the northeast, which compares with the dip of the vein, 42 deg. to the north. The displacement of the vein is 300 ft. vertically. This fault does not outcrop at the surface, but is buried by gravel wash, a circumstance tending to conceal its true character, which was consequently not recognized until 1911. That this fault was encountered early is shown by the sketch, Fig. 3, and a quotation from a letter[1] written in 1872 by the superintendent of the mine to Rossiter W. Raymond, then U. S. Mining Commissioner:

"At a depth of 232 ft. below the surface of the mesa the fissure is found to change from a dip of 45 deg. north-northeast to an almost vertical position. . . . After sinking 50 ft. behind the foot wall, from the 232-ft. level, the fissure was crosscut and found to be 47 ft. in width, and having on the hanging wall a seam of blue clay some 12 or 15 in. thick. Outside of this was the hanging-wall rock peculiar to the mine above; but the fissure, throughout its width, was found to be filled with a hard black rock full of fine iron pyrites and some galena, and similar in character to the cap or barren filling which is found in many Colorado lodes."

It is interesting to find the correct interpretation of this puzzling geological structure by comparing the sketch, made in 1872, with the cross-section of the orebody as developed in 1918. So far as is known, no work was done deeper than that shown in the old sketch until 1911.

It is not easy to show these faults and their relation to the vein clearly and fully without a series of cross-sections or a model, but the two accompanying sketches, Fig. 2, will give an idea of the disastrous results of the faulting. The fault was encountered during the recent working of the mine on the 500 level near the plane of section *A-A*, and here it was from five to six feet wide between the walls and was filled with gouge and broken fragments of schist and quartz. For a short distance, in some places fifty or sixty feet, below the point where the vein was cut off, the fault contained so much crushed vein matter that the fault was profitably stoped for a considerable distance. The fault is mineralized discontinuously by calcite, which appears in lenses a few feet in length, sometimes a foot in thickness, dark colored, and containing here and there crystals of galena. The calcite is comparatively plentiful near the surface and is not found in the deeper parts.

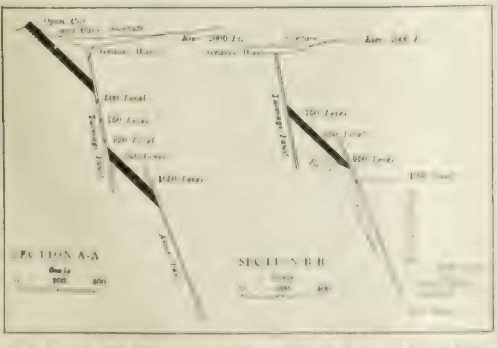

FIG. 2. CROSS-SECTIONS ON *A-A* AND *B-B* OF THE VULTURE MINE, SHOWING THE EFFECT OF FAULTING

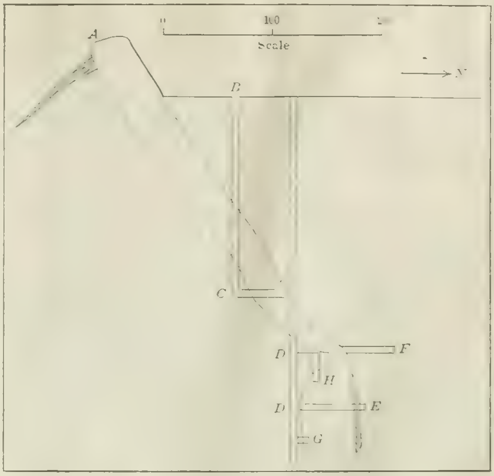

FIG. 3. SECTION OF VULTURE MINE

Drawn by Peter Taylor, superintendent, in 1872, published in report of the U. S. Commissioner of Mining Statistics, 1874, page 348. *A*, outcrop; *B*, mouth of main shaft at surface of mesa; *C*, 182-ft. level; *D-D*, interior shaft; *E*, crosscut at 282-ft. level, showing vein 47 ft. thick, with seam of clay on hanging wall; *F*, north property drift, at 232 ft.; *G*, crosscut (unfinished) at 312-ft. level; *H*, small winze.

When the position of the fault was determined by the extension of the underground work, its apex was projected and staked on the surface, and it was found that it cut through an area of old dry-placer workings about 700 ft. southeast of the orebody. A working hypothesis was developed based upon the idea that the old placer marked the position of the faulted outcrop of the vein, and exploration was thereafter directed by a drift on the 750 level southeasterly along the fault and by a vertical winze from the same level on the northeasterly side of the fault. This work resulted in cutting the vein on both the 750 and 850 levels exactly where the hypothesis indicated. The orebody, when rediscovered, was 35 ft. thick, and the best part of the ore shoot 200 ft. long.

At this stage it was thought that nothing could interfere with the realization of the most sanguine expectations entertained for the mine, but before many months had gone by the Astor fault was cut on the 1,050 level, at a place where it was expected to find ore. This new fault is parallel, or nearly parallel, to the Talmadge fault, and the displacement is in the same direction—that is, downward on the northeasterly side. The amount of that displacement is not known, for the reason that neither the vein nor any other correlating features have been found beyond it.

The physical condition of the fault-filling does not suggest displacement greater than that of the Talmadge fault, but the winze 500 ft. vertically below the 1,050 level did not find the vein, although it did find stringers of quartz which yielded good assays, a condition which is characteristic of mineralization in the schist beyond the ends of the ore shoots. It is believed that the drifts might wisely have been carried further east before the work was stopped, but, in any case, if the vein should some day be found in the east end, a new shaft from the surface would be necessary for economical working, and any further explorations had probably best be done by diamond drilling.

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[1] Mineral Resources West of the Rocky Mountains, 1873

The purpose of this account is to put on record the facts concerning a remarkable gold mine, with the hope that it may be of service to others who may harken to the call of the Vulture.

Iron-Ore Production in 1920

THE iron ore mined in the United States in 1920, exclusive of that which contained more than 5.5 per cent of manganese, is estimated by the U. S. Geological Survey at 67,773,000 gross tons, an increase of 12 per cent as compared with the output in 1919. The shipments of ore from the mines in 1920 are estimated at 69,558,000 gross tons, an increase of nearly 24 per cent as compared with shipments in 1919. The stocks of iron ore at the mines, mainly in Michigan and Minnesota, apparently decreased from 12,986,000 gross tons in 1919 to 11,145,000 tons in 1920, or 14 per cent.

The production of iron ore in 1920 was less than 2,000,000 tons below that of 1918 and is exceeded only by that of the war years 1916, 1917, and 1918. In 1920 shipments exceeded production by approximately 1,785,000 gross tons, but in 1919 production exceeded shipments by about 4,147,000 tons.

LAKE SUPERIOR DISTRICT

About 86 per cent of the iron ore mined and shipped in 1920 came from the Lake Superior district, in which 58,173,000 gross tons was mined and 60,056,000 tons was shipped, increases of about 12 and 24 per cent, respectively, as compared with the quantities mined and shipped in 1919. These totals include the ore mined and shipped from the Mayville and Baraboo mines, in Wisconsin, and ore shipped by rail as well as water from all mines, but exclude manganiferous ores that contained more than 5.5 per cent manganese. The ore is chiefly hematite. The stocks of iron ore in this district apparently decreased from about 11,887,000 gross tons in 1919 to about 10,000,000 tons in 1920, or 16 per cent.

The shipments of iron ore by water from the Lake Superior district in 1920 (including manganiferous iron ore), according to figures compiled by the Lake Superior Iron Ore Association, amounted to 58,527,226 gross tons, an increase of 24 per cent as compared with these shipments in 1919. A total of about 1,529,000 tons is thus indicated to have been shipped by rail.

The mines in Minnesota furnished 67 per cent of the total iron ore shipped from the Lake Superior district in 1920 and 58 per cent of the total of the United States. The mines in Michigan furnished 31 per cent of the Lake shipments and 27 per cent of the grand total.

SOUTHEASTERN STATES

The southeastern states, which constitute the second largest iron-ore producing area, including the Birmingham and Chattanooga districts, mined 6,663,000 gross tons of iron ore in 1920, an increase of 16 per cent as compared with 1919. The shipments of ore from these states to blast furnaces in 1920 amounted to 6,575,000 gross tons, an increase of 18 per cent as compared with shipments in the previous year. The ore contains about 78 per cent of hematite, 21 per cent of brown ore, and 1 per cent of magnetite. The production of ore in these states in 1920 apparently slightly exceeded the shipments, so that the moderate stocks at mines and furnace yards were increased.

NORTHEASTERN STATES

The northeastern states, which include New Jersey, New York, and Pennsylvania, in 1920 mined 2,027,000 gross tons of iron ore and shipped 2,070,000 gross tons, an increase of 12 per cent over the quantity mined and of 36 per cent over the quantity shipped in 1919. A slight decrease in ore stocks is thus indicated. Most of this ore is magnetite, and is subjected to concentrative treatment before shipment.

WESTERN STATES

Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Washington and Wyoming, the iron-ore producing states in the West, are estimated to have mined and shipped 734,000 gross tons of iron ore in 1920, an increase of 8 per cent as compared with the quantity mined and shipped in 1919. No large stocks of iron ore are maintained at western mines. Hematite predominates in the western states, but considerable brown ore and magnetite are mined.

OTHER STATES

Other states, including Connecticut, Maryland, Massachusetts, Missouri and Texas, in which there are small iron mines that produce chiefly hematite and brown ore, mined about 176,000 gross tons in 1920, an increase of 63 per cent as compared with the quantity mined in 1919. The shipments from mines in these states in 1920 are estimated at 123,000 gross tons, an increase of 16 per cent over the shipments that were made during the year 1919.

Prehistoric Monsters Overran Nebraska And Wyoming

What geologists term the Oligocene formations contain the fossil bones of a great variety of strange extinct animals. These strata are among the most widespread and most regularly distributed of the Tertiary sedimentary rock formations of the Great Plains, and cover a vast area in Nebraska and Wyoming.

The lower Oligocene beds, which are believed to be over a million years old, are often called *Titanotherium* beds, because they contain great quantities of the bones of extinct mammals of that name. They were clumsy brutes of elephantine size, according to the U. S. Geological Survey, having on the front of the skull a pair of great bony protuberances, which, although hornlike in form, were probably not sheathed in horn.

The animals of Oligocene time were apparently abundant as well as varied in kind. Among those characteristic of this epoch were primitive forms of rhinoceroses, peccaries, ruminants, camels, insectivores, and opossums. The saber-toothed tiger, one of the most formidable enemies of primitive man, first appeared in the Oligocene epoch. The horses whose history began with the diminutive four-toed *Eohippus* continued in the Oligocene. Hoglike animals were rather numerous. One of these was a formidable beast with curious protuberances on its head, the use of which is not known. Rhinoceroses similar to those now found in Africa and India lived in western America, and other rhinoceros-like animals were abundant.

Consumption of Reagents Used in Flotation

IN APRIL, 1919, according to Thomas Varley, of the U. S. Bureau of Mines,[1] the Bureau sent to ore-dressing plants a questionnaire asking for data on their operations in 1919. Replies have been obtained from practically all plants, and the figures are representative and complete enough for all practical purposes. Presumably they cover plants in all parts of the United States.

The reports showed that 26,545,564 tons of ore was treated by flotation, from which 3,105,343 tons of concentrates was produced. The total of 113,510,234 lb. of oil, acid, and other reagents used was equivalent to 4.2384 lb. per ton of ore treated, by far the greater part of which was copper ore.

Not many reports were received from companies treating ores of gold and silver. In the plants making reply, 75,081 tons of ore was treated, yielding 8,698 tons of concentrates, a concentration of 8.63 into 1. Oils used were petroleum fuel oil, 42,054 lb.; pine-tar oil, 24,720 lb.; and turpentine, 36,320 lb.

The number of tons of graphite ore treated was 55,980, yielding 906 tons of concentrate, a concentration of 6.18 into 1 Oils and reagents used were pine oils, soda ash, and lime, aggregating 250,700 lb.

Of miscellaneous and complex ores, 73,690 tons was treated, yielding 5,840 tons of concentrates. Oils and reagents used were sodium sulphide, 73,360 lb.; soda ash, 133,770 lb.; sodium silicate, 111,136 lb.; and pine oils, 22,786 lb.

In tabulating the returns for copper ores, all plants that were treating ores solely by gravitation methods have been excluded. Many companies, however, use a combination of gravity concentration and flotation. Of 38,255,707 tons of ore milled, 23,265,832 tons, or 60.8 per cent, was treated by flotation. This would indicate that 39.2 per cent was discarded as tailings low enough in metal content not to warrant regrinding for further treatment, although a certain small proportion would represent concentrates removed by concentration machinery.

In the following table the total amount of each reagent used is calculated into average number of pounds consumed per ton of ore. This figure of course does not represent the average consumption in any one flotation plant, for some plants use large quantities of one reagent, whereas others use none. The total amount of copper ore treated by flotation was 23,265,832 tons, producing 2,837,660 tons of concentrates, a concentration ratio of 8.23 into 1.

REAGENTS USED ON COPPER ORES

	Pounds	Equivalent in Lb. per Ton of Ore Treated
Coal tars	20,488,27[illegible]	0.8[illegible]
Coal-tar creosotes	1,399,170	[illegible]
Hardwood creosotes	1,774,782	[illegible]
Pine oils	2,142,06[illegible]	[illegible]
Pine tars	[illegible]	[illegible]
Fuel oil	21[illegible]	[illegible]
Sulphuric acid	7[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Kerosene acid sludge	[illegible]	[illegible]
[illegible]	228,740	[illegible]
[illegible]	188,377	[illegible]
[illegible]	[illegible]	[illegible]
Others [illegible]	[illegible]	[illegible]
Total average quantity of copper reagents used per ton of ore [illegible]		[illegible]

The comparative tonnage of lead and lead-silver ores treated by flotation is considarably less than that of copper ores. The total quantity of these types of ores treated by combined gravity and flotation methods was 6,742,815 tons. Only 1,671,740 tons, or 24.78 per cent of the total tonnage reported, was treated by flotation. This 1,671,740 tons, re-treated by flotation, produced 147,552 tons of concentrates, a concentration ratio of 11.33 into 1.

REAGENTS USED ON LEAD AND LEAD-SILVER ORES

	Pounds	Equivalent in Lb per Ton of Ore Treated
Coal tars	324,861	0.1943
Coal-tar creosotes	71,860	0.0430
Hardwood creosotes	642,051	0.3840
Pine oils	221,416	0.1324
Pine tars	22,904	0.0135
Wood tars	86,926	0.0520
Crude petroleum	318,544	0.1905
Sodium sulphide	151,212	0.0904
Cresylic acid	12,069	0.0072
Sulphuric acid	98,027	0.0586
Kerosene	9,707	0.0057
Gasoline	2,934	0.0017
Soda ash	95,210	0.0570
Sodium silicate	144,371	0.0863
Niter cake	161,270	0.0964
Other reagents	86,720	0.0517
Total average quantity of oils and reagents used per ton of ore treated by flotation		1.4647

The reports show that 2,917,443 tons of zinc ore was treated by combined gravity concentration and flotation, whereas 1,563,482 tons, or 53.59 per cent of the total tonnage, was treated by flotation alone. This yielded 211,302 tons of concentrates, a concentration ratio of 7.39 tons into 1.

REAGENTS USED ON ZINC ORES

	Pounds	Equivalent in Lb. per Ton of Ore Treated
Coal-tar creosotes	21,110	0.0013
Hardwood creosotes	31,742	0.0020
Copper sulphate	81,145	0.0518
Pine oils	1,741,674	1.1136
Crude oils	11,238	0.0007
Other oils and reagents	63,300	0.0041
Average quantity of oils and reagents used per ton of ore treated		2.5578

The most generally used flotative agents for copper ores are sulphuric acid, kerosene acid sludge, and the coal tars. For lead and lead-silver ores hardwood creosote is used most generally, followed by coal tars, crude petroleum, and pine oils. Most important for zinc ores are the pine oils, with copper sulphate and hardwood creosote next in importance.

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[1] *Reports of Investigations*, No. [illegible]

Talc Production in Canada

The talc production of Canada has increased steadily during the last ten years, and as a large part of the Canadian talc is exported to the United States, the increase can be followed approximately from the imports into this country, according to the U. S. Bureau of Mines. Practically all of the talc produced in Canada comes from near Madoc, Hastings County, Ont. The three companies, George H. Gillespie & Co., Ltd. Madoc, Ont.; Anglo-American Talc Co., Ltd., Madoc, and the Eldorado Mining & Milling Co., Ltd., Eldorado, are producing ground talc. Of these companies the George H. Gillespie company is probably the largest and ships the highest grade of talc. The mine and mill are efficiently operated and had a prosperous year in 1920. It is reported that the erection of a new mill of larger capacity is under consideration. According to reports of the Ontario Department of Mines, the Eldorado company does not produce a real talc, but an altered siliceous magnesian limestone.

Pyritic Smelting of Refractory Sulphides in a Knudsen Furnace

Experiments on Copper-Nickel Ores of the Sudbury District Prove That the Necessary Fuel Can Be Reduced From the Normal Figure of 11 per Cent on the Charge to 4 per Cent

By Edward H. Robie

Written for *Engineering and Mining Journal*

TO COMBINE the functions of the copper blast furnace and converter in one vessel, or at least to make the flow of molten material between the two continuous, has been the subject of much thought and the object of many experiments. It is a variation of the problem of pyritic smelting, the solution of which has also been formidable. Normally, the blast furnace may be said to be essentially a melting furnace, the object being to transform the ore to a molten condition, so that the mineral matter may be separated from the rock, this being commonly done in an external settler or forehearth, where advantage may be taken of the relative specific gravity of the matte and slag.

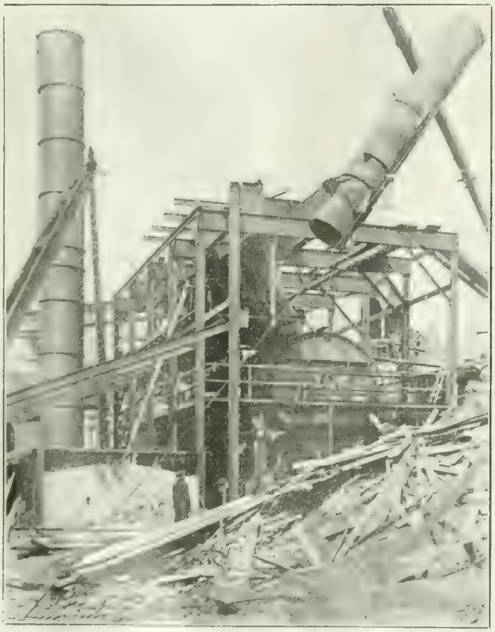


FIG. 1. KNUDSEN FURNACE AND SETTLER UNDER CONSTRUCTION

The function of the converter is to oxidize iron and sulphur; that is, after the mineral has been separated from the rock in the blast furnace, the converter separates the commercially important metal or metals in the matte from those which it is found advisable to throw away. Any method of treatment, therefore, which seeks to perform both of these operations at once, or within the walls of one furnace, must be the result of careful thought, with a full knowledge of the reactions involved in each operation. Pyritic, or semi-pyritic smelting, as practiced at Mount Lyell, at Copperhill, at Anyox, and at Clarkdale, is a partial solution of the problem. Those who have been successful with this method of smelting know that the charge must be of a definite character, and the process is a delicate one which is of only limited application.

The Knudsen Furnace

At each of the plants mentioned, blast furnaces of conventional design, or at least with only minor modifications, are employed. In Norway, however, at Sulitjelma, an entirely different type of smelting furnace has for several years been used, known as the Knudsen furnace. The design is more like that of a converter than a blast furnace. The operation is briefly as follows: The tuyères, which are near the bottom of the interior space, are covered with a small quantity of solid fuel, low-pressure air then being turned on to start combustion. Sulphide ore is then charged, which is melted by the heat from the burning fuel, and a bath of low-grade matte forms gradually over the tuyères. The air pressure is gradually raised as the bath of matte and slag becomes deeper. When the charge is completely fused and the matte blown to the desired grade, the furnace is tilted down and the contents are poured through the throat into some form of settler where the slag and matte may be separated, the matte later to be blown to blister by conventional methods. The product of the Knudsen furnace, therefore, is not unlike that of the pyritic blast furnace, although the operation is quite different. The action is not continuous, but a saving of fuel is made.

Seven years ago the officials of the International Nickel Co., after a long series of unsuccessful attempts to apply the principles of pyritic smelting to the copper-nickel sulphide ores of the Sudbury district, in Ontario, decided that the problem offered little hope of solution unless radical changes were made in the design of the equipment used. The successful operation of the Knudsen process in Norway being known, it was decided to send 200 tons of the Sudbury ores to the Sulitjelma plant for experimental treatment. David H. Browne, who had been conversant with the pyritic experiments formerly conducted by the Nickel company at Copper Cliff, went to Norway to observe the work. The results were so promising, even with small furnaces and unsatisfactory means of disposing of the product, that it was decided to spend a large sum on experimental equipment at Copper Cliff. To be practicable, larger units would be required than were used in Norway, so a furnace which would hold fifty tons was designed, following the same principles as were embodied in the Norwegian twenty-ton furnaces. A small oil-fired reverberatory was also provided for settling the Knudsen product. Fig. 1 is a photograph taken during construction.

The shell was of the cross-section shown in Fig. 2, having somewhat the characteristics of a horizontal converter of the Peirce-Smith type, with the exception of a narrow crucible along the bottom instead of the ordinary circular cross-section. The inside length was 30 ft., the width 6½ ft. and the height 9½ ft. Magnesite brick, 18 in. long, formed the lining, except in the roof, where 12-in. magnesite brick was used. Air was admitted through seventy-six 1-in. tuyères. A special turbo blower was installed to furnish air at the variable pressures and volumes required by the furnace. The oil-fired settler was 38 ft. long and 12 ft. wide, with walls of 24-in. magnesite brick, a magnesite floor and a 12-in. silica-brick roof. Slag and matte were tapped from this settler intermittently into pots standing on a standard-gage track.

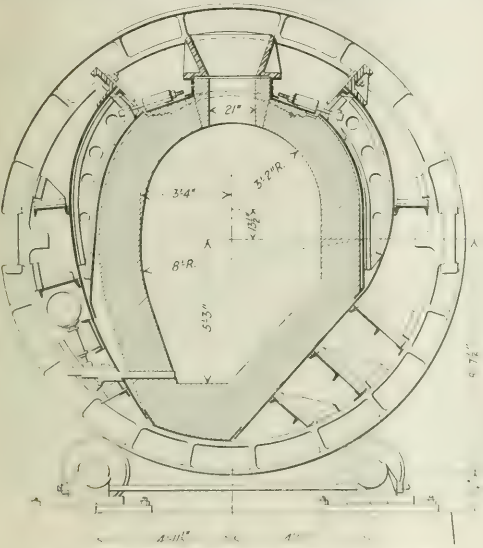


FIG. 2. SECTION THROUGH CHARGE HOLES FIRST DESIGN

Before describing just what happened in this furnace, brief mention may be made of the character of ore customarily smelted and of the previous attempts to smelt it pyritically. The ore from the Creighton mine which was used in the Knudsen test was not unlike that ordinarily smelted by the company. It averaged about 1.50 per cent Cu, in the form of chalcopyrite; 4.10 per cent Ni, in the form of pentlandite or nickeliferous pyrrhotite; 42 per cent Fe; and 23 per cent S, the iron sulphide being wholly pyrrhotite. The gangue was largely norite from the hanging wall and granitoid gneiss from the foot wall. The SiO_2 content of the ore smelted was between 18 and 19 per cent. Theoretically, such an ore should be capable of a high degree of pyritic treatment, but all such efforts had failed.

In 1905, G. F. Beardsley unsuccessfully attempted to apply experience gained at Mount Lyell. Later, in 1909, D. H. Browne and J. L. Agnew carried out extensive experiments, in which almost every conceivable idea was thoroughly tested. In 1912, G. A. Guess, with experience at the Tennessee Copper Co., failed to solve the problem. In 1913, a basic lined tilting forehearth, similar to a Peirce-Smith converter, was installed alongside of an ordinary blast furnace, smelting green ore. Instead of running the low-grade matte and slag into a settler, it was run continuously into this forehearth and blown, with the addition of flux. Owing to rapid corrosion of the magnesite forehearth lining and insufficient improvement in the grade of matte, the experiments seemed to offer little encouragement as a solution of the problem. With a purely copper ore the pyritic process was workable, but nickel for some reason appeared to add some devilish impediment; it seemed, as some one has said, to put the Old Nick into the charge, the two words having the same meaning and derivation.

The practice in 1914 remained as it had been, and as it still is, with minor modifications—roasting in open heaps to 10 or 12 per cent S and smelting the roasted ore, which is essentially self-fluxing, with about 11 per cent of coke on the charge, to a 20 to 25 per cent CuNi matte. If this 11 per cent of coke—and the figure was sometimes higher—could be reduced to 2 or 3 per cent, as the Knudsen process promised, the saving would be considerable, for the fuel charge was very close to $1 per ton of ore smelted.

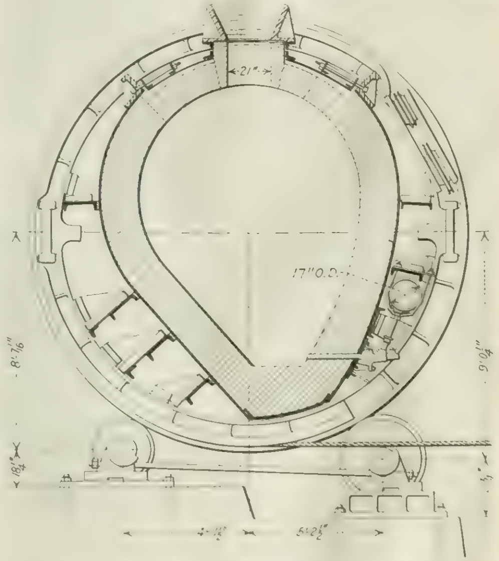


FIG. 3. REVISED DESIGN SECTION THROUGH CHARGE HOLES

OPERATING DIFFICULTIES

The method of smelting in the Knudsen furnace has already been given briefly in the third paragraph of this article. The first few runs proved that the Knudsen process was actually able to smelt this troublesome ore with less than 5 per cent of fuel. This was the first time this feat had been accomplished, and the solution of the local problem of pyritic smelting seemed to be at hand. To be sure, the operators experienced a liberal amount of what metallurgists so aptly term "grief," but that was to be expected. At first, of course, the lining leaked, tuyère hose was burned up and tuyères frozen, the blower was inclined to be balky, with obvious effects on the charge; too little fuel was sometimes used in an effort to be economical, or ore of too low sulphur content was charged. Great crusts would form across the molten bath, which had to be barred out or smelted out, and sometimes, for some of the reasons already given, the entire charge froze up. The intense fumes of SO_2 added to the excitement.

After eighty-eight charges had been treated, it had been proved that the bath was not of sufficient depth for the proper blowing of the matte. Had the interior of the furnace remained clean, the dimensions might have been adequate, but occasional blocks and crusts cut down available capacity and prevented the molten material from being evenly distributed along the tuyères. Decision was, therefore, made to decrease the inside length from 30 to 21 ft., to increase the width from 6 ft. 6 in. to 8 ft. 7 in. and to increase the height from 9 ft. 6 in. to 11 ft. The bottom was also hoppered in for 2 ft. from each end. The new design, shown in Fig. 3, gave a deeper bath over the tuyères from the same amount of charge, particularly in the early stages of the blow, when it was most needed. The shorter length necessitated fewer tuyères, forty, 1½ in. in diameter, being used.

After remodeling and relining, ninety-four more charges were smelted, after which the furnace was closed down, sufficient data having been obtained on which to calculate the advisability of using the process permanently.

The new form proved more successful than the original design, and the data which follow are based only on the second campaign. Also, some charges have been omitted in making up some of the averages, such charges not being representative of what the furnace could do, for various reasons.

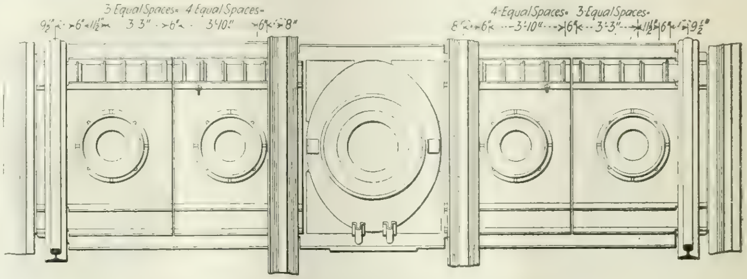


FIG. 4. PLAN OF TOP OF FURNACE AS RE DESIGNED

About 4 Per Cent of Coal and Coke Necessary

The first thing charged to the furnace is the fuel. Various kinds and qualities were tried, but for satisfactory work it was found that about 3,000 lb. of bituminous coal mixed with 1,000 lb. of coke was necessary. This was distributed as well as possible along the bottom of the incandescent lining, and it immediately ignited. The blower was then started and set to deliver about 2,000 cu.ft. of air per minute at a pressure of from 8 oz. to 1 lb. per sq.in. In a few minutes the air was shut off and the ore charged into the throat through a chute. It was found that starting the smelting on the average ore containing about 23 per cent of S furnished hardly sufficient heat properly to smelt the upper portions of the charge. Hand picking of clean sulphides was then resorted to, about 10 per cent of the charge being so picked and added first. This picked ore contained possibly 30 to 35 per cent of S. This hand picking was a disadvantage which had weight in finally determining the commercial applicability of the process.

About fifty tons of ore and four tons of quartz flux was customarily charged, and with a clean interior this amount could be slightly exceeded. After fusion was well under way, the furnace was blown with maximum pressure and volume of air, up to 14,000 cu.ft. per minute at 15 lb. per sq.in., until the charge was in complete fusion and the matte was of the desired grade. This could be determined from experience, from an inspection of the interior, from the appearance of the flame, from the ease of punching and from the sound. The average blowing time under normal conditions was four and a half hours, although various factors caused a variation of from three to eight hours. To empty the furnace, clean accretions from the throat and recharge, required, when all was going well, close to two hours, but this time could probably be reduced to one hour with conditions more favorable, so that the twenty-four-hour capacity would be between 225 and 250 tons of charge, or a less amount of ore if reverts were added.

An effort was made to smelt a lower grade of ore from the company's No. 3 mine, containing about 3 per cent of Cu plus Ni, 11 per cent of S, and 27 per cent of SiO_2. Several tons of this was added toward the end of some of the charges, but its refractory qualities usually caused trouble.

The grade of the matte produced was, of course, dependent on the length of the blow. A matte containing 40 per cent of Cu and Ni was the aim, for a richer matte than this meant an unwarranted slag loss. With low-grade ore from the No. 3 mine on the charge, long blowing was required for complete fusion, and the matte was in some instances as high as 60 per cent.

No attempt was made to recover any flue dust, and it is unlikely that any great amount would be formed unless fine ore were used on the charge. Most of the "dust" which was visibly liberated seemed to be in the form of small prills of matte and slag such as are customarily found in converter flues. In Norway, it is understood, fine ore and flue dust have been successfully smelted by the Knudsen process, but the work at Copper Cliff was almost exclusively done on the oversize from a 1-in. trommel. Some scrap will also have to be taken care of; in fact an unconscionable lot was made during the tests. With normal operation, however, it is unlikely that the total reverts would exceed 15 per cent of the ore charged, and possibly the figure might be considerably under this.

The magnesite lining stood up better than was expected, and the wear was comparable to that of an ordinary basic converter working on similar material. During the second campaign over 4,400 tons of ore was smelted, and the bricks were still in such good condition that they were used, after the furnace was dismantled, in making repairs to the ordinary converters, for which they came in handy when magnesite was expensive and scarce in the early months of the war.

Careful records were kept of the power requirements, and it was found that 27 hp. was theoretically required for blast per ton of charge smelted. Figuring the over-all efficiency of the blast equipment at 55 per cent, 49 hp. would actually be required per ton of charge. The power consumption, of course, rapidly increased toward the end of the blow, when both volume and pressure are the greatest.

Separating the matte and slag was found to be a big problem in itself, and several delays were caused by trouble with the reverberatory settler. Large quantities of magnetite formed in the Knudsen, which not only was conducive to a mushy condition in the settler, but also, according to the researches of Maier and Van Arsdale, no doubt accounted for the suspension of much valuable metal in the slag. The average slag loss was well over 1 per cent of Cu plus Ni, although a temperature of 1,350 deg. C. was maintained in the settler by the liberal use of oil burners. Such a loss is, of course, out of the question. It was believed that a loss as low as 0.8 per cent might be obtained with a 40 per cent matte in regular practice, but even this would seriously affect the commercial applicability of the process. Nickel, it may be said, replaces part of the copper and is not an additive loss.

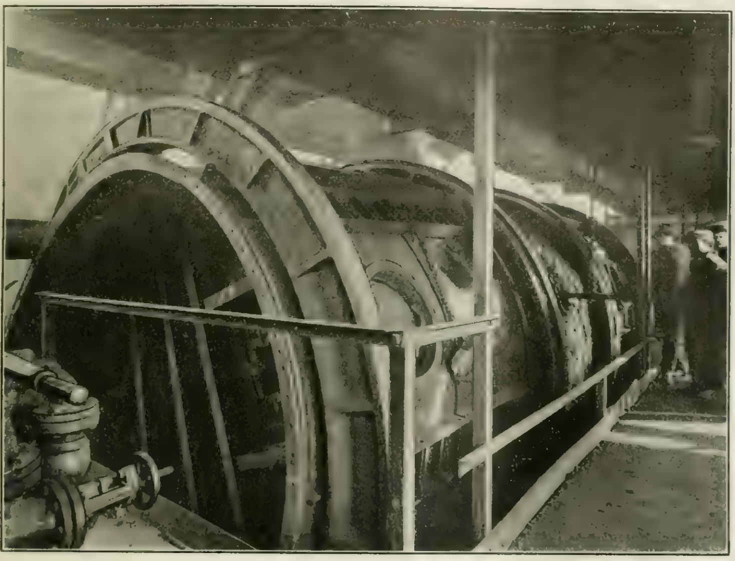


FIG. 5. CHIPPING THE THROAT OF THE FURNACE IN ITS LATER FORM

The ordinary blast-furnace losses in nickel plus copper are no higher than the copper loss alone would be with ore of similar character. The slags are heavy, for the ore contains only about 2 per cent of lime, and iron oxide has to be almost wholly relied on for the basic constituents. The addition of about 8 per cent of quartz to the ore charge in the Knudsen proved efficaceous to a large extent in preventing the formation of magnetite, and reduced the slag loss. The high temperature maintained, along with a seemingly very corrosive basic slag, played havoc with the walls of the settler, and fettling was necessary, that they might be preserved.

The relative cost of the Knudsen process and ordinary smelting at Copper Cliff was gone into as thoroughly as conditions would permit. The figures will not be given here, for space forbids a detailed analysis, and they would otherwise be meaningless or misleading, as unexplicated cost figures so often are. Suffice to say, although the experiments were a metallurgical success, it was not felt that the time or conditions were opportune for erecting a commercial plant. The intermittent smelting operation and the high slag loss went far to offset the advantage of low fuel costs. Also, should the grade of smelting ore materially drop, and the sulphur content fall below 20 per cent, a great deal of difficulty might be had in smelting, as was indicated by work on the lower-grade No. 3 ore.

Considering the difficulties which have always been experienced in smelting the Sudbury ores pyritically, the Knudsen process certainly achieved a metallurgical triumph, and had it had the benefit of some of the long years of development which the older process has enjoyed, might also have proved well worth trying from the commercial standpoint. It should work much better on straight copper ores; that is, it should be able to treat ore containing considerably less than 25 per cent of S satisfactorily. Whether the results would show an advantage over pyritic smelting in blast furnaces, with low fuel ratios, and converting in ordinary basic converters, is a question about which, so far as I know, no accurate comparative data have ever been obtained.

My thanks are due to John L. Agnew, vice-president of the International Nickel Co. of Canada, and general manager of the Mining and Smelting Division, for permission to publish this article. Some of the data are from memory of the work, but I believe the information is accurate.

Mine Rescue Telephones in England

A new mine rescue telephone has been introduced in England to fulfill requirements of the British mining acts, writes the *National Safety News*. The British mining laws prescribe that rescue telephones must be part of the equipment of a rescue outfit and that they must be metal cased.

The new telephone outfit is constructed of cast aluminum, and is of the magneto type, made easily portable and compact, and is fitted with induction coil, two dry cells, powerful magneto generator and buzzer. It has a combination transmitter and receiver of a short pattern, which clips into a cast aluminum hinged cover on top of the case, which fastens with a strong spring. The cover also protects the generator handle. The hand combination is connected by a metallic flexible cable, which coils in the cover when not in use, and the case is provided with a strong leather carrying strap. The line cable is connected by means of a twin connecting plug. Cable of especially strong construction is unreeled from a cable reel on a special stand at the top of the mine, and is so connected that the conversation with the person in the mine can be carried on even when the person below is moving and unreeling main line.

Chinese Tungsten and the American Market

Asiatic Supplies Abundant and Labor Cheap—Expensive Plants and Equipment Not Essential —System of Village Control—Despite Handicap of High and Abnormal Exchange Conditions, the Chinese Product Appears Able Successfully To Meet American or Other Competition

By HARWOOD KOPPEL

Written for *Engineering and Mining Journal*

THE normal demand for tungsten ore in the United States in the pre-war period was about 2,000 tons per annum, and during the war this demand increased to about 7,500 tons, which is the estimated production in South China in 1918. The pre-war demand was supplied almost wholly by American mines, and after the war demand for tungsten began to be felt it was possible, by extending workings, to increase the American supply to about 5,300 tons. The high price which resulted from the shortage of the American supply caused increased developments in China, where it was found that tungsten ores were much more accessible than in America, and that they could be landed in American ports, even with excessive freight charges, at prices with which American ores could not compete. The low wage scale in the Chinese mines was an important factor in this situation, although how far the comparative ease with which the ore is mined in China affects the factor of higher efficiency attending the higher wages paid in American mines, operated under more difficult conditions, is manifestly hard to judge accurately.

THE COMPETITION OF CHINESE TUNGSTEN

The natural result of this condition was a remarkable exploitation of the tungsten mining areas of South China; but with the armistice came a temporary lull in the American market for Chinese tungsten. The abnormally high prices which prevailed during the war were followed by a decided decline, which was immediately reflected in the lessened avidity with which the small Chinese miners sought the ores. It is now generally conceded, however, that Chinese ore can be marketed in America in normal times at good profits in competition with domestic ore; and the Chinese industry is, therefore, gradually assuming permanent proportions.

Though no separate statistics for tungsten exports are available in the Chinese customs, the exports of "ores, unclassed," show an increase from 275,031 piculs (36,670,800 lb.), valued at 1,152,744 haikwan taels (average exchange value for year, $1.03) in 1917, to 687,146 piculs (91,619,465 lb.), valued at 7,826,734 haikwan taels (average exchange value, $1.26) in 1918. It is reasonable to assume that all of this increase was accounted for by tungsten ore. Hongkong consulate figures show a total 1918 shipment of 5,163 short tons of tungsten ore to the United States, valued at $4,808,358, gold. American import statistics report an increase in tungsten ores from "other countries," including China, from 726 tons, valued at $558,848, in 1917, to 5,897 tons, valued at $6,262,043, in 1918, and practically all of this increase came from the tungsten-mining areas of China.

An interesting feature disclosed by the American Government statistics is that, with a war demand estimated at 7,500 tons, the United States imported in 1918 a total of 10,362 tons, valued at $11,409,237. This is undoubtedly accounted for by the fact that many users of tungsten were encouraged to stock up heavily with ore when there was some uncertainty as to the time when the European conflict would end. To tide over the effect of this overstocking, plans are on foot to erect smelters in China where the ore may be treated and offered in markets which furnish a steady demand for the finished product.

ECONOMIC AND POLITICAL CONSIDERATIONS

The growth of China as a predominant figure in the tungsten market of the world is based on sound economic laws of abundant and cheap supply, and it should be to the greatest advantage of American manufacturers whose products are affected by the price of high-speed steel to continue to draw from the Chinese market. This will not only give their products a lower price in world competition, but will encourage export trade with China by furnishing return cargo.

On the other hand, it is argued, with a good deal of justice, that by not discouraging the importation of Chinese tungsten the mining interests and the people of the United States are practically scrapping an American mining industry which should prove a desirable source of supply for a very essential raw material in case of war, and that it is more desirable to maintain present American sources of supply, albeit they tend to increase cost of production in the steel industry, than to abandon these and become dependent upon far-distant mines. The wisdom of any course of action in this situation depends wholly on whether America's future economic policy is to be guided by a fear of war or by a confidence that, through a just application of economic principles, economic and other warfare will eventually cease.

TRADE PRACTICES

Tungsten ore is usually bought in the United States according to the tungstic-acid content. Ore containing 1 per cent of tungstic acid is taken as a unit, and the price is generally fixed on a guaranty that the ore contains from 60 to 65 per cent tungsten. The American consumer usually buys the ore from the Chinese exporter on a cash payment of approximately 50 per cent, the balance being paid when the ore arrives, is assayed, and the actual tungstic-acid content determined. The ore is packed in double bags, 100 lb. to the package, and the whole wrapped with matting and bound with rattan. Local Chinese capitalists in South China employ individual native miners to collect the ore from pockets, and sell it to native traveling middlemen, who in turn sell it to the foreign exporter in the port.

The results of heavy overstocking, as evidenced by 1918 statistics of imports into the United States, were a fall in the American market and the temporary collapse of the industry in China in the closing months of 1918, affecting most heavily the exporters and middlemen.

A report from the American Consul General at Hongkong points out that the volume of shipments of the ore to date is in no fair way a measure of the potential production of the ore from year to year. Under the stimulus of war conditions, production was rapidly developed at points near the seaboard, and often in pockets or deposits which were more expensive to work than normal conditions might have justified. On the other hand, the great mass of China's tungsten resources is as yet untouched, and the best fields or deposits were just coming into working when the collapse of the war trade came. One field discovered in July, 1918, was producing, at the height of the demand, 1,200 tons of ore per month, and the possibilities of its development on an economical, scientific, and normal basis are indicated by the fact that the shipments of ore out of South China were made profitably at about one-third the price realized from the later shipments.

The new field centers around Sai Wah Shan, in the vicinity of Nannanfu, in Kwangsi Province, not far from the Kwantung Province boundary line. Practically all of this ore is taken from public or semi-public lands —i.e., lands owned in common by the people of neighboring villages—and the work is done either by the villagers or by Chinese capitalists working under an arrangement with the people of the villages. Therefore, though the recent collapse affected all the people concerned in the trade who had ore on hand at the time, it involved no expensive plant and little permanent investment.

CHINESE PRODUCTION COSTS

It is almost impossible to establish a fair value for the ore in South China. The actual cost of production in most of the deposits for good ore is generally placed at about $20 local currency per picul of 133⅓ lb. (at recent exchange about $16 gold per picul, or $240 gold per short ton). The same ore at the same price at normal pre-war exchange would cost, say, $130 gold per short ton. Of course the coolie transport, the small boat transport, and so many transshipments render the cost of getting the ore to the coast very high, to which must be added *likin* charges. When prices of the ore were high, all these drains could be paid, and there still remained a large margin of profit, but with the prices low all such items must, so far as it is possible, be eliminated from the expense account. One of the difficulties of the present situation is that of indicating to the Chinese concerned what they can reasonably ask for their part of the proceeds of ore sold—the price villages may fairly ask for ore rights, the taxes officials may fairly impose, and the division of the various charges generally.

The Eastern situation is further complicated by the fluctuating exchange value of silver, the effect of which is to vary greatly the gold price of the Chinese ore as compared with smaller fluctuations four or five years ago. Ultimate costs in American currency of producing ore for the American or European market therefore are at present largely a matter of exchange. The difference is illustrated by the fact that the short ton of tungsten ore that was bought in the United States for $330 gold, at an exchange of 82c. gold to the Hongkong dollar, would have cost only $160 gold four years ago, at exchange of 40c. gold to the Hongkong dollar. It seems probable, from the course of the tungsten market generally, and as a result of the adaptability of the Chinese producers to the demands of the moment, that the ore can be mined profitably and exported, even at present exchange, in competition with ore produced in any other field in the world; and with normal exchange China is unquestionably the cheapest producing market. Even under present conditions of production any steady demand from the United States for the ore at a fair to good price will result in an immense increase in its production and a steady supply.

Tin and Tungsten Production in Burma In 1919

The increased price of tin stimulated activity in the tin-mining industry in Burma during 1919, and production of tin and tin ore showed an improvement of 48 per cent over the figures of the previous year, according to *The Ironmonger*. The cessation of the government demand for tungsten after the armistice caused many of the wolfram mines to be closed and miners to turn their attention to tin. The figures for tin production are based on the royalty paid, but they do not represent the exact amount of the metal exported, as much tin is included in concentrates as wolfram.

With the exception of 462¼ tons from the Southern Shan States, the whole of the 1,250 tons of tin ore exported from Burma in 1919 comes from Tavoy and Mergui and two other districts of the Tenasserim division. The industry employed a daily average of 2,738 persons during 1919, as compared with 1,524 persons in the previous year. Despite the collapse brought about by the cessation of the war, the production of tungsten ore in 1919 was maintained at a higher average rate than in any year prior to 1916.

In the Mergui district a good deal of the mining, both for tin and wolfram, is done by Chinese contractors on the tribute system. Many large European firms have taken up the work in Tavoy, investing capital in the newest machinery, so that prospects of larger supplies in the future seem to be warranted. The government also is opening up roads and communications and making fresh surveys. A railway in the direction of Tavoy from Moulmein is in course of construction.

Unprofitable Malay States Tungsten Mining in 1919

Tungsten mining was unprofitable in the Malay States in 1919, according to Consul H. J. Dickinson in *Commerce Reports*. With the withdrawal of government support in the spring, the open market for the metal fell to a nominal figure, but the price is regarded as too low for miners to exploit their deposits, in view of increased costs of labor and materials. Exports from the Federated Malay States in 1919 amounted to 7,323 piculs (1 picul = 133⅓ lb.) as compared with [illegible] piculs in 1918.

Few Persons Have Ever Seen Radium

Radium is a metal that is described as having a white metallic luster. It has been isolated only once or twice, and few persons have seen it. It is ordinarily extracted from its ores in the form of sulphate, chloride, or bromide, according to the U. S. Geological Survey, and it is in the form of these salts that it is usually sold and used. These are all white or nearly white substances.

BY THE WAY

Mathematically Speaking

"'Ere's a story, m'son," said Cap'n Dick, "that h'only gaws to show that a chap be sometimes deceived by tryin' to figger h'out somethin' 'e naws nothin' baout. H'appears h'up in Painesdale, Michigan, tha members o' tha h'Odd Fellows' Lodge put h'up a large buildin' for to 'old meetin's in. An' then they 'ad a h'openin', an' tha 'ol town turned h'out. In tha front they 'ad one o' these 'ere 'uge signs with tha letters h'I. h'O. h'O. F. T., h'all made o' h'electric lights, so tha bloody thing could be seen for miles. Tha firs' night they lit 'er h'up, Jan Trengrove an' Billy 'All wuz comin' h'off shift'. 'Damme,' sez Jan, 'some beauty, isn't un?" 'She surely be,' sez Billy, 'an' I wonner w'ot's for they letters stan,' readin' tha h'I. h'O. h'O. F. T. 'W'y, you bloody fool,' sez Jan, 'that stan's for a 'undred feet tall!' W'ot's think o' that naow?"

The Missing Link

"Crawford, I am firmly convinced that I have located the oil stream which connects the Tampico and Texas fields. I am not yet prepared to announce my discovery, but I am going to go there and drill a well. It is a very long way from the railroad, probably ninety miles, but I am going to drill a well there and I am confident that I will strike oil and plenty of it."—Thus spake S. E. J. Cox, of Houston, Tex., recently. Domes be hanged! Drill deep where the oil floweth and tap the mother stream—we can hardly say lode. If Mr. Cox is right, then the solution of the Mexican petroleum problem is in his hands. All he has to do is to connect with this deep-lying pipe line, let the gushers gush and the pumps pump, and sooner or later the Tampico field will be drier than we are, and there will be no oil left to scrap about.

Columbus Astray

The Bank of Miami, Ariz., recently received its share of the "300,000 Columbian half dollars, issued by an act of Congress to commemorate the landing of the Pilgrims in 1620," according to a Miami newspaper. The sale of these souvenir coins by the banks at $1 is authorized by the Government, and it is intended that the proceeds from the sale will be used to build the Pilgrim monument at Plymouth. A small portion of the fund might fittingly be spent in putting a breakwater around Columbus' footprints on Plymouth Rock.

Religion and Mining

In certain circles the mixing of mining and high finance is not uncommon. Religion and mining, on the other hand, are usually felt to be as oil and water in their relationships, one being of a spiritual and the other of a materialistic nature. It has remained for Charles F. Caldwell, general overseer of the Christian Catholic Apostolic Church, to demonstate in no uncertain way that religion and mining are capable of fusion. Mr. Caldwell has been identified with various mining enterprises in the West for the last thirty years, his operations including the Cœur d'Alenes, Rossland, and Slocan camps. Recently he accepted the overseership of what is known as the Christian Catholic Appostolic Church, a religious sect founded by the late John Alexander Dowie, and having its community headquarters at Zion City, just north of Chicago. Upon returning to the scene of his former activities on a business trip early in January, Overseer Caldwell decided that a little religious instruction would do no harm to the natives, and in Kaslo, B. C., he advertised as follows:

Religious Service
Eagles' Hall

Commencing at 2:30. Subject: "Greater Prosperity of Kaslo and Slocan Depends upon Righteous Living and Righteous Laws," by

C. F. Caldwell,

General Overseer Christian Catholic Apostolic Church, founded by John Alexander Dowie; Caldwell is also president of the Independent Mine Owners' Association; president of the Utica Mines; president of the New Alaska Mines, believed to be one of the largest mines in Alaska; director of the Forty-nine mine, undeveloped bodies estimated at three millions; president of the Portland Canal Railroad & Terminal Co., which taps the largest and richest gold and silver mines in the world; come and hear about them; president of the Alaska-British Columbia Financial Agents, head office, Fifth Avenue, New York.

Dangers of Carrying It on the Hip

A news dispatch says that Frank Pelone, a stable boss of Uniontown, Pa., on finding a stick of dynamite, put it in his hip pocket. Later while working in the stable, he was kicked by a mule. The dynamite exploded, blowing Pelone to atoms and destroying the stable. What happened to the mule remains unrecorded. We cannot guarantee the reliability of this tale. We got it from another. It does, however, forcibly point out the danger of carrying stuff with a kick in it on the hip.

The Librarian Speaks

Who e'er you are
That put the gin in Engineering
And make our daily grind more cheering,
We thank you;
For

When indexing seems cold and gray
And technical accounts infernal
We grab the Eng. and Mining Journal
At
"By the Way,"

Where comments by that jolly bloke
Old Cap'n Dick help make us merry,
(We'll e'en peruse the dictionary
To get
The joke);

And gleefully we watch you close
The boxite scrap, while to the cellar
You pack the statements of the feller
Who said 'twas
"*Boze.*"

Subconscious psychic stunts and such
We scan . . . oh that we could a' seed yuh
When you interrogated Ouija
And learned
Too
Much!

The solid stuff that you purvey
We read to earn our bread and butter
And socks—so we'd not have you flutter
From mining dope to F. P. A.
Nath'less warm thanks to you we utter
Whene'er you're
Gay.

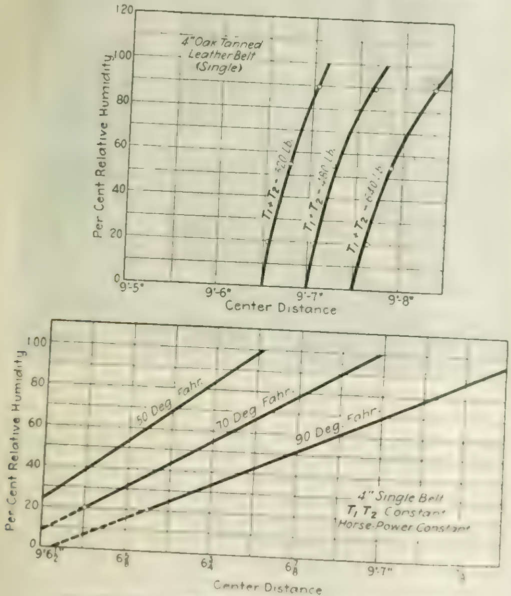
A. S.

HANDY KNOWLEDGE

Effect of Humidity Upon Leather Belting

The effect of relative humidity upon leather belting was recently investigated by F. W. Roys, of the Worcester Polytechnic Institute, and the results of his experiments are presented in a paper read before the National Association of Leather Belting Manufacturers, on Nov. 17, 1920. The experiments were restricted to the study of a single four-inch belt under various conditions of humidity.

In the first series of tests the sum of the tensions (tight and loose sides of the belt) was varied, the horsepower being constant. The center distances between the driving and driven pulleys varied with a change in humidity for a given sum of tensions, increasing as the humidity increased. In other words, the moister the air the greater the stretch of the belt for all other conditions fixed. As an example, at a tension of 450 lb., the distance between pulley distances was increased from 9 ft. 7 in. at 20 per cent relative humidity to 9 ft. 7½ in. at 90 per cent relative humidity. At a constant humidity and horsepower, an increase of temperature increased the length of the belt. The illustration depicts the conditions for both variation in humidity and temperature.



HUMIDITY EFFECTS ON LEATHER BELTING

The upper figure shows the relation between relative humidity in per cent and distances between pulley centers for three sets of constant power. The lower figure denotes the relation between pulley centers and relative humidity at three different temperatures

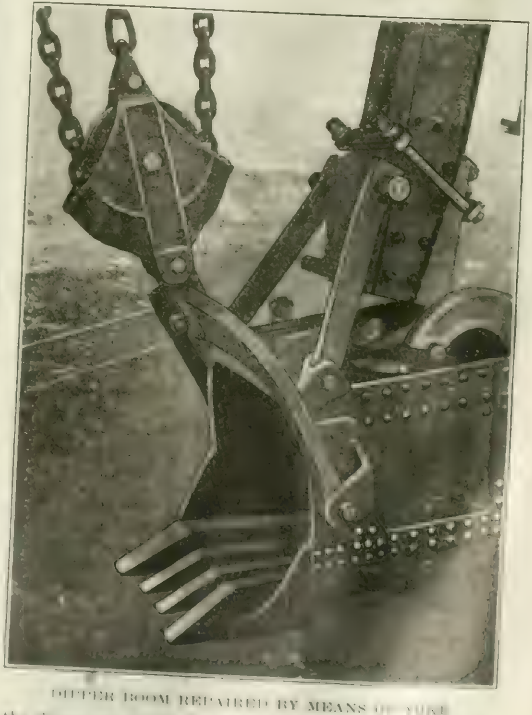
Mr. Roys states in summary of the practical bearing of his experimental work that "in a general way it may be stated that the effect of a change in the relative humidity is greater at high humidities than at low; that the effect is shown more rapidly in single than in double belts; that increasing the humidity shows practically immediate results, while a decrease in the humidity takes a longer time to be effective."

Steam Shovel Repairs

By H. H. Hunner

Written for Engineering and Mining Journal

Quick repairs can be made to a steam shovel dipper boom by means of a yoke. As an example, the shovel crew on a 100-ton shovel allowed the four large bolts securing the dipper castings to the lower end of the dipper boom to work loose. The shovel was operating under exceptionally heavy duty, and, as a consequence, the two bottom straps on the dipper boom sheared off, the direct result of the loosening of the bolts mentioned. After the 1 x 6-in. straps had been sheared, the rear bolts could no longer hold against a hard pull. A yoke was made consisting of top and bottom 2 x 6-in. straps and 2 in. bolts on the sides. The straps were given a twist of about 20 deg. near the end, thus securing a flat bearing for bolt washers. The upper plate or strap, as shown in the illustration, rests on the upper straps and the bottom plate supports the dipper inside. The repair yoke has been in service for six months without repairs.



DIPPER BOOM REPAIRED BY MEANS OF YOKE

Dredge Repairs and the Electric Furnace

In the second annual report of the Canadian Klondyke Mining Co., Ltd., and the Canadian Klondyke Power Co., Ltd., the prohibitive cost of steel wearing parts used in dredge operation caused careful consideration to be given to the advantages that would result from the installation and operation of an electric furnace for remelting and manufacture of scrap steel into bucket lips, bushings, and other parts. Excessively high cost, unsatisfactory delivery, and heavy investment charges militated against direct purchase of such parts. To obtain the necessary dredge supply parts to complete the dredging season of 1919 and to begin operations for the season of 1920, the minimum cost of repairs which it was considered absolutely necessary to insure such operations was estimated at $140,000. The companies being in the hands of a receiver, it was impossible at the time to finance this sum, and a three-ton electric furnace was purchased. The Canadian Klondyke Mining Co., Ltd., had at the time 2,000 tons of steel scrap and 400 tons of scrap iron. Other supplies of scrap were available at reasonable cost. The scrap was estimated to have a value of 8c. per lb. for remelting purposes. To operate the three dredges of the company efficiently a minimum of 350 tons of dredge wearing parts are required annually, distributed as shown in the following table:

	Tons		Tons
350 bucket lips	350	Dump box and chute plates	30
Six sets upper and lower tumbler plates	22	Miscellaneous iron and steel castings	59
225 bucket pins	54		—
900 bucket bushings	25	Total	350
Screen plates and bars	30		

It was estimated that from 33 to 40 per cent of this tonnage would be reclaimable as scrap to be worked up in the electric furnace.

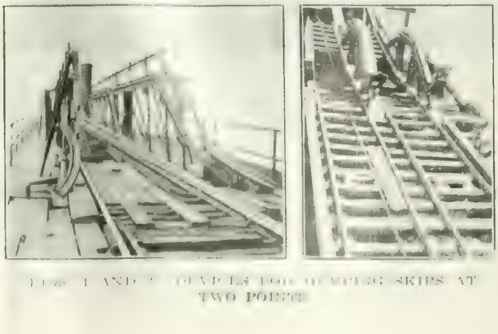
The "landed cost" of the repair parts for the operation of three large dredges and one 7-cu.ft. dredge was estimated at $225,000 and the extra spare parts to insure continuous operation at $250,000. The 2,000 tons of scrap in sight was estimated to be sufficient to keep the reclaiming plant in operation for five or six years.

Skip Dumping at Different Levels In Inclined Shafts

By George J. Young

Written for Engineering and Mining Journal

Three methods for skip dumping at two points are shown in the accompanying illustration. Fig. 1 shows the device in use at the Raimund mine, in the Birmingham district, Alabama. A single skipway is used. The skip is tilted into the dumping position by projecting treads concentric with and a part of the lower wheels of the skip. These strike the dumping track, and the bottom end of the skip is lifted up the curved portion of the track. A track run parallel with the skip tracks succeeds the lifting portion of the dumping truck. The gage of the dumping tracks is greater than that of the skip tracks. A section of the lifting track is hinged, and by means of levers both parallel sections can be lifted from their position, permitting the dumping treads to pass on to the next dumping track in the headframe. The last pair of dumping tracks is made without the hinged sections.



FIGS. 1 AND 2. DEVICES FOR DUMPING SKIPS AT TWO POINTS

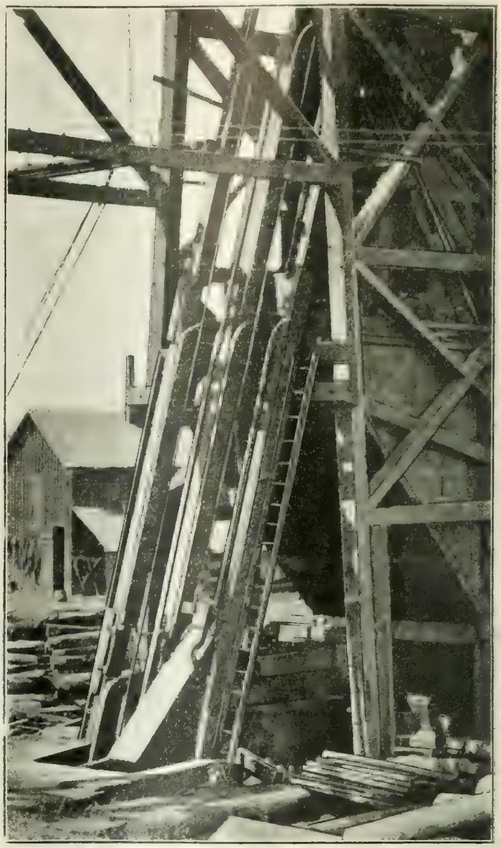


FIG. 3. SKIP DUMPING AT THREE POINTS

A guard rail is placed directly above the lifting rail and prevents overturning of the skip. The arrangement is not satisfactory for a double-track skipway, as there is insufficient room between the two skip tracks. A simple arrangement for a double-track skipway is shown in Fig. 2. In this arrangement hinged plates are used to cover the gap through which the dumping treads pass when it is desired to use the upper dump in the headframe. The plates are moved by hand. Instead of being hinged in the manner shown they are sometimes hinged on an axis parallel with the track, and lifted up like the cover of a box, as shown in the illustration in Fig. 3.

The Mining and Preparation of Rhodesian Mica

THE mica in the deposits at Lomagundi, Rhodesia, is wholly muscovite, chemically a hydrated silicate of aluminum and potassium, according to the Rhodesia Geological Survey. It is usually either of a ruby or of a bottle-green color, though some clouded silvery mica has been found. The native name for the mica is "datsi." The books of mica occur in a band or in a series of lenticles on each wall of a pegmatite dike, the books lying at all angles, but often touching one another and even being closely packed. The band or lenticle is in places close to the wall of mica schist country rock, in others separated from it by a few inches of pegmatite. Here and there a dike is seen with only one band, but this is unusual.

Inclusions or horses of mica schist country rock are common in the dikes, and it is usual to find a zone of mica books completely surrounding the horse, which is thus a structure not unwelcome to the mica miner. The books vary in size from 4 to 5 in. in length to as many feet, the majority probably being between 6 and 18 in. They are seldom more than 6 in. thick, and frequently half that. Much of the mica is stained—near the surface deeply stained—but mining seems to show that staining diminishes 10 to 15 ft. down, and the mica becomes slightly stained, spotted, or clear.

All work is open-cut, not below a depth of about 35 ft. Much of it is done by pick and shovel, the feldspar of the pegmatite being decomposed to a clay and therefore easy to work. When blasting has to be resorted to, either 30 per cent or farmer's dynamite is used for loosening the rock without shattering the books. The pegmatite dikes are on some claims so closely placed that it is economical to take out together the foot-wall band of mica, the intervening strip of mica-schist country rock, and the hanging-wall band of mica in the next dike. In other occurrences the two bands belonging to the one dike are worked together, or each band is separately worked.

The books commonly split up on being taken out into slabs about ½ in. thick. These slabs are taken to the dressing ground, and first split up with the aid of a knife into sheets about 1/16 in thick. They are next trimmed by shears into irregular polygonal shapes, all cracks, flaws, and striations being rigorously cut away, and the faces of the sheets peeled until a smooth even surface is obtained. Bent or buckled mica should not be split at all, but rejected.

The trimmed sheets are taken to the grading sheds, where this most important operation is carried out. The groups depending on transparency recognized recently by the Ministry of Munitions are: Clear, part stained, second quality clear, second quality part stained, fair stained, ordinary (rust and clay stained), densely stained, black spotted, and soft white. Generally, however, only four groups are recognized, namely: Clear, slightly stained, stained, and densely stained. In each group there are ten sizes, depending upon the largest rectangle which a sheet can give. The largest size is 72 in. square or over.

It is estimated that 1½ lb. of trimmed mica is a good average yield from each hundredweight of mica won. The waste is therefore enormous. Much of the waste is of marketable quality, and could be converted into splittings for the manufacture of mica board, mica cloth, or mica paper, and other parts could be pulverized to form ground mica.

The quality and quantity of the mica over a large area in Lomagundi are sufficient for the establishment of a regular mica-mining industry, and the mica is more regular in its distribution in the dikes than is usual in pegmatites. The deposits are seldom pockets, but are generally sufficiently continuous to be called "reefs," as this term is understood in South Africa. The mode of occurrence of the mica, and the ease with which a marketable product can be obtained without much capital, make the work suitable for the "small man," and in view of the large number of reefs scattered over a wide area it may be confidently anticipated that continual efforts will be made to work the mineral.

The Domestic Talc Situation

The year 1920 was a very busy one for the talc industry in general, according to R. B. Ladoo, of the U. S. Bureau of Mines. With little additional plant capacity, a record production was made. The demand was strong up until about November, when the general business depression was strongly felt. At the close of the year, new orders were scarce, production had started to decline, and stocks of finished talc in the hands of producers were large and increasing, owing to the catching up on unfilled orders, and lack of new business. Some producers reported orders booked for over 50 per cent of capacity for 1921, and others no orders booked; but a general attitude of optimism for the new year was evident.

No general decline in quotations for talc in 1921 is looked for, as the prices of talc have not increased materially since 1914. The average value of talc in 1920 was only about 13.5 per cent greater than that of 1914. Labor supply was adequate but not plentiful, with wages remaining about the same. Car shortage hampered shipments for over half the year, resulting in the maintenance of many unfilled orders on the books. Numerous inquiries for spot shipments sent to several producers simultaneously made a further apparent increase in demand. Most of the producers, however, met the demand by increased efficiency and capacity output. A few expansions in capacity were noted, but on the whole they were unimportant.

Toward the close of 1920 new plant capacity, building or under consideration, amounted to nearly 300 tons per day, or 90,000 tons per year. The country probably cannot absorb this additional capacity for several years at a normal rate of increase, but new uses which would consume it might be developed through research and publicity. However, it is not likely that much more than a third of this projected plant capacity will actually be built and placed in operation.

Little progress was made in 1920 in the development of new uses which would absorb large quantities of talc, most of the production going into the paper, roofing, paint, rubber, and textile industries. A previously known use, however, as one of the principal ingredients in fire-retardant paints, received an impetus, due to the publication of favorable results of tests on these paints and the licensing of paint companies to manufacture them. This use should create a market for an increasing quantity of talc in the future. The opening of no new talc deposits has been reported, but a few old deposits were reopened.

THE PETROLEUM INDUSTRY

Total Petroleum Production and Imports During 1920 Show Increase—Consumption Reaches Unprecedented Figures

THE following statistics of the production of petroleum in the United States east of California in December, 1920, and the two preceding months, based on reports filed with the U. S. Geological Survey, show the quantity of oil removed from producing properties by pipe line and other marketing companies and by refineries that receive petroleum through private pipe lines or in tank cars or boats directly from the wells. Data concerning oil consumed on the leases and producers' storage cannot be obtained in time for use in the monthly reports, but are used in compiling the annual figures showing production. The production reported for California is the average shown by figures collected by the Standard Oil Co. and by the Independent Producers' Agency and includes all petroleum brought to the surface:

PETROLEUM PRODUCED IN THE UNITED STATES IN OCTOBER, NOVEMBER AND DECEMBER, 1920

(Barrels of 42 U. S. gallons)

	—October, 1920 (a)—		—November, 1920 (a)—		—December, 1920—	
State	Total	Daily Average	Total	Daily Average	Total	Daily Average
California	9,459,000	305,129	9,340,000	311,333	10,038,000	323,806
Central and Northern Texas	6,659,000	214,806	6,711,000	223,700	6,749,000	217,710
Coastal Texas	2,619,000	84,484	2,762,000	92,067	2,517,000	81,193
Oklahoma	9,437,000	304,419	9,028,000	300,933	8,742,000	282,000
Kansas	3,269,000	105,452	3,215,000	107,167	3,044,000	98,194
Northern Louisiana	2,511,000	81,000	2,462,000	82,067	2,434,000	78,516
Coastal Louisiana	150,000	4,839	153,000	5,100	164,000	5,290
Wyoming	1,676,000	54,065	1,340,000	44,667	1,424,000	45,936
Illinois	872,000	28,129	847,000	28,233	840,000	27,097
West Virginia	673,000	21,710	656,000	21,867	748,000	24,129
Kentucky	759,700	24,506	723,000	24,100	740,000	23,871
Central and Eastern Ohio	446,000	14,387	437,000	14,567	466,000	15,032
Northwestern Ohio	182,000	5,871	165,000	5,500	172,000	5,548
Pennsylvania	646,000	20,839	603,000	20,100	624,400	20,142
Montana	56,000	1,807	92,000	3,066	86,000	2,774
Indiana	85,000	2,742	81,000	2,700	84,000	2,710
New York	82,000	2,645	75,000	2,500	79,000	2,549
Colorado	9,000	290	8,000	267	9,000	290
Tennessee	1,300	42	1,000	33	600	19
Totals	39,592,000	1,277,162	38,699,000	1,289,967	38,961,000	1,256,806

(a) Revised

A halt to the long-sustained increase in the production of petroleum in the United States, which has been reported monthly throughout the year except for similar checks in May and September, is recorded for December. The daily average production during December amounted to 1,256,806 bbl., a decrease of a little more than 33,000 bbl. a day compared with revised figures for November, but more than 200,000 bbl. greater than the daily average production for December, 1919. Imports during December, amounting to 12,845,482 bbl., a daily average of 414,370 bbl., decreased almost a million barrels over the imports during November, but increased more than 8½ million barrels as compared with December a year ago. Consumption of domestic and imported petroleum during December, estimated to have been 47,909,000 bbl., decreased almost a million barrels as compared with revised figures for November, and stocks increased more than three million barrels. A gain of 2½ million barrels was made in stocks of Oklahoma-Kansas-Central and North Texas grade and of more than ¼ million barrels of Gulf Coast grade. Smaller gains are recorded for stocks of other domestic grades except California and North Louisiana, there being a loss of 342,000 bbl. in stocks of California grade.

Preliminary figures for the year 1920, including a number of revisions of reports of previous months, show a total production of 443,402,000 bbl., a gain of 17 per cent as compared with 1919 and 78 per cent as compared with 1913. These figures, representing the quantity of petroleum removed from producing properties, will be increased when the amount of oil consumed on the leases is known and after allowance is made for net changes in stocks held by producers on the leases. Imports of petroleum during 1920 amounted to 106,175,000 bbl., more than double the imports of 1919 and almost five times greater than the imports in 1913. These impressive figures emphasize the growing dependence of the United States on foreign supplies.

Consumption of domestic and imported petroleum during 1920 reached the unprecedented total of 531,186,000 bbl., yet it did not keep pace with the increase in available petroleum, and at the end of the year there was recorded a net increase of stocks of more than ten million barrels, of which pipe-line and tank-farm stocks of domestic petroleum amounted to 5,823,000 bbl. and stocks of Mexican petroleum held in the United States by importers amounted to 4,523,000 bbl. Although for the entire country there was this total increase of stocks for the year, conditions in California were reverse, there being recorded for that state a net decrease in stocks of 8,212,000 bbl.

To Seek Oil in Leicestershire, England

The British Ministry of Munitions is reported by the *Chemical Trades Journal and Chemical Engineer*, to have granted a license to Reginald Gilbey, of Nottingham, to bore for petroleum at Weston, Leicestershire. Boring must begin within six months from Oct. 9, 1920, and payments by way of royalties, commissions, profits, or otherwise for the petroleum obtained are specifically forbidden.

Oil Development in British Columbia

By Robert Dunn

Written for *Engineering and Mining Journal*

A NUMBER of parties have been organized to make the winter trip into the Fort Norman oil district of northwestern Canada, so that they may be on the ground when the spring opens and proceed with their prospecting without delay. The geographical branch of the Provincial Lands Department has been asked for information concerning the best route.

Careful investigation shows that there are three practical overland winter routes into the Mackenzie River country via British Columbia. The best route is by way of Fort Selkirk, Yukon Territory. In reaching Selkirk no great difficulties are to be encountered, there being boat and railway transportation as far as White Horse and a trail thence into Dawson. Though the trail is not as generally used this year as heretofore, the White Pass & Yukon Ry. Co. having withdrawn its elaborate system of stage transportation, it is quite passable to dog teams; in fact, the mail is carried to Dawson by that means at regular intervals.

From Selkirk east across the Yukon and across the Rockies into the Mackenzie River basin is the part of the trip that will test the experience and the endurance of those who have determined to reach Fort Norman before the breaking of the ice. The distance is roughly 385 miles, the country for the most part is open, and there is a good pass through the mountains. But it is no task for a *chechako*. Those who hit the trail will have to travel light and be prepared to meet and overcome all the hardships and dangers of the Canadian Northland in the grip of winter.

The two other routes that have been considered are by way of Atlin and of Dawson. The former, on the information available to geographers, is the least practical. It is true that there is easy transportation from Victoria or Vancouver to the town of Atlin, but an expedition leaving from that point would have to travel overland approximately 460 miles in reaching Fort Norman, and, for a considerable part of the distance, the going would be comparatively rough. As for the selection of Dawson as a starting point, it would be a good place to outfit, and the journey, a distance of about 460 miles, is quite as feasible as is the Selkirk route.

However, there is no doubt that although exceptionally enthusiastic prospectors will take the winter trail, the majority will defer the trip into the new oil fields until the ice breaks and the great waterway from Athabasca Landing is open. This will occur sometime in the latter part of June or early in July. This trip presents all the attractiveness of a Pullman car as against a cattle car in comparison with the snow routes that have been described. From the city of Edmonton, the capital of the Province of Alberta, to Athabasca Landing, there is the Edmonton, Dunvegan & British Columbia Ry. From the landing it is a matter of taking a boat down the Athabasca River to Athabasca Lake, thence down the Slave River to Great Slave Lake, and from there down the Mackenzie River to Fort Norman. The distance is approximately 1,400 miles.

No doubt, with the opening of these waterways transportation will be provided, as the news of the finding of oil by representatives of the Imperial Oil Co., and the well-authenticated reports that there is a vast extent of promising territory yet to be prospected, will draw hundreds to the Fort Norman region. There already are reports that a number of gas boats will be pressed into the service, oil tanks being constructed at proper intervals along the route to provide the necessary fuel. Under such conditions the journey should not take longer than twelve days from Edmonton.

Navigation for light-draught craft is simple. The rivers are large bodies of water, and the only dangers of note are sand bars and banks.

In discussing the prospects of marked activity in country adjacent to Fort Norman this year it is interesting to note that there is talk of the organization by a syndicate of Vancouver business men of a seaplane expedition as soon as weather conditions improve. The proposal is that the planes shall set out from Edmonton and go by way of Fort McMurray. The plans, according to reports, have been well advanced, and it is intended that the seaplanes shall be used not only in reaching the immediate objective of Fort Norman but in transporting experts from one point to another in the northern territory for prospecting purposes. The Imperial Oil Co. too, it is commonly reported, is taking steps to provide for a similar method of reconnaissance. Certainly these air-boats should be well adapted to such work in the Fort Norman country, as it abounds in rivers, lakes, and streams.

The investigations of this year in the Canadian Northwest, however, are not to be confined to the Mackenzie River basin. The government of the Province of British Columbia is to carry on its explorations of the Peace River section of the Provincial Northeast. The field work of the last two years, carried out under personal supervision of geologists, has established that oil may be expected and that systematic drilling is likely to develop the presence of petroleum in commercial quantities.

The Pouce Coupe district, situated in the Peace River country, is particularly promising from an oil standpoint. The Imperial Oil Co. has leased about 40,000 acres along the Pouce Coupe River, at a point about ten miles north of the village of Rollo and running in a southeasterly direction into the Province of Alberta. Within this area there are a number of known seepages. A peculiar occurrence was described a few days ago to me by a resident of the district. He said that along a rugged canyon on the river there is a natural cup in the shale formation, from which there gushes at intervals of about ten minutes, with the regularity of a heartbeat, a small quantity of petroleum. There are many other stories of indications, such as the discovery by settlers that their well water is tainted by petroleum. The Imperial Oil Co. is planning to begin drilling as soon as equipment can be brought from Spirit River, the nearest railway point.

It may be stated in conclusion that several companies are engaged in drilling at different places on the lower mainland of British Columbia and that these investigations are said to be promising. The Graham Island Oil Development Co. also is preparing to begin drilling operations in the spring at the north end of Graham Island, one of the Queen Charlotte group.

Technical Papers

Steel for Mining and Milling—The January number of the *Bulletin of the Institution of Mining and Metallurgy* contains an eighteen-page paper descriptive of the kinds of steel found best adapted for drills, stamp shoes and dies, cam shafts, cams and tappets, battery stems, mortar boxes, mortar-box linings, battery screens and frames, crushing rolls, balls, rock-breaker jaws, tube-mill liners, dredges, and other appliances. The author, E. A. Wraight, gives many analyses, and points out that much of the data is of a conflicting nature. A copy of the paper may be had for 1s. 6d. by applying to the offices of the Institution, 1 Finsbury Circus. London, E. C. 2, England.

Idaho Clays—A pamphlet of seventy-four pages devoted to the clays of Idaho has just been issued as Bulletin No. 2 by the Bureau of Mines and Geology, Moscow, Idaho. It may be had without charge. Several pages of general information on clay are given, followed by a description of methods of testing and the results of a large number of tests. The clay resources of Idaho are large, but are only beginning to be developed.

Corundum—Memoir No. 15 of the Geological Survey of South Africa (Pretoria) is entitled "Corundum in the Northern and Eastern Transvaal." It contains 223 pages and is sold for 7s. 6d. The corundum fields in the Transvaal are the largest known. This book describes the geological features in detail and also has chapters on the classification and character of corundum, and its industrial and economic aspects.

Ontario Mining—A report on the mining industry along the T. & N. O. Ry. has just been issued by the Temiskaming and Northern Ontario Railway Commission, Toronto (fifty-three pages, free). The report is devoted largely to statistics concerning Cobalt and Porcupine producers.

Bureau of Mines—The tenth annual report of the Director of the Bureau of Mines is available at 15c. from the Superintendent of Documents, Wash- D. C. It is a [illegible]-page book covering the activities of the Bureau for the year ended June 30, 19[illegible]

Etching Reagents—A recent bulletin of the U. S. Bureau of Standards discusses the etching of copper in metallography, and the reagents used. It may be obtained on application to the Bureau at Washington, for Bulletin No 399.

South African Geology—The Geological Survey, Pretoria, South Africa, has issued a forty-eight page pamphlet on the geology of Pondoland and portion of Alfred and lower Umzimkulu counties, Natal. The book also contains a list of all the survey publications. Price, 2s. 6d.

Mineral Fuels—Part II of Bulletin 711 of the U. S. Geological Survey, "Contributions to Economic Geology," is a 171-page book devoted to mineral fuels. It is a compilation of previously published separate papers on petroliferous occurrences in various parts of the country. Obtainable on request to the Survey at Washington, D. C.

Wyoming Oil—U. S. Geological Survey Bulletin 716—E (thirty-two pages, free from the Survey at Washington) is descriptive of the Lance Creek oil and gas field, in Niobrara County, Wyo. The field now has about a dozen producing wells.

Black Sand—U. S. Bureau of Mines *Reports of Investigations* No. 2,192 describes briefly test methods of recovering gold from Alaskan black sand. Obtainable on request to the Bureau at Washington.

Book Reviews

Latin-American Year Book for 1920. Cloth; 6 x 9; pp. 647. Published by the Criterion Publishing Syndicate, Inc., New York. Price, $4.50.

This is the third of a series of annual handbooks descriptive of Mexico and the Central and South American countries from the investors and merchants' standpoints. Considerable space is devoted to political conditions, natural resources, foreign trade, financial conditions and customs tariffs. Names of important dealers in each country are also given.

The Centenary Volume of Charles Griffin & Co., London. Cloth; 6 x 9; pp. 290; illus.

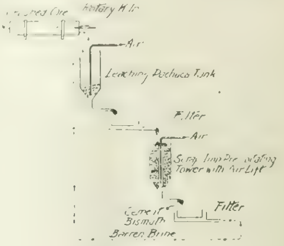
This artistic book has been prepared to review a hundred years of progress by the technical publishing house of Griffin. The achievements of this firm in the dissemination of scientific knowledge have made their name familiar throughout the world. The volume is most happily conceived, and gives a brief history of the development of mining, metallurgical and chemical technology throughout the last hundred years, as well as other subjects which have been covered so authoritatively by the Griffin publications.

Annual Report of the Director of the Mint for the Fiscal Year Ended June 30, 1920. Cloth; 6 x 9¼; pp. 309. Government Printing Office, Washington, D. C. Free from the Treasury Department.

This is a report of the operations of the Mint during the fiscal year 1920, with the production and consumption of gold and silver in the United States during the calendar year 1919. The book contains highly valuable statistical tables covering foreign and world monetary matters, as well as many descriptive reprints of articles discussing developments in currency during the last year.

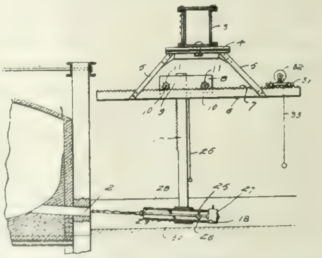
Recent Patents

Extraction of Bismuth—No. 1,360,271. J. F. Cullen, Midvale, Utah, and M. J. Udy, Salt Lake City, Utah, assignors to U. S. Smelting, Refining & Mining Co. A method of extracting bismuth which consists in leaching the ore with brine containing an acid to form a solution of the bismuth salt of that acid, and precipitating the bismuth from solution.



Flotation Reagents—Nos. 1,364,304-8 inc., C. L. Perkins, Pittsburgh, Pa., assignor to Metals Recovery Co., New York. These patents in order cover the use of a non-oleaginous mineral-collecting agent; an organic nitrogen compound containing two nitrogen atoms joined to each other; a hydrazine compound; an organic nitrogen-sulphur compound, and a thio-urea substance or compound. Mr. Perkins' patents Nos. 1,364,858 and 1,364,859 cover similar flotation processes.

Furnace Tapping Machine—No. 1,361,103. T. T. Scott, Youngstown, Ohio. A mechanical arrangement to facilitate the tapping of furnaces as shown in the accompanying cut.



Amalgamator—No. 1,361,723. Ralph Hanssen and P. B. Haug, Great Falls, Mont., and M. E. Darby, Tacoma, Wash. A form of amalgamator comprising an inner and outer cylinder, with riffles and ribs on the outer cylinder to hold the mercury.

Concentrating Table—No. 1,360,764. Irving Klindt, Round Mountain, Nev. A new concentrating table of box form.

Roller Mill—No. 1,361,601. F. E. Marcy, Salt Lake City, Utah. A new type of mill, having the discharge end normally open, and carried on roller bearings.

COURT DECISIONS IN MINING CASES

By Wellington Gustin

Oral Agreement Void in Transfer of Real Property

Cerro Gordo Mines Co. and Others Win New Trial Over Chris Crohn Springs in California

The Inyo Cerro Gordo Mining & Power Co., the Cerro Gordo Mines Co. and Louis D. Gordon, defendants in the action brought against them by S. C. Simons, have been granted a new trial by a decision of the Supreme Court of California, reversing the judgment obtained against them.

The lower court had adjudged Simons to be the owner of the "Chris Crohn Springs," situated about four miles northeasterly from Cerro Gordo, in Inyo County, Cal. It further decreed that Simons had the right to divert all the waters for domestic, mining and milling purposes; that Simons is the owner of all the pipes, flumes, tanks, pumps and other apparatus used to divert and conduct the waters; and that plaintiff recover damages of defendants.

Simons claims title to the springs as successor in interest of Chris Crohn, an old miner and prospector, who conveyed water in kegs on muleback from one of the three springs to the mining camp at Cerro Gordo and there sold it by the gallon. This business was continued until 1882. In 1878 a pipe was laid to the Augusta mine located by Crohn.

Defendant Cerro Gordo Mines Co. claims through the Union company, which purchased the Cerro Gordo mine in 1889 and purchased from others rights to the springs, such rights being claimed by reason of certain appropriation notices posted by it at or near the springs. Immediately after purchasing these claims the Union company built and installed the diversion system of pipe lines, pumps, tanks, and complementary distributing apparatus. From its installation in 1889 to the date of the trial the system was used by the Union company and by its successor the Cerro Gordo Mines Co.

There was evidence to the effect that in 1890 the general manager of the Union company told Chris Crohn that the company would pay Crohn 1½c. per gallon for all water it might take from the springs through its diversion system, and that if it did not pay such rent and the company should quit working, Crohn could have the pipe lines, pumps, tanks, and other means of storage and distribution.

The court held the system to be real property, title to which under an agreement with the general manager of a mining company must be supported by evidence that he had authority to dispose of same. Further, it was pointed out that, the right of way and pipe lines being realty, the property could not be conveyed by an oral agreement. The sale must be evidenced in writing.

But it was said that the Cerro Gordo Mines Co. and its predecessor the Union company were trespassers, and therefore had no rights to the system. In answering that the court said, even if the Union company never acquired any water right, and even if, as against the Federal Government, the laying of the system through upon the vacant public lands was a trespass, still as between the disputants herein, the plaintiff Simons would not be entitled to the system. But as a matter of fact, the court said, neither the Union company nor the Cerro Gordo Mines company was a trespasser, either at the springs or in the vacant government lands wherein its diversion system was installed.

Oklahoma Court Defines Operators' Liability

A judgment for $9,650 for personal injuries has been affirmed in the Supreme Court of Oklahoma against the Quapaw Mining Co., and in favor of Charles Cogburn. The latter was employed in the company's lead and zinc mine, and was severely injured by falling rock from the roof or side of the drift in which he was working. He alleged that the company was negligent in failing to provide timbers to prevent the falling of the rock and in failing to inspect the mine. The company made denial, and defended on the grounds of contributory negligence and assumption of risk of the employee, and further alleged a settlement with the employee before trial. These things were in turn denied by the employee, and though the settlement was admitted it was charged same was procured by fraud.

These facts were presented to a jury, which rendered the above detailed judgment against the company. The injuries consisted of wounds upon the head, back, breast, and arm, the back wound resulting in permanent paralysis from the waist downward. Settlement had been made for $2,000, which was alleged to have been obtained by fraud, consisting of false and misleading statements made to the employee concerning his condition by the claim agent and physicians, that he was not badly injured.

The court said that where a release for personal injuries has been obtained fradulently for a grossly inadequate sum, an action for damage may be brought without first obtaining a decree to cancel or rescind the release. Further, the statute prescribing certain duties of mine operators toward employees, including the duty of daily inspection, applies to the operator of lead and zinc as well as coal mines.

Leases of Blue Stem Oil Cancelled

Kansas Supreme Court Holds Them Terminated Notwithstanding Unavoidable Obstacles

The difficulties of well drilling and a lack of foresight in the lease contracts are shown in the decision of the Supreme Court of Kansas terminating the leases of the Blue Stem Oil Co. on the Baldwin lands in Greenwood County.

The leases provided that they should remain in force for three years, and that they should terminate in one year if no well was completed within that year. They also provided for an extension of the leases from year to year by the payment of rental named therein; but the leases terminated absolutely at the end of three years from their dates, unless a well was drilled producing oil or gas.

The oil company contended that the leases should not be forfeited by reason of the failure to complete a well before the end of the three year period. Forty days previous to this date drilling was begun. The delay in drilling was due to lack of adequate water supply, as it was alleged that from 1916 to Nov. 7, 1918, rain did not fall in a quantity sufficient to supply water for drilling, and that after the latter date drilling operations were begun, but on account of excessive rainfall the roads became muddy so that fuel for the engine and casing for the well could not be transported. Then a blizzard intervened, and the employees became sick—too sick to drill. Furthermore it was impossible for them to obtain coal and casing, on account of the action of the United States in taking charge of coal supplies and all casing, and in prohibiting the purchase, sale, and use of casing, in wells in territory not proven.

The Supreme Court said ample time was given by the terms of the leases. The company was compelled to take notice of the climatic conditions and of the topography of the country in the vicinity of the lands; as well as of the powers of the Government over coal and iron industries. The company with knowledge of these things contracted positively that it would be certain work within a certain time, or that its rights in the premises should cease, unless gas or oil should be produced from the land, by the lessee. Neither was produced. By paying the rent provided for in the leases, the company could neglect to drill until the leases expired, but the company, if it failed to produce oil or gas from the lands, could not, by paying rent, extend the leases beyond the time fixed for their expiration, nor could excuses for nonperformance extend the leases beyond that time.

The leases were declared by the court to be forfeited.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Labor, "Capital" and Brains Discussed Before Philadelphia's Engineers

J. Parke Channing Points Out Reason for Human Engineering, Outlines Its Field, and the Object To Be Attained

"Industrial Relations" was the subject of an address made by J. Parke Channing, of New York City, before the Engineers' Club of Philadelphia, on Feb. 1 last. Mr. Channing holds that "the capitalistic system of production is the best that we know of. It is by no means perfect, but it has within itself the capacity for such advancement and improvement that it ever tends more nearly to perfection. A balancing of our altruistic and egotistic tendencies will lead to a proper solution of the problem of production and distribution.

"In industry there are three elements to be considered—labor, management and capital. Capital is nothing more or less than the savings of the prudent, which are put aside for the construction of new means of production. But labor and capital would not of themselves be capable of carrying on industry. Most important of all is management, which also contains that element of brains, which leads to discovery, invention, and the increased productivity of labor and capital. Mallock has pointed out that the century's tenfold increase in productivity has been caused by the application of brains." Logically brains should have received this increase, but in fact the larger portion goes to the manual laborer, who, in the long run, represents the consumer.

"In common with non-technical men the engineer has neglected the human side of engineering. Most technical schools in the United States, including the Y. M. C. A., now have courses in Human Engineering. We must give the men working for us an idea of economics. We must let them know what profits we possibly can make in any industry. We must also impress upon them that they are the ultimate consumers of goods and get them to recognize that a man ultimately is not paid in dollars and cents but in food, clothing, and a house to shelter him, and in the various pleasures of life. We must take him into our counsels when we consider the conditions of work, get his ideas, and arrive at conclusions that are mutually satisfactory. These results are being brought about by shop committees and by agreements with unions.

"We must not arbitrarily say that we cannot deal with unions any more than they can say they will not deal with large aggregations of capital. The progressive labor leaders are good economists, and many of them understand the theories of production better than most employers. They practically say they do not wish to trespass upon the domain of management. What they want are good living conditions for the members of their unions and as large a part of the profits as they may economically get.

"John R. Commons has pointed out that if all employers and all managers were ideally constituted there would be no need of unions, and John R. Commons started life as a printer! . . . We have inefficiency of capital and inefficiency of management. One of the first things Herbert Hoover did when he became president of American Engineering Council was to appoint a committee on the elimination of waste in industry. His idea was to fearlessly investigate waste of effort, both on the side of the laborer and on the side of capital, and, after getting at as many of the facts as possible, to see if there was not an opportunity of stabilizing industry in the same manner in which banking has been stabilized by the introduction of the Federal Reserve system. It is a tremendous task, but unless someone gets at it it never will be done."

Copper and Its Uses Discussed by New York Section, A. I. M. E.

Engineers, Statisticians and Publicity Men Analyze Reasons and Remedies for the Metal's Troubles

At the annual meeting of the New York section of the A. I. M. E. held on Feb. 2, the general subject for discussion was "Copper Metal—From the Consumer's Point of View." The four speakers were W. S. Barstow, an electrical engineer familiar with electrification problems of national scope; Ivy L. Lee, a publicity man who has been investigating new outlets for copper for the Copper and Brass Research Committee; William S. Murray, chairman of the Superpower Survey, and H. A. C. Jenison, statistical expert on copper for the U. S. Geological Survey.

Mr. Barstow pointed out some of the possibilities for the use of copper in railroad electrification and emphasized the evil results which over-regulation of public utilities had brought about. The electrical industry is prevented by unwise laws from expanding, and copper producers should take more of an interest in this subject.

Mr. Lee read an exceedingly interesting paper which chiefly brought out how copper has been superseded by less meritorious metals, owing to their cheapness and better advertising. Aluminum, he said, was a drug on the market twelve years ago. Now 50 per cent of the kitchen utensils sold in this country are made of that metal, 25 per cent of enameled ware and only 6 per cent of copper, which was formerly so popular. The reason—publicity; advertising. Armco iron and monel metal were also cited as metals, the sales of which were vastly increased by the interest taken by their producers in marketing their product. No such scientific effort has ever been made to broaden the uses of copper.

During the war copper and brass were hard to get, and substitutes were developed which are still used. They are in general cheaper and less satisfactory, but the consumer has not been educated to know the difference.

Mr. Lee gave some enlightening statistics on the amount of copper now used in pins, plumbing, hardware, and other fields, and of the ridiculously small amount purchased for some of the large New York buildings.

Mr. Murray explained the problems which the Superpower Survey is trying to solve. He showed how much more efficient electrified railroads in densely populated communities are, as compared with steam, and explained the advantages of immense central stations of approximately 300,000-kw. capacity situated at strategic points for supplying power. The opportunities for copper in this work are obvious. Mr. Murray seconded Mr. Barstow's remarks on the evils of over-regulation of public utilities.

The last speaker, Mr. Jenison, unfortunately had prepared a paper which covered the same ground as that of Mr. Lee. He brought out several new points, however, among them the importance of pushing the investigation and use of steel containing small percentages of copper. The anti-corrosive properties of such steel appear to be marked. Mr. Jenison also suggested that the propaganda of the aluminum producers in their effort to introduce aluminum cables for transmission purposes should be combated.

Journal of Electricity and Western Industry

The *Journal of Electricity*, which has been one of the McGraw-Hill publications since September, 1919, is hereafter to be known as the *Journal of Electricity and Western Industry*. This announcement was made at a dinner held on Feb. 1 at the Palace Hotel, San Francisco, in recognition of the thirty-fifth anniversary of the *Journal of Electricity*. Robert Sibley will continue as editor of the enlarged publication.

MEN YOU SHOULD KNOW ABOUT

L. W. Stephenson has been given leave of absence by the U. S. Geological Survey to accept a private geologic mission in Mexico.

D. H. Angus, former manager of the Tough Oakes mine, has been appointed manager of the Bidgood mine, Kirkland Lake, Ont.

W. A. Howard, general manager of the United States Smelting Co., in Salt Lake City, has returned from a trip to the East.

D. R. Thomas, mining engineer, has moved from Teziutlan, Puebla, Mexico, to Mexico City, where his address will be Edificio La Mutua 522.

George E. Burton, geologist, has opened an office for consultation in petroleum geology at 1216 Colcord Building, Oklahoma City, Okla.

A. M. Yonge, consulting mining engineer, has closed his office in Washington, D. C., and is now established at 2638 Russell St., Berkeley, Cal.

G. L. Harrington, of the U. S. Geological Survey, has been granted leave of absence for one year that he may engage in private work in South America.

S. R. Guggenheim has been elected president and chairman of the executive committee of Braden Copper Co., succeeding W. C. Potter, who has resigned.

Walter J. Browning, manager of the Rio Tinto mines, in Spain, was twice fired at recently while on his way to the company office. He escaped injury.

M. Gomez, administrative director of la Société des Hauts-fournaux de Bilbao, Spain, was seriously wounded during a terrorist attack.

Charles Trezona has concluded an inspection of the Gogebic Range, in the course of which he investigated developments and progress in mechanical mucking.

Thomas A. Graves, of Silver Creek, N. Y., has returned there after a nine months' trip to Peru, where he examined mining properties and petroleum territory.

James Hamet Dunn, a native of Nova Scotia and a prominent financier, who organized the British America Nickel Corporation during the war, has been made a baronet.

Arch M. Chisholm, a large holder of mineral lands on the Mesabi Range, Minnesota, is making an extended trip through the Southwest and Mexico to look over some holdings there in which he is interested.

H. C. George, chief engineer of the Wisconsin Zinc Co., succeeds **A. E. Drucker**, resigned, as professor of metallurgy on the staff of the Wisconsin State Mining School at Platteville, Wis.

Archie McDonald, resident manager of the Sterling Mining & Milling Co., Flesher, Mont., is devoting three months to special studies in ore testing at the Idaho School of Mines, Moscow, Idaho.

Oliver C. Ralston, superintendent of the Seattle station of the U. S. Bureau of Mines, is accompanying the supervisor of stations, **Dorsey A. Lyon**, on a visit to the various Western stations of the Bureau.

H. A. Guess, consulting engineer on mining and milling subjects for the American Smelting & Refining Co. and the Guggenheim interests, left early this week for a two months' trip to South America.

Eugene H. Dawson, of New York City, has just returned from a trip to South America, in the course of which his investigations involved a trip up the Amazon through Brazil and over the Andes into Peru.

W. J. Cowsert continues in charge of the construction of the new mill for C. O. D. Mines, Inc., at Kingman, Ariz. Charles H. Urquhart, general superintendent, writes that Mr. Cowsert has been in charge since the start. This is to correct a statement concerning L. F. Barber published on Dec. 11 last.

Charles Grabowsky, assistant general superintendent in the Eveleth, Minn., district for the Oliver Iron Mining Co., has been promoted to be general superintendent in the same district, succeeding the late R. J. Mitchell. **W. F. Pellenz** has been promoted to assistant general superintendent.

Colin G. Fink, manager of laboratories of the Chile Exploration Co., New York City, addressed the Pittsburgh Section of the American Electrochemical Society on Jan. 28. He spoke on "Modern Developments in Metallurgical Research."

Sam H. Richardson, mining engineer, identified with mining operations in the Republic district, Washington, has been elected to the Legislature. It is believed that Mr. Richardson is the first mining engineer to be elected to the Washington Legislature.

The American Committee of the International Chamber of Commerce includes among its members Herbert Hoover, of Palo Alto, Cal.; Cornelius F. Kelley, of New York City; J. D. A. Morrow, vice-president National Coal Association; and Thomas A. O'Donnell, Los Angeles, Cal.

Among engineers visiting New York City during the week ending Feb. 8 were **Charles Janin**, San Francisco, Cal.; **Carl Nystrom**, care of the Swedish Legation, Washington, D. C.; **Jon A. Udden**, chief geologist of Sinclair Oil & Gas Co., Tulsa, Okla.; and **C. E. Macdonald**, Toronto, Ont.

George C. Martin, geologist, with the Division of Alaskan Mineral Resources, U. S. Geological Survey, has resigned that position to become technical assistant to **C. F. Bowen**, chief geologist of the Standard Oil Co. (N. J.). Dr. Martin, who is a graduate of Johns Hopkins University, has been with the Geological Survey since 1903, and was acting chief of division during 1917-1918. He has devoted much time and study to the coal and oil fields of Alaska, Maryland, and other states.

SOCIETY MEETINGS ANNOUNCED

The Engineers' Club of Northern Minnesota expects to hold its annual banquet on Feb. 26 at Eveleth, Minn.

The Iron and Steel Institute, 28 Victoria St., London, S. W. 1, will hold its annual meeting on May 5 and 6 at the House of the Institution of Civil Engineers, Great George St., London, S. W. President J. E. Stead, F. R. S., will preside. The annual dinner will be held on the evening of May 5.

American Association of Engineers will hold a national engineering conference on public information at the Congress Hotel, Chicago, Ill., on Feb. 25. Engineering publicity will be discussed from every angle. Among the speakers will be: F. M. Feiker, of the McGraw-Hill Co. publications; Richard H. Waldo, of New York; State engineer J. G. D. Mack, of Wisconsin; and C. R. Thomas, of Forest Products Laboratory at Madison, Wis.

The Idaho Mining Association held its eighth annual meeting at the Chamber of Commerce, Boise, Idaho, Feb. 11 and 12. The discussions covered: Proposed revision of the Underwood tariff act, and of the Kitchin revenue act; the stimulation of gold production; the injustice of the "enlarged homestead" act. On the evening of Feb. 11 D. H. Ferry, manager of Yukon Gold Co., gave an illustrated talk on gold dredging, and Walter C. Clark illustrated the mining industry of Idaho.

OBITUARY

Harry D. Symmes, mining engineer and member of the Engineering Institute of Canada, died at Niagara Falls, Ont., on Jan. 29 at the age of fifty-one. Mr. Symmes was on the directorates of the McIntyre and Temiskaming mining companies for several years, and was largely interested in oil and natural gas enterprises. He was also the manager of the first electric railroad built in Canada.

John Edyvean, a pioneer resident and copper washer, died on Jan. 10 at his home in Lake Linden, Mich., at the age of sixty-seven. He was born in England, and came to this country at an early age with his parents. At the time of his death he was foreman copper washer in the Hecla mill of the Calumet & Hecla Mining Co., and had occupied a position of trust with that company for many years.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

WEEKLY RÉSUMÉ

The second shot has been fired by Karl Eilers in his fight to oust the Guggenheim interests from the control of the American Smelting & Refining Co. Stockholders have been circularized by Mr. Eilers with a further request for proxies to be used at the approaching annual meeting. As to the industrial situation, curtailment of production and wage reduction continue the features most prominent. Anaconda has suspended development at its South American properties and will shut down its electrolytic zinc plant at Great Falls on Feb. 28, Elm Orlu also closing its mine and mill. Producers of magnesite in the State of Washington have ceased all operations, which is attributed to the competition of Austrian magnesite. In Colorado, the Industrial Commission has invited operators to attend a hearing on Feb. 15 at which the question of wage reduction (already announced and in some places now in effect) will be discussed, the point being that the state law forbids such changes without investigation first. A bill calling for the creation of a Blue Sky commission to license the issue and sale of securities in the state has passed second reading at Denver. At Butte, counsel for Butte & Superior and Minerals Separation are expected to ask soon that a date be set for argument in connection with the accounting in the flotation case.

Little has occurred at Washington. The proposed Division of Mines and Geology has been discussed in the Senate Committee on Mines and Mining and the Senate bill for liberalizing war mineral relief legislation has been broadened as to the "request or demand [illegible]

Blue Sky Commission Called for in Colorado Bill

A bill has passed the Colorado Senate on second reading providing for a Blue Sky commission authorized to license the issue and sale of securities within the state. The bill is strongly opposed in its present form and only escaped defeat by a margin of two votes.

There is strong sentiment in favor of some sort of Blue Sky legislation in both branches of the Legislature, and the leaders say that the platform pledges of both parties for regulatory enactments regarding the sale of securities will be carried out.

The Naica Controversy

Protest of Foreign Governments Over Recent Decision of Mexican Court Puts Famous Case Once More in Limelight—Stoppelli Heirs and Associates Awarded Property and Damages

BY JOHN E. KELLY

The recent action of the Supreme Court of Mexico in deciding in favor of the Stoppelli claimants in the celebrated Naica case has attracted widespread attention, owing to the prominence of the litigants, the amount involved and the protests of four foreign governments at the decision. The litigation is said to involve a sum not less than 10,000,000 pesos.

The heirs of Santiago Stoppelli are suing the Cia. Minera de Naica, S. A., for the return of the Maravillas mine, a surrender of all returns from the workings, and 6 per cent interest on same. The American Metals Co., Ltd., through the Cia. Minera de Penoles, S. A., of Mapimi, Dgo., is owner of 40 per cent of the stock of the Cia. Minera de Naica, the rest being held by Mexicans, Belgians, French and English subjects. The mines are situated at Naica, Chihuahua, east of Jiminez. A narrow-gage line connects the property with the Mexican Central. The mines are extremely rich, but in common with other properties in Chihuahua, were hampered by many interruptions during the Villa rebellion.

The history of the mine dates back to 1896, the year in which the Maravillas mine was discovered and denounced by Don Santiago Stoppelli. The litigants agree on this point, but vary so widely on all subsequent happenings that their respective claims on each important point will be noted that the reader may judge for himself.

Stoppelli disclosed his find to one Don Saturnino Gonzalez, a contract being drawn up between them. The Cia. Minera de Naica claims that Stoppelli sold his right of denouncement, which was all he possessed at the time, for 500 pesos, and was granted twenty-five of the original hundred shares in the Cia. Minera de Naica, S. A. The heirs claim that Stoppelli owned the Maravillas property, that he did not sell or transfer his ownership, but that he merely permitted it to be exploited under the terms of the agreement. They further claim that he paid twenty pesos (the nominal value) for each of the twenty-five shares he received, so that instead of receiving the 500 pesos, as alleged by the company, he paid it into the treasury in cash.

The company further states that as Stoppelli did not pay an assessment, his shares were declared vacated, and that he lived seven years after the original agreement in 1896, and four years after his shares had been declared vacated, without making any protest. The heirs' rejoinder claims bad faith on the part of the other shareholders, in that no assessment could be claimed against the fully paid shares under the law, that the meeting at which the alleged assessment was passed was illegal, as it was not advertised and other legal requisites were not observed. They quote the Commercial Code to show that a protest against an action in bad faith may be brought by the interested person or his estate at any time, no matter how long after the action of which complaint is made. In other words, that there is in this matter no statute of limitations as the company claims.

The Naica company further states that in 1905 the heirs brought suit, not against the validity of the company, but basing their claim on the vacating of the shares held by Stoppelli in 1896. That this suit was settled by the payment of 30,000 pesos to the heirs. That the heirs, despite the fact that they were enjoying the payment of the above sum, were tempted by the large returns due to heavy investment and wise management, and again brought suit. To these charges, the claimants reply that the former suit was brought by Maria Stoppelli, not by the heirs, as the majority of them were minors in 1905, and that, in any case, that action was based on the vacating of Stoppelli's shares, whereas they claim that the Maravillas property in itself is their property, as their father never ceded it, but merely permitted its operation by the company, in whose profits he was to share.

The Naica company makes a point that the original agreement plainly states that Stoppelli was to transfer entire title in the Maravillas property as soon as a title in his name should be granted by the Secretaria de Fomento.

The heirs reply that the agreement was illegal according to Articles 95, 170, and 175 of the Commercial Code, in that it does not contain a statement of the capitalization nor of the value of the real estate introduced by Stoppelli; that it does not define the number, kind, and nominal value of the original shares; that no sinking fund was provided for, and other legal details of like nature.

It is further claimed by the company that, under Article 51 of the Mining Law, the owners of a property are permitted to occupy and work it as long as taxes are paid thereon, and that as the heirs have paid no taxes on the property, they would have lost ownership in any case. This argument would seem ill-founded, for the Stoppelli interests have not been in physical possession of the property since 1896, and if, as the claimants allege, the company is in unlawful possession of the property, the taxes paid by the company during the time that it has possessed the Maravillas would be credited to the rightful owners.

COURT FINDS FOR PLAINTIFFS BY SIX TO FIVE VOTE

In brief, the Stoppelli interests claim that Stoppelli never relinquished ownership of the Maravillas mine, and that his heirs and their associates are entitled to a restoration of the property and all its profits, whereas the Cia. Minera de Naica contends that whatever claim Stoppelli had on the property was disposed of in 1896, in a document which the heirs declare illegal. On these facts, the Supreme Court of Mexico decided, by a vote of six to five, to uphold the action of lower tribunals directing the restoration of the property, and the payment of damages, interest, and costs by the Cia. Minera de Naica.

It is to be deplored that four foreign governments have seen fit to intervene in the domestic concerns of Mexico. It will do no good, for it will merely strengthen the determination of the court to uphold its decision. Both the Cia. Minera de Naica and the Cia. Minera de Peñoles are Mexican corporations, which are bound by their charters to abide by the decision of Mexican courts. It is true that the Cia. Minera de Naica denies that it has officially protested to any foreign government, naïvely adding, however, that it "cannot prevent" (*no tiene a su alcance medio de impedir*) its foreign shareholders from appealing to their governments.

Some attempt has been made to give a political color to the controversy, it being alleged that Lic. Roque Estrada, brother to the Subsecretary of War, and the late General Benjamin Hill, Secretary of War in the cabinet of President Obregon, were interested in the Stoppelli claim. A dispatch emanating from Washington after the Supreme Court's award was known pointed out that the American Metals Co. had enjoyed favors from the Carranza regime, the inference being drawn that an anti-Carranza government had shown its resentment by an adverse verdict. But there is no evidence to show any tampering with the Supreme Court, which affirmed the decisions of two lower courts, and it should be remembered that the magistrates composing the court took office under President Carranza, were with him when he evacuated Mexico City last May, and, far from being prejudiced against Carranza or his favorites, their decisions on political matters have so often been displeasing to the present government that the Procurador General, Lic. Eduardo Neri, recently threatened to cite the court before Congress, charging them with delaying actions brought against members of General Carranza's party.

Leadville Mine Development Co. Organized

Leadville is to again have a strong home operating mining company which will be known as the Leadville Mine Development Co. The company was organized at the instance of the Leadville Chamber of Commerce and the property selected was the choice of almost 60 per cent of the votes of its members. The company is capitalized at $150,000 in $10 shares.

On the Board of Directors are Jesse F. McDonald, former Governor of Colorado; John Cortellini, president of the Leadville Chamber of Commerce; E. D. Dickerman, M. Harvey and Joseph W. Clark, all operators of mines in the Leadville district.

The property to be taken over by the home company is known as the Canterbury Hill and Prospect Mountain tunnel project and has been under consideration for several years past by several interests which for various reasons have failed to enlist the necessary capital. The proposed tunnel opens up a territory where surface development in early days along the line of the tunnel is said to have been very promising.

The initial work will be the driving of the tunnel 1,600 ft. to a point beneath the old Diamond shaft where, before the advent of the railroad into Leadville, ore was taken which ran several hundred ounces in silver, with a high percentage of lead. This property has been idle since 1894. Ultimately it is expected that the tunnel will be extended to connect with the Yak workings.

Washington Mining Association Elects Officers

The Washington State Metal Mines Association re-elected the following officers at the annual meeting held recently at Spokane, Wash.: L. K. Armstrong, president; F. H. Knight, vice-president; M. F. Poole, secretary-treasurer. The following, together with the officers, constitute the board of trustees: H. S. Stoolfire, M. J. Sweeny, Dan Barnett, J. L. Drumheller and J. C. Haas. These were all former members of the board except J. C. Haas.

Karl Eilers Solicits Proxies Again for A. S. & R. Election

Recent Letter to Stockholders Repeats Charges Made in Application for Writ of Mandamus

Stockholders of the American Smelting & Refining Co. have recently been circularized by Karl Eilers, formerly vice-president and director of the company, in a further effort to secure sufficient proxies to enable him to oust the Guggenheims from control at the next annual meeting, to be held in New York on April 6. In a letter sent to each stockholder under date of Jan. 31 Mr. Eilers repeats his former charges, saying in part:

"Probably you have wondered at and perhaps been concerned about the situation in your company. Its stocks have declined far below those of other supposedly good industrials. Its net earnings have declined so as to be changed into losses. Its cash has declined so that the company has become a large borrower. Its directing head has declined and tapered down from a Daniel Guggenheim to a Simon Guggenheim. Its organization has declined in morale, efficiency and personnel. Its dividends have declined and its chances of increased dividends are steadily declining. Its business prospects are declining, particularly since the recent gift of the copper sales agency (heretofore worth more than a million a year) to Guggenheim Brothers. Why?

"The Guggenheim family formerly owned a very large stock interest—probably the actual control. They absolutely dominated the company. When either because of or in spite of this domination the company had grown and a broad market had been established for its stock the Guggenheims quietly sold out 'on the other stockholders' to the extent of practically all their stock. It then being to their interest, perhaps they really did do a good deal toward placing the company in such good position—that they could profitably sell out. At any rate, up until after that time Mr. Daniel Guggenheim gave to the matter his personal attention.

"Since then, taking their profits and investing them elsewhere, the Guggenheims have had larger financial interests in other concerns with interests conflicting more or less with those of your company. However, they have held on to the control of your company largely because of the prestige and strength it gave them in handling their own enterprises. They still absolutely dominate your company because you stockholders have not awakened to the alarming situation which has been greatly intensified by these changes. That the Guggenheims themselves are quite awake to the change occasioned by their disposal of their stock [illegible] shown, perhaps, by the fact that, except in matters affecting Guggenheim interests, Mr. Daniel Guggenheim has ceased to bother with the affairs of your company, and whatever care and direction it gets has to come from his younger brother, Si

"They gave an illustration of their absolute domination and of their disregard of stockholders at the last election. They used the proxies, confidingly sent them by the stockholders, to drop me from the board (and they now speak of me as a discharged employee), although the company's books show that I was by far the largest stockholder on the board. I happened to be personally in a financial position which allowed me to question Simon Guggenheim's plans and policies when they were not in the interest of the stockholders, and often I had found it necessary to do so. The sole ground of my removal—obligingly given in advance in writing by President Simon—was that I was not in accord with him.

"The Guggenheim management of Smelters has but just now transferred as a *gift* from your company to Guggenheim Brothers contracts for copper sales agency or brokerage which brought the company in net proceeds of over $10,000,000 in eight years. No characterization of this amazing transaction is necessary. The Guggenheims, apparently, thought they had to say something and have sought to do two difficult, if not impossible, bits of explaining—that is, to justify this *gift* and to excuse certain past losses incurred in gambling in copper—by playing one questionable act off against another in making the absurd claim that the gambling was a necessary part of the brokerage.

"Do you, an owner of Smelters, believe that the Guggenheims, who are but slightly interested in Smelters and very largely interested in Guggenheim Brothers, should have had the 'say' as to handing over that valuable business? Should they have the say as to the making of smelting contracts with mining companies in which they are interested more largely than they are in Smelters?

Although in the *fourteen* years, ending June 30, 1920, the capitalization and debt of the company have been largely increased, no possible benefit therefrom has accrued to the stockholders. The net quick assets per $100 of capitalization and debt show no increase. And on the contrary the dividends on the common stock have declined from 7½ per cent to 4 per cent per annum.

"The Guggenheims have resented criticism by the real owners and have run your company, with which they are little concerned, as a convenient side enterprise of their own. For instance, they have turned over to Smelters for approximately $22,000,000 in cash and its equivalent some of their poorer mines. But by a remarkable series of coincidences neither Chile, nor Braden, nor Utah nor Nevada Con., nor any other of the wonderful successes offered to the Guggenheims ever found its way into Smelters or was offered to its stockholders, but went where the Guggenheims personally were more interested. That is, Smelters paid them for less successful mines, but never even by accident did it get any of the remarkably good opportunities which came to the Guggenheims originally because of their positions in Smelters.

"The domination of the Guggenheims is to be regretted not only for many things which they have done, but also for many things which they have not done, and even more for many things which, by merely occupying the positions of power and initiative, they have kept others from doing. Perhaps the greatest of all the evils due to their domination is that it has prevented, and, if continued, will prevent your company from having a management of its own of responsibility and initiative.

"To remedy this is of the utmost importance, and can be done, I believe, with very few changes in the management if the directors are made to owe their position to the vote of the stockholders and not to the whims of the Guggenheim family. The removal of the Guggenheim threat with the opportunity of freedom of action to the directors and management will immediately increase the opportunities, efficiency and energy of the board and the organization, and will benefit the company almost at once and automatically.

"Very large salaries (amounts kept secret even from the directors but believed to aggregate more than $500,000 each) have been paid by your company to a number of members of the Guggenheim family who were more interested in other concerns and who devoted most of their time and real effort to other matters. To what end were they given these offices and salaries? Since they sold out, certainly not because of their investment in the company.

"It has been the policy of Smelters and of other large industrial corporations to require their higher salaried men to make contracts to devote their 'entire time, energy and skill' to the service of the company. Were the numerous Guggenheims required to make such contracts? If not, why not?

"If so, what rights has your company in the enormously valuable Chile Copper and other properties to the organization and development of which they devoted so much of the 'time, energy and skill' which must have belonged to your company?

"The sum total of such salaries paid the members of the Guggenheim family is very large, but it is as nothing compared with the value of opportunities which the Guggenheims sent elsewhere or compared to other possible losses due to having the actual management of the company in the hands of those who were not primarily concerned with the company's financial success but were personally interested in the success of other and sometimes conflicting concerns, even if they had no intent to divert profits from your company."

Inspiration's Output Unchanged

Inspiration produced 5,000,000 lb. copper in January; unchanged from December.

Legislature Calls for Inquiry Into Golden School's Affairs

Bill Introduced To Place Management Under Regents of State University

The controversy regarding the Colorado School of Mines has resulted in the introduction into the General Assembly at Denver of a bill providing for the removal of the management of the school from the board of trustees and placing the institution in the hands of the regents of the State University. On Feb. 3 the House passed a joint resolution calling for an investigation of the board of regents, school of mines, its officers and the administration of the school which stated:

"Whereas, for several years past the friction and discord relative to the management of the Colorado School of Mines has brought unenviable notoriety to that institution and resulted in conditions affecting the reputation of the school which can no longer be ignored;

"Whereas, in an effort to remedy conditions relative to the administration of the school, a bill is now pending before the General Assembly which would place the control of this institution in the hands of the regents of the State University; therefore be it

"Resolved, by the House of Representatives of the Twenty-second General Assembly, the Senate concurring, that the Speaker of the House shall appoint three members and the president of the Senate two members who shall compose a committee empowered to make such investigations regarding the board of regents, the school of mines, its officers or the administration of the school, as they deem proper under the provisions of this resolution, and be it further

"Resolved, that this committee shall make its report together with such recommendations regarding the management of the Colorado School of Mines as its members believe will restore the prestige formerly enjoyed by this institution, said report to be made on or before Feb. 21, 1921."

The resolution will promptly pass the Senate and indications are that a strong committee will be appointed to carry out the provisions of the resolution.

Concentrator at Park City, Utah, Destroyed by Fire

The concentrator of the Silver King Coalition Mining Co. at Park City, Utah, was destroyed by fire on the night of Jan. 27. The fire is thought to have started in the boiler room. A small transformer house, about 300 ft. of snowsheds, some ore bins, and trackage were also destroyed, although a strong east wind blew the fire away from the mine buildings in time to prevent more damage. The mill was insured, and it is planned to build a more modern plant. Experiments with oil flotation have been made with some success, but it is hardly likely that wet concentration will be supplanted entirely by this newer method.

German Attention on Plebiscite Nearing in Upper Silesia

Loss of Great Mineral Wealth Would Be Blow to Empire—Coal Wages Doubled in Year

From Our Berlin Correspondent

The coal socialization as a center of public interest is superseded by the coming plebiscite in Upper Silesia, by which it will be decided whether the province will fall to Poland or will remain German. Upper Silesia is one of the richest German provinces, and political strife for it is running high between Germans and Poles. The population is kept in great excitement by the propaganda carried on by both sides. The fate of Upper Silesia is a source of unrest in the center of Europe and it seems a matter of the strictest expediency to settle it without delay. This delay is apparently caused by the fact that half of the population is armed and bloodshed is expected during the polling. As no steps are however taken to alter circumstances it is difficult to see how matters can be improved by further hanging fire.

Upper Silesia, which in 1871 had only 131,000 inhabitants, has now 2,200,000, of which 356,000 are employed in mining and other industries. The province contains in a narrow space probably more mineral wealth than any other part of the continent. Coal occurs in Carboniferous strata below Triassic beds which contain zinc and lead deposits, above which are rich deposits of iron ore. The area of the coal deposits is stated to be 1,200 sq.mi., and the quantity worth mining 113 billion tons. The production of coal was in 1914 43,000,000 tons valued at 400 million gold marks. It is the second largest in Germany and was nearly double the production of the whole Russian Empire and one and a half times that of the Austro-Hungarian Empire.

The zinc and lead deposits occupy two strata of from five to one hundred meters in depth, and it is estimated will last another hundred years at the present rate of output. The whole mineral production in 1916 was estimated at 1,200 million gold marks, and the capital invested in the mineral industry is approximately two billion gold marks. The loss of Upper Silesia would be an enormous blow to Germany and greatly impair her economic strength. It would materially affect the coal situation in Germany, although only half of the Upper Silesia coal is consumed in Germany, not counting local use. One quarter is taken up by the country itself, and the other quarter is being exported to neighboring countries.

The following figures show the average wages in 1920 of the coal miners in comparison to those of last year. The wages per man and day were as follows:

	June, 1920 Marks	1919 Marks
Upper Silesia	49.0	[illegible]
Lower Silesia	42.0	[illegible]
Lower Rhine district	53.0	[illegible]
Ruhr district	49.50	[illegible]

Since last June wages have increased in the Ruhr district from 49.50 marks to 60 marks per shift. From the above figures it appears that the wages have more than doubled since last year. The total of the miners' wages in Prussia in the second quarter of 1920 was 1,991,000,000 marks compared with 1,472,000,000 marks in the first quarter of the same year. From these figures it may be taken that the situation of the mines is indeed not as rosy as it was last year.

Mills in Ontario Not Liable to Municipal Taxation

Supreme Court Rules in Favor of Mining Companies in Tisdale Township Legal Issue

A case of considerable importance to the mining industry of the Porcupine district was decided by the Supreme Court of Ontario on Jan. 31. The court rendered judgment to the effect that concentrators are not liable to municipal taxation. The dispute is one of long standing, and arose from the claim of Tisdale Township that all mills were assessable for municipal taxes. The mining companies contended that "concentrators" were specially exempted under the assessment act.

It was urged on behalf of the township that the term "concentrators" only applied to mills using mechanical processes, and that the use of cyanide, which has a chemical action, took the Porcupine mills out of the class known as concentrators. The case was appealed from court to court, with varying results, until the final appeal resulted in favor of the mining companies. The companies concerned are the McIntyre, Dome, Schumacher, Dome Lake, Porcupine Crown, and Davidson, the mill properties of which have an aggregate value of about $2,000,000.

Bacon Loses to Neill in Suit Over Interest in Premier

Neill, With Associates, Also Defendant in Similar Action Brought by Patrick Daly, of Nelson

Action brought by Maurice W. Bacon against R. K. Neill, one of those interested in the Premier mine, for the recovery of a one-quarter interest in the property has been dismissed by Federal Judge E. H. Rudkin, at Spokane, Wash. The latter in his judgment stated that the plaintiff in two cases had influenced witnesses and had lacked good faith in not bringing the suit in 1917 when he first knew of Neill's operations instead of waiting until the mine proved of worth.

Patrick Daly, of Nelson, B. C., is suing R. K. Neill, R. W. Woods, A. B. Trite and W. R. Wilson, all of whom are interested in the Premier mine, for a one-fifth interest in the same. He alleges that Neill entered into an agreement with him to finance the development of the property and to give him the share he is asking for. This undertaking, he says, was approved by the other defendants when they became partners. The Premier is near Stewart, B. C.

Colorado Commission Inquiring Into Wage Reduction

Law Forbids Change Without Investigation First—Some Companies Already Under New Schedule

In compliance with the Industrial Commission laws of the state over fifty Colorado metal mine operators since Jan. 1 have filed the required thirty-day notice, announcing a 50c. decrease in wages, effective in the metal mines and mills of the state. On Feb. 1 the Industrial Commission issued a notice to these companies that it would hold a hearing on Feb. 15 in Denver for the purpose of investigating and determining all matters and questions involved in the matter of the proposed reduction.

The law provides that pending an investigation and hearing by the commission neither the employers or the employees shall alter or change conditions of employment with respect to wages or hours.

The action of the commission has somewhat complicated the situation inasmuch as several companies have already put the lower wage scale into effect where due notice had been given, or an agreement reached with the employees. The action of the commission would seem to make all companies liable for the old wage scale up to at least Feb. 15.

Chicago for Next Convention of Mining Congress

The next annual convention of the American Mining Congress will be held in Chicago, it is announced. John T. Burns, assistant secretary, has recently closed a contract for the Coliseum during the week of Oct. 17. Convention and exposition headquarters have been opened at the Congress Hotel.

Washington Magnesite Industry Shut Down

The long heralded Austrian magnesite competition has finally attained such magnitude as to force the shut down of the Washington magnesite industry. During 1920 Washington supplied approximately 80 per cent of the magnetsite used for refractory purposes in the United States. This was produced by the Northwest Magnesite Co., the American Mineral Production Co. and the American Refractories Co. All three have now suspended operations and nearly 500 men have been thrown out of employment. The American Mineral Production Co. has erected an especially designed kiln for the burning of caustic-calcined magnesite. It is now carrying on experiments with this furnace and hopes eventually to supply a portion of this kind of magnesite, which is used in the building industries.

Anaconda produced [illegible] lb copper in January, as compared with 10,500,000 in December.

United Verde Extension produced 3,219,912 lb copper in January.

NEWS FROM WASHINGTON

By **PAUL WOOTON**
Special Correspondent

Senate Relief Bill Broadened as to Request or Demand

Measure Thought To Have No Chance Now—Efforts To Secure Passage To Be Concentrated at Extra Session

The Senate Committee on Mines and Mining has responded to a last-minute effort on the part of Senator Robinson, of Arkansas, to broaden the "request or demand" feature of the War Minerals Relief statute. The committee instructed Senator Henderson, of Nevada, to report the bill favorably to the Senate. The bill adds a proviso to the act stating that the section with regard to "request or demand" is to be liberally interpreted so as to include all claimants "who, in response to any personal, written, or published request or demand from any of the government agencies mentioned in the act" are to be reimbursed for "such net losses as they may have been found to have incurred and are in justice and equity entitled to." The bill provides that the money must have been expended in good faith in producing or preparing to produce any of the minerals covered by the act. The bill further provides that the unexpended portion of the appropriation is to continue available.

It is generally admitted, even by those in favor of the Robinson bill, that it has little opportunity to become a law at this session. It is the intention, however, to take the matter up vigorously at the opening of the extra session in case the bill should not be passed before March 4. The chances for liberalizing the War Minerals Act during the next Congress are regarded as less probable. The fact that the war period is becoming more remote is a factor in the decrease of interest in this legislation. In addition, there will be a decided change of personnel in the next Congress. New members are expected to feel less responsibility for this type of relief. They are likely to argue that the failure to liberalize the law on the part of the Congress which adopted it should be final.

Through no fault of the War Minerals Relief Commission it was impossible to wind up its work by the first of the year as was intended. The commissioners have been required to continue their work, as it was necessary for them to handle personally a number of appeals and petitions which have developed in connection with some of the plans. These matters are being cleared up rapidly, however, and the commissioners are making their personal plans to leave the Government service some time in March.

A total of [illegible] was recommended for award during the week ended Jan. 29. In the tungsten claim of S. M. Summerfield an award of $3,500.82 was recommended. The amount claimed was $40,620.06. In the pyrites claim of Robert L. Mock an award of $4,529.15 was recommended. The claim asked for reimbursement to the extent of $11,189.66. In the claim of Henry E. Egan, which had been disallowed, $919.55 was recommended on reconsideration of the claim.

Proposed Division of Mines and Geology Discussed

Secretary Payne Expected to State Views on Henderson Bill Before Retirement Next Month

That the Senate Committee on Mines and Mining takes seriously the proposal by Senator Henderson, of Nevada, to create a division of mines and geology in the office of the Secretary of the Interior was indicated on Feb. 3 when the matter was discussed by the committee. Though there is no chance of taking up this bill at this session of Congress it was suggested that the personal views of the present Secretary of the Interior would be of value. Senator Henderson has arranged to discuss the matter with Secretary Payne and it is expected that Judge Payne will reduce his views to writing prior to his retirement from the Secretaryship of the Interior on March 4.

The Henderson bill, as introduced, does not pretend to be in exactly the form that would meet the situation best. It was submitted with the idea of its being the basis for possible legislation. It provides that the division of mines and geology is to be under the direct control of an assistant Secretary of the Interior, who "shall be qualified technically by experience and education" to take charge of those duties. He is to be appointed by the President, subject to confirmation by the Senate. The salary proposed is $10,000.

It is not the intent of the bill to disturb in any way the existence of either the Geological Survey or the Bureau of Mines as independent entities. The new division would be in the nature of a liaison agency tending to unify the work pertaining the mining industry. The hope is expressed that from such a nucleus eventually would spring a Department of Mines and Mining.

The proposal is to draw to the new combination the powers and duties of other departments, bureaus, commissions, and agencies relating to mining, metallurgy, mining technology, classification of public lands, examination of geological structure, and mineral resources.

Little Change in Appropriation for Bureau or Survey

Increase for Alaskan Work Refused by Senate Committee—More Money for Enforcing Leasing Regulations

The Senate authorized few changes in the appropriations for the Geological Survey and the Bureau of Mines. The item for engraving and printing geologic maps was increased from $125,000 to $140,000, but the increase for the investigation of the mineral resources of Alaska, urged by the director of the Geological Survey, was not allowed. As only $75,000 is made available for the Alaskan work it will be necessary to curtail activities there, especially as it costs three times as much now to do a square mile of geologic work in Alaska as it did ten years ago. Director Smith had pointed out to the committee that the Alaskan work was somewhat behind, owing to the fact that sufficient men to carry on the work during the war were not available. Dr. Smith also pointed out that the Survey had anticipated the building of the Alaskan railroad and for a number of years had concentrated work in that region. He declared, however, that there is urgent need to continue that work, so as to encourage mining activities that will give some business to the railroads.

In the appropriations for the Bureau of Mines the Senate has approved an increase from $50,000 to $132,000 for enforcing the operating regulations under the Mineral Land Leasing Law.

The total of the appropriations for the Geological Survey, as approved by the Senate, and which likely will be the final amount, is $1,614,340. The Bureau of Mines total is $1,427,400.

Extra Session to Consider Revision of Mining Laws

Revision of the mining laws was among the matters which came before the Committee on Mines and Mining of the Senate at its meeting Feb. 3. As nothing can be gained by taking up the matter during the short time remaining of the present session no action was taken in this connection. It clearly is the intention of the committees on mines and mining of the Senate and of the House of Representatives to go into this subject early in the extra session.

The Utah Power & Light Co. is applying to the Federal Power Commission for permission to conduct extensive surveys in the Green River country in Grand and Emery Counties, to ascertain whether dams and power plants can be built to advantage along the Green River.

NEWS BY MINING DISTRICTS

SPECIAL LONDON LETTER

Share Market Stagnant—Technical Interest in Rand Mining Reviving—British South Africa Co. Award Disappoints

By W. A. Doman

London, Jan. 27—For the time being the piping of the sellers of mining shares to the public has ceased, because there is no dancing in response. Interest in mining business is nevertheless kept well alive by the movements, mostly downward, in the prices of metals. With tin at £169-5-0 and with stocks increasing, this particular industry is in a very doleful condition. A few of the Cornish companies contemplate developing the china clay deposits of the Duchy rather than cease operations completely. The pegging of the price in the Federated Malay States at £115 a picul is only temporary, for, although the government has apparently sufficient funds to continue, it is doubtful whether all the expected benefits will materialize. According to rumor this official action was not taken so much in the interests of the industry as to retain the Chinese labor in the country. At the Chinese New Year (next month) it is expected that an alteration will be made. The fixing of the price will have served one purpose—it will benefit the local companies whose books are made up in February.

In a technical sense there is a revival of interest in Rand mining. Toward the end of last year the New State Areas struck the reef in the south shaft at a depth of 3,676 ft. and twelve sections taken over the whole shaft gave an average assay value of 89.8 dwt. over 18.9 in. New Brakpan Mines has reached the reef horizon in its No. 4 shaft in the lease area at a depth of 4,218 ft. Twenty-five sections of the reef were taken, and the average of ninety-five samples gave 7.6 dwt. over 39.2 in. This result is only moderate, it is true, but it is payable, and consequently is satisfactory. In the Far Eastern district of the Rand the reef is undulating, and the payable portions are in shoots, so that to locate and sink a shaft so to speak at a venture, and happen upon a pay shoot must be regarded as encouraging. Other shafts are to reach the reef during the first half of the current year. Next month the No. 1 shaft of West Springs should attain its goal; the No. 2 shaft should reach the horizon in June, at which date, too, the No. 4 shaft of the Springs Mines should also show results. The various sinking projects mentioned represent a very extensive area, and if successful results are obtained the Union Government will doubtless offer additional leases, though the terms will not in future be so favorable from their point of view. Existing companies are feeling the purchase consideration rather onerous.

The award of the Cave Commission in respect of the claim of the British South Africa Co.—popularly termed "Chartered"—was received with mixed feelings. The company delivered an amended statement of net expenditure showing £7,866,117. This has been whittled down to £4,435,225, and no interest is allowed. It was mainly on the score of non-payment of interest that disappointment was keenest. Another matter, which the company itself does not quite appreciate, is that it has to pay for lands appropriated to its own uses. How and when payment is to be made is not stated. After the first spasm of disappointment holders of the shares entertained a more hopeful view, assuming that as the award was so greatly reduced the chances of early absorption in the Union of South Africa had increased. When deprived of its administrative powers the company will still possess its mining and trading rights, as well as its very useful railway system. The great drawback of course is the sparseness of the white population. For the whole of Rhodesia the whites, all told, are under 40,000, which means that progress is slow.

CANADA

British Columbia

Noble Five Shuts New Concentrator Down at Sandon—A.I.M.E. Section Meeting for Kootenays

Sandon — Milling operations have been suspended at the Noble Five mine following instructions received from the Dunsmuir interests, Victoria, the owners. This shutdown marks an almost total cessation of milling operations throughout the Slocan district. The concentrator, which is regarded as one of the most modern plants in British Columbia, was only completed in the summer of 1920, and is said to represent an outlay of $250,000.

Taghum—George Gormley, formerly of Sandon and more recently of the Bosun mine, between New Denver and Silverton, and who has a lease on the Goldhill property near here, has just made a [illegible] of high grade ore to Trail, the values being chiefly in gold.

Nelson—Messrs. Thompson and McKinney, operators of the North Star group, [illegible], with assistance of Andrew G. Larson, of Spokane, have recently been making an examination of the [illegible] property.

Present plans are that the Columbia section of the A.I.M.E. will hold [illegible] in the Kootenays in 1921. [illegible] are now being conducted with a view to having the [illegible] Nelson and Trail at the time of the annual International Mining Convention, which, if held this year, will take place in June or July.

Urging Nelson as the proper site for location of projected federal government ore-testing plant in British Columbia, E. W. Widdowson, assayer and provincial analyst, points out that for all-round requirements a concentrator equipped to give ores a primary treatment would prove of the greatest advantage. Location of such a plant at coast points would be of very little advantage, Mr. Widdowson claims, as the bulk of ore to be treated would come from Kootenay-Boundary points, and if the material had to bear long haul freight charges to the coast and the product a similar freight rate charge back to Trail advantage otherwise gained by shippers would be lost.

Ainsworth — The new government floating wharf at Princess Creek, two miles north of here, has been practically completed and ready for use. This will prove of much value to mining operators at Princess Creek.

Trail—Ore shipments received at Consolidated smelter during the week ended Jan. 31 totaled 13,306 tons, as follows:

Mine	Location	Net Tons
Bell Mine,	Beaverdell	16
Gold Hill,	Taghum	33
Horn Silver,	Chopaka	92
L. T. Mine,	Slocan City	11
Paradise,	L. Windermere	29
Company Mines		13,125

Ontario

Opposition Developing to Proposal To Increase Mine Taxes

Toronto—A great deal of opposition is being developed to the proposal of the Minister of Mines for Ontario for an increase in mining taxes. At the present time the mines, with the exception of the nickel companies, pay 3 per cent on profits over $10,000 a year. It is now proposed to raise this rate to 4 per cent. and when profits exceed $1,000,000 to make the rate a [illegible] 7 per cent. The latter rate is also proposed for the nickel companies. The new rates would mean that in some cases the taxes would be doubled.

The mining companies show [illegible] desire to evade their fair share of taxation but they want it to be fair. When the Royal Ontario Nickel Commission, appointed by the Ontario [illegible], made its report it stated that the maximum tax which the [illegible] could afford to pay was [illegible] of the profits. In addition to the hardships under which the miners labor on account of their location the companies have to [illegible] build houses for [illegible] provide electricity, water, [illegible] and mail [illegible] and their employees [illegible] other industries in the older [illegible] are furnished by the community.

MEXICO

Coahuila

Torreon Smelter To Be Blown in Soon; Coal Shortage Over

Torreon—The Torreon smelter is again receiving ore shipments and will shortly blow in after its idleness caused by lack of fuel. It now has on hand a good supply of coal and coke with several large shipments en route.

Saltillo—Eutimio Elizondo has filed on a group of twelve claims in the San Marcos Mountains, district of Monclova. The survey includes the old San Marcos mines, on which two prospect shafts were sunk, prior to the revolution, developing some good silver and lead deposits.

Henry Miller has applied for titles to six claims in the Sierra de Purisima, in the Monclova district, to be known as the San Pedro group. William A. Couley, a mining engineer of La Reforma, is making the surveys of these properties.

J. F. Mendoza is developing a newly acquired group of six claims in the Minerva Mountains near Muzquiz. Samples taken from the first prospect shaft show good values in silver.

CALIFORNIA

Ample Water Supply for Mining Operations Anticipated—Bureau of Mines Men Meet at Berkeley

San Francisco—Of general interest to industry in California, particularly to power and mining, is the fact that the present accumulation of snow at Summit is 10 ft. deep. This signifies that the prolonged water shortage is at last over and there will be ample water for alluvial mining and for power throughout 1921.

During the week beginning Jan. 24 a conference of U. S. Bureau of Mines officials was held at the Pacific Experiment Station, Berkeley, Cal. D. A. Lyon, E. A. Holbrook, O. C. Ralston, Thomas Varley, C. E. Van Barneveld, L. H. Duschak and others of the bureau attended. Of University representatives, Milnor Roberts, of the University of Washington; F. C. Lincoln, of the University of Nevada; J. F. Merrill, of the University of Utah; G. M. Butler, of the University of Arizona, and F. H. Probert, of the University of California, were present and took part in the meetings. The purpose of the meetings was to bring about closer co-ordination of the work of the bureau and the several universities at which experiment stations have been established.

In California, gold mining operations are being gradually resumed. The Bunker Hill mine has started milling operations. Development has begun in the upper levels of the Fremont Consolidated. Announcement has been made that the Angels Deep will put its mill into operation early in February. At the Morgan mine ten 1,250 lb. stamps, three 8 x 22 Hardinge mills and other necessary equipment have been added to the twenty-stamp mill, and the new addition is expected to be in operation this month. The enlarged mill will have a capacity of 12,000 tons per month. The shaft has reached a depth of 3,160 ft. and a new level has been established at 3,110 ft. Plymouth Consolidated Gold Mines, Ltd., reports 8,350 tons milled during December, 1920, and that its main working shaft has reached a depth of 3,170 ft. Unwatering at the Kennedy has proceeded to a depth of 3,440 ft., or within 10 ft. of the 3,450 level.

Falling prices and an abundant supply of labor have bettered the position of the gold mines, and there is a more optimistic feeling than for some time.

NEVADA

Railroad Bill Introduced in Legislature by John T. Reid

Rochester—The report of the Rochester Silver Corporation shows that for December last $64,810.84 was recovered from 5,005 tons of ore milled, an average of $12.95 per ton. The ore carries .102 oz. gold and 12.28 oz. silver.

Candelaria—The Vanderbilt tunnel will be extended to cut the veins in the Hecla group at a depth of about 1,000 ft. from the surface, according to present plans of the Candelaria mines company.

Jarbidge—The Jarbidge-Buhl Mining Co. is planning a large amount of development work for the coming summer, according to J. C. Finch, secretary. There is said to be considerable ore already blocked out in the property, which is in the "crater" section of the Jarbidge district.

Carson City—John T. Reid, mining engineer of Lovelock, has had a bill introduced in the Legislature to grant an extension of the franchise for building a railroad from either Parran or Hazen, in Churchill County, to a point in Lander County. There is some good mineral territory along the proposed route, in which Mr. Reid is interested.

Bristol—In spite of severe weather and heavy snow, freight teams are reaching the new camp in the Silver-Horn district near Bristol. Lumber is being hauled and boarding house equipment recently shipped from Cima has arrived at Pioche and will immediately be installed at the properties. A number of men are now working in the district. New York and Tonopah capital is heavily interested and increased activity is expected this spring. An assay office will be built. C. E. Blount, of Salome, Ariz., is in charge.

Pioche—Ore shipments from the Pioche district for the week ended Jan. 27 were curtailed owing to heavy snow. They were: Prince Cons., 1,510 tons; Virginia Louise, 745, and Lyndon mine, Comet, 35; total, 2,290.

Ely—Theodore Taraldson, the principal owner of the Lake Valley mine, has gone East to complete arrangements for financing the property. A mill will be erected this summer.

MONTANA

Anaconda To Stop Development at South American Properties

Butte—Anaconda has suspended development work at its South American properties. East Butte will reduce its operations at its flotation plant from seven to five days per week. Anaconda will also suspend operations at its electrolytic zinc plant at Great Falls at the end of this month. The zinc concentrator has also shut down at Anaconda, Mont., with the Elm Orlu zinc mine and mill, which furnished Anaconda with zinc concentrates, also suspending, all owing to market conditions.

In consequence of developments on its lowest levels, Anaconda has ore which it will not reach for twelve years at the prevailing rate of production, it is said in engineering circles. Anaconda has 1,500 miles of drifts and crosscuts and is interested in contiguous properties.

At present the company has on its payroll 4,500 persons. About the only activity displayed is in connection with its plans for the production of fertilizer, which are going steadily forward.

With the completion of its air shaft from the 2,700 level to surface the Davis-Daly will curtail forces at the Colorado mine and reduce its output from 300 tons daily to 200 and its working forces to one shift of about 225 men as compared with 400 several weeks ago. Operations at the Hibernia mine will not be curtailed. Shipments from this property are averaging around 6,000 to 7,000 tons monthly.

Counsel for Minerals Separation, Ltd., and for the Butte & Superior company are expected to appear in the United States court soon and agree on a date for hearing argument in connection with the accounting in the flotation infringement suit, the settlement of which now awaits the fixing of the amount of damages due Minerals Separation from the Butte & Superior for patent infringement. Shaft sinking chiefly is engaging the attention of the Butte & Superior at the Black Rock mine at present.

North Butte has made a further slight reduction in its forces at the Granite Mountain and Speculator mines, but the ore output will stand around 450,000 lb. of copper monthly.

Sinking by the Tuolumne company is progressing rapidly at the Main Range shaft with the timbering now below the 1,350 level. High-grade copper ore is continuing to come from the 1,200 level. The output is around 50 tons daily.

The Butte & Western Silver has started sinking from the 200 level with the 300 level as objective.

Elkhorn District—The Boston & Montana concentrator at the Elkhorn mines is now under cover with all the machine foundations completed and awaiting installation of milling equipment. At the mine, it is said, sufficient ore to permit operation of the mill is being blocked out.

UTAH

Western Utah Copper Shipping Low-Grade Arsenical Ore—Two-Cent Duty on Lead Asked by Utah Operators

Salt Lake City—Utah lead producers are asking a duty of 2c. per lb. on lead to meet the difference between the cost of production at home and that abroad, Mexico being the chief competitor with easier mining and lighter labor costs. Ernest Bamberger, testifying for Utah producers before the House Ways and Means Committee in Washington recently, explained that the industry was not looking forward to a period of artificially high prices, but that it merely sought to keep going. The present cost of production is over six cents a pound, he said, and costs are not likely to grow less. Bonanzas have been worked out and Utah ores are produced from deep workings. The mines are expensive to explore, to develop and to operate. Work is done largely through shafts.

Gold Hill—The Western Utah Copper is shipping up to 300 tons a day of low-grade arsenical ore, consisting chiefly of scorodite, ahydrous arsenate of iron, and carrying 2 or 3 per cent lead and a few ounces of silver. The ore is shipped to one of the valley smelting plants and the arsenic as well as the silver and lead recovered.

MICHIGAN

The Copper Country

Quincy Again Reduces Wages—Isle Royale Stops Mining in No. 6 Shaft

Houghton—The Quincy Mining Co. has announced a further reduction of wages and salaries effective Feb. 1, 1921. This cut amounts to 10 per cent and is entirely due to present conditions in the copper business. It will affect all employees.

The annual meeting of the Arcadian Consolidated Copper Co. was held in Houghton at the office of the company on Feb. 8, 1921. Plans for further development of the property were discussed. Shaft sinking is still in progress at the New Baltic shaft.

The Seneca Mining Co. produced 98,000 lb. of copper in December. The concrete work is being done in the shaft between the 5th and 6th levels. When completed drafting will begin in both directions on the 6th level. One of the raises at the south end of the 13th level of the Gratiot shaft has holed through to the 11th level and the other raise will soon follow.

The mining department of the Michigan Copper Mining Co. is completely closed down, but the company is cutting some timber off its lands. This timber is mostly pulp-wood, and will help in meeting the annual tax bill, which this year amounts to about $18,000.

The management of the Isle Royale Copper Co. has decided to cease mining for the present in the No. 6 shaft, confining attention to the three northerly shafts, Nos. 1, 4 and 5.

COLORADO

Portland Makes Rich Strike on 2,450 Level—North Boulder Creek Mill Running

Georgetown—Retimbering the main shaft of the Capitol Mining Co. is in progress, and development and operation will be resumed soon under a leasing system.

Boulder—The new mill of the North Boulder Creek Mining Co. was started recently, and is treating ore from the Blue Bird mine. Test shipments of crude ore and concentrates will be made. Recent underground development was encouraging. J. E. Pherson is superintendent.

Victor—Rich ore has been opened on the 2,450 level of the Portland. The ore is reported to be equivalent in value to that on the 2,300 level and the strike is considered important.

Sherman—Work is progressing on the new power plant and mill which the Colorado Consolidated Mining Co. plans to have ready for operation by June. A consignment of machinery was delivered on the ground recently.

Capitol City—W. E. Mendenhall has secured a lease on the Excelsior-Broker properties and development work has begun.

Denton—The shaft of the Emma mine is being unwatered preparatory to resuming development on the 6th level under James Clamp's direction.

MINNESOTA

Minnesota Steel Co. Shut Down by Gas Explosion

Duluth—The Minnesota Steel Co.'s plant has been shut down temporarily by a gas explosion in the blast main, which did considerable damage and injured several employees.

Mesabi Range

Interstate Iron Co. To Shut Down Four Mines—Oliver Iron Drilling on Mesaba Lake

Hibbing—The Interstate Iron Co., which operates many mines on the Mesabi Range, has decided to shut down four of them, namely, the Lincoln mine, at Virginia, and the South Agnew, Leetonia and Mississippi, at Hibbing. The construction work on the concentrator at the Hill-Annex mine will be continued. Several days before this notice had been posted announcing a 15 per cent reduction effective Feb. 1.

Aurora—Active drilling is being done by the Oliver company on Mesaba Lake, which lies in the S. W. ¼-N. W. ¼ of Section 27-59-15. The drills are set up on the ice.

The Mohawk mine, a Pickands-Mather property, has laid off one shift, affecting about sixty men. The mine will operate on a one-shift basis.

Gilbert—Pickands Mather recently announced a 15 per cent wage reduction effective Feb. 1. This affects the Scranton, Albany and Utica mines, of Hibbing, the Elba and Corsica, of Gilbert, the Belgrade, of Biwabik, and the Mohawk, of Aurora.

CHRONOLOGY OF MINING

January, 1921

Jan. 1—Wages reduced by many companies in Michigan, Minnesota, Idaho, Nevada and elsewhere.—Reduced freight rates on ores from Cœur d'Alene to East Helena, Mont., in effect.—Zenith Furnace Co., Duluth, Minn., blew out furnaces for indefinite period.—Guggenheim Brothers began acting as sales agents for copper companies formerly selling output through American Smelting & Refining Co.

Jan. 3—Colorado Metal Mining Association met with Colorado Chapter of American Mining Congress at Denver, Col.

Jan. 12—Hearings on tariff revision on metal imports opened by House Ways and Means Commtitee.—T. F. Ward, president of Ward Copper Co., found frozen to death near Teller, Alaska.—Operators in Mohave County, Ariz., met at Kingman and decided on general reduction in pay, beginning Feb. 15.

Jan. 14—American claimants to Naica mining property, Mexico, file memorandum with U. S. Department of State.—Purchasing agents for copper mines and smelters in Southwest met at Bisbee, Ariz.

Jan. 15—Calumet & Sonora Mining Co., Cananea, Sonora, started new power plant.—Silversmith mill at Sandon, B. C., stopped by water shortage and market conditions.—New Jersey Zinc Co., Palmerton, Pa., reduced wages 10 per cent and dropped 8 per cent bonus system.

Jan. 17—Superintendents of Bureau of Mines experiment stations west of the Mississippi River met at San Francisco to plan future investigations.—Rex mine, Herb Lake, Ont., started mill. Hearing held at Wilmington, Del., on supplemental bill to bring Minerals Separation North American Corporation into its suit against Miami Copper Co., argument being set for Feb. 21.—Cananea Consolidated Copper Co. completed shutdown at Cananea, Sonora.—Davidson Consolidated shareholders decided to sell out to English syndicate.

Jan. 19—Arguments concluded in suit between Silver King Coalition and Conkling mining companies at Park City, Utah.

Jan. 20—Experiment station at Reno, Nev., opened.—California Legislature adopted resolution endorsing the McFadden Gold Bonus Bill.

Jan. 23—Rico Consolidated Mining Co., Rico, Col., awarded decision in apex suit against Rico Argentine Mining Co.

Jan. 24—Superintendents of the Western experiment stations of Bureau of Mines met [illegible] a two-day conference.—U. S. Supreme Court set aside sale of [illegible] Gold & Silver Mining Co. to Anaconda Copper Co. on ground of an [illegible] price.

Jan. 26—Minnesota Senate Commission reported on the [illegible] and peat deposits on state lands.

THE MARKET REPORT

Daily Prices of Metals

Feb.	Copper, N. Y. net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
3	12.50	27.50	30.75@31.00	4.60	4.50	4.95@5.05
4	12.50@12.75	29.00	31.75@32.50	4.60	4.45@4.50	4.95@5.05
5	12.50@12.75	29.00	31.75@32.00	4.60	4.45	4.95@5.05
7	12.75	29.00	33.00@33.25	4.60	4.40	4.95@5.05
8	12.75	28.50	32.25@32.75	4.60	4.35	4.95@5.05
9	12.75	27.75	31.75@32.00	4.60	4.35	4.95@5.05

*These prices correspond to the following quotations for copper, "delivered": 12.75, 12.75@13, 12.75@13, 13, 13, and 13c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Feb.	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
3	68¼	68⅞	76	155½	161½	22½	23	23¾	24¼
4	69¼	70¼	76½	164	169¼	22¾	23¼	24¼	25
5									
7	72	72⅜	77	166½	172	22⅝	23⅛	24¾	25½
8	72	72½	78	164	169	22½	22⅞	25⅜	26⅜
9	72	72½	78	161¼	167¼	21⅝	22⅞	25⅞	26⅞

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Feb.	Sterling Exchange	Silver New York, Domestic Origin	Silver New York Foreign Origin	Silver London	Feb.	Sterling Exchange	Silver New York Domestic Origin	Silver New York, Foreign Origin	Silver London
[illegible]	383	99½	63⅛	37¾	7	383	99½	60½	36
4	[illegible]	99½	60	36¼	8	385⅞	99½	61⅜	36½
[illegible]	[illegible]	99½	60	36¼	9	387¼	99½	62	37

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, Feb. 9, 1921

No real change can be noted in the attitude of consumers during the last week, though the [illegible] and lead markets have been governed somewhat by outside influences. Most of the metal now on the market is in fairly strong hands, so that sharp and continued declines are not to be expected. On the other hand, consumers show no inclination to take advantage of existing low prices to lay in stocks and are not therefore likely to start any heavy buying movements which would cause a pronounced advance. Most of them have no surplus cash to finance such buying.

Transatlantic freight rates to England have at last been reduced somewhat, and yesterday $11 per long ton was quoted on copper and $9 on lead and zinc, a reduction of $2 from former prices.

Copper

Up to the hour of going to press no official announcement has been made as to the plans of financing export sales of copper. The information we gave last week, however, seems to be substantially accurate, and we can confidently say that 400,000,000 lb. of copper will be taken off the domestic market by this plan. It is said that the National City Bank and the Guaranty Trust Co. are to take care of the $40,000,000 debenture issue which is to be made. The companies which will pool part of their copper surplus for this purpose are apparently the same as those that make up the Copper Export Association, although it is understood that invitations to share in the arrangement have been extended to other companies.

Since these plans were announced, consumers have taken a little more interest in the market, and domestic sales have been in more satisfactory volume. Export business continues good also, the metal going principally to England, France, and Germany. Prices have tended firmer, and no copper can now be obtained for less than 13c. delivered for February-March delivery, or 13.25c. for the second quarter. As long as it can be sold for export at these prices or better, there is no chance of a reduction.

Lead

When all was going smoothly in the lead market, certain interests in St. Louis found, apparently, that they had more of the metal than they could handle, and on Monday began to take strenuous measures to unload. The price was depressed, and yesterday business was done at 4.35c. The credit situation is reported to be more acute in the Middle West, and the banks there are apparently refusing further to advance money on metal stocks. Just how much of this lead is to be thrown on the market we do not know. One rumor says close to 10,000 tons. Some sales have been made in New York above the price which we quote; in fact, we have reports of lead sold last Saturday at 4.82c. On the other hand, we have heard of good corroding lead which ordinarily commands 15 points premium, selling for 4.675c. As rather large tonnages have been marketed at 4.60c., we consider this a fair price. At present there is little if any difference between prompt and forward delivery. It is unlikely that the depressed St. Louis price will affect New York unless the difference exceeds 50 points, which is approximatly the freight rate between the two cities.

Zinc

No perceptible change can be noted in the zinc market, which continues dull, with many producers out of the market. The majority of American zinc smelters are closing down. High-grade zinc in fair demand at 7c.

Tin

The Straits government, it is rumored, has reduced the price which it will charge for the product of that country from the equivalent of £236, London, to £203. This has not been confirmed, but the report is generally given credence here. The New York market continues quiet, with a few small sales for February, March and April delivery.

Straits tin for future delivery: Feb. 3d, 32@32.50c.; 4th, 32.75@33.50c.; 5th, 32.75@33.50c.; 7th, 33@33.75c.; 8th, 33.25@33.50c.; 9th, 32.25@32.50c.

Arrivals of tin, in long tons: Feb. 1st, Straits, 625; Marseilles, 25; London, 250; 3d, China, 10; 4th, Straits, 50; 8th, Liverpool, 35; London, 25.

Silver

The local market has fluctuated within a range of about 2c. for the last week and the volume of business has been small. In London a wide spread again appeared between the spot and future quotations, spot being quoted today at 37d., whereas futures are 2d. lower at 35. This condition is also reflected in the price which London is bidding for prompt shipment from New York, which is below London spot price. There is evidently a squeeze for spot delivery in London, but whether this is on account of scarcity of silver for immediate shipment to India, or attributable to covering by shorts, is uncertain. Another factor which tended to bring about this condition in London was the closing down of refineries at the end of the year, thereby causing a temporary shortage of supplies; but as they are again working and there is plenty of melted silver coins in London, the position should soon become more nearly normal.

Mexican Dollars.—Feb. 3d, 48⅜; 4th, 45⅝; 5th, 45⅝; 7th, 45¾; 8th, 46⅞; 9th, 47¼.

Gold

Gold in London: Feb. 3d, 106s. 9d.; 4th, 106s. 9d.; 7th, 107s.; 8th, 106s. 6d.; 9th, 106s.

Foreign Exchange

Sterling continues its advance toward $4, and other foreign exchanges show firmer tendencies. On Tuesday, Feb. 8th, francs were 7.18c.; lire, 3.645c.; and marks, 1.66c. New York funds in Montreal, 13 per cent premium.

Other Metals

Aluminum.—List prices of 28@28.5c. are nominal. Outside market 24@25c.

Antimony — Chinese and Japanese brands, 5¼c.; market quiet. W.C.C. brand, 6¼@6½c. per lb. Cookson's "C" grade, spot, 9⅜c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony[1] (200 mesh), 7@7½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 7c.

Bismuth—$2.25@$2.35 per lb., 500 lb. lots.

Cadmium—Nominal, $1.40 per lb., in 1,000 lb. lots.

Cobalt—Metal, $4.50 per lb.; black oxide, $3@$3.10 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $325 per oz.

Magnesium — Crude, 99 per cent, $1.25@$1.35 per lb., f.o.b. Philadelphia.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 38@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—Firm at $70 per oz.

Quicksilver—Nominally $50 per 75-lb. flask. San Francisco wire missing today.

[1]**Rhodium**—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 50@55c. per long ton unit, f.o.b. Atlantic ports.

Manganese Ore—35@40c. per unit, seaport; chemical ore (MnO_2) $60 per gross ton, lump; $65@$70 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

[1]**Tantalum Ore**—Guaranteed minimum 60 per cent tantalic acid, 40c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¼@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Feb. 5—Zinc blende, per ton, high [illegible], basis 60 per cent zinc, premium, $22.50; Prime Western, [illegible]; [illegible] and slimes, [illegible]. Average settling price, all zinc ores, $27.29.

Lead, high, $52.10; basis 80 per cent lead, $47.50@$45. Average settling price, all lead ores, $50 per ton.

About three-fifths of the 5,600 tons bought this week was purchased Saturday, Sunday, and Monday on $25 basis, the price dropping in midweek to $22.50 and today to $20 basis.

Shipments for the week: Zinc blende, 4,775; lead, 857 tons. Value, all ores the week, $173,370.

Reports that the Waco mines would close tonight lack confirmation, but the larger producing company is seriously considering closing down. About fifty mines have been operating in the Oklahoma-Kansas area in the last week, several of which cannot meet operating expenses, with today's offerings of zinc blende down to $20 basis.

Platteville, Wis., Feb. 5.—No quotations for zinc or lead ores. Shipments for the week: Zinc ore, 446; lead ore, 40 tons. Shipments for the year: Zinc ore, 4,645; lead ore, 430 tons. Shipped during the week to separating plants, 908 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $2,000@$3,500; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, $23; ground (white), $45; ground (off color) $30@$32 per net ton, less than carload lots, f.o.b. New York. Crude, first grade, $10 per ton, f.o.b. cars, Missouri; floated, $28 per ton in bbls.; $26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis.

Chalk—English, extra light, 5@5½c.; light, 5@6c.; dense, 4½@5c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$12; washed, $12@$15; powdered, $18@$22; bags extra, per net ton, f.o.b. mines, Georgia; crude, $8@$12; ground, $15@$40, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $25@$35; powdered, $30@$35, f.o.b. New York.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $25 per ton, f.o.b. Illinois mines, and $25.50, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, $60; lump, $15, f.o.b. Tonuco, N. M. In Canada

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

85 per cent calcium fluoride sells for $20 per ton, f.o.b. Madoc; output limited. Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines.

Fuller's Earth—$16 per ton, carload lots, f.o.b. mines.

Graphite—Ceylon lump, first quality, 8@9c. per lb.; chip, 7c.; dust, 5½c. No. 1 flake, 7½c.; high-grade amorphous crude, 3c. No change.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Dolomite, 1@2 man size, $1.60@$1.65; 2@8 in., $1.55@$1.65 per net ton, f.o.b. Plymouth Meeting, Pa.; fluxing, $1.65@$1.75 per net ton, f.o.b. Howellville, Pa.

Magnesite, Calcined—High-grade caustic calcined, lump form, $35@$40 per ton, carload lots, f.o.b. California points. In Chicago district, $57.70; Atlantic seaboard, $61@$63.

Dead-Burned—$38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); all f.o.b. New York.

[1]**Monazite**—Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $13; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $8.35; 68 per cent, $7.85; 68@66 per cent, $7.60. Finely ground Tennessee rock sells for $8.50 per net ton for 13 per cent phosphorus content, agricultural application; for acid-making, 14 per cent, $9; both prices f.o.b. Centerville, Tenn.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 16½c.; Spanish lump, 14@16c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1½ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Sand (Glass)—Dry glass sand, $4 per net ton, f.o.b. cars Mapleton, Pa. Sand, f.o.b. Ottawa, Ill., is $3 per ton; $2.50 on annual contracts. Sand at Klondike, Gray Summit and Pacific, all in Missouri, is $2.50 on contract; some outside sales have been made at $4. St. Louis, open market, at $3.50; contract price on large quantities, $2.50; on small quantities, $3.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$45, talcum powder grade. Southern talc, powdered, carload lots, $12@$15 per ton; less than carload, $25, f.o.b. cars; freight to New York $5.25 per ton, carload lots; less than carload lots, $9.25. Imported, $40@$50; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 10¾@11c. per lb.; sulphide, powdered, 15@15½c. per lb. in carload lots.

Sodium Nitrate—$2.85@$3 per cwt. ex vessel, Atlantic ports. Market quiet.

Sodium Sulphate—For 95 per cent material, $22 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract.

Potassium Sulphate—Domestic, $220@$230 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrocarbontitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 16@17c. per lb. of chromium contained; 4 to 6 per cent carbon, 17@18c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $100, f.o.b. furnaces; resale, $90, delivered; English, $100, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $40@$45, f.o.b. furnace.

[1]**Ferromolybdenum**—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $55@$65; 50 per cent, $78@$80.

Ferrotungsten—Domestic, 70 to 80 per cent W, 55@60c. per lb. of contained tungsten, f.o.b. works. Foreign, 60c.

Ferro-uranium—35 to 50 per cent U, $7 per lb. of U contained, f.o.b. works.

Ferrovanadium—Basis 30 to 40 per cent, $5 per lb. of V contained, plus 75c.@$2 differentials and according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York list price, 21½c. per lb.; wire, 15¾.

Lead Sheets—Full lead sheets, 8½c.; cut lead sheets, 8¾c. in quantity, mill lots.

Nickel Silver—33½c. per lb. for 18 per cent nickel.

Yellow Metal—Dimension sheets, 19¾c.; sheathing, 19⅝c.; rods, ⅜ to 3 in., 16¾c.

Zinc Sheets—$11 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $80 per net ton, shipping point; arches, keys, wedges, $85; splits, soaps, $100.

Fire Brick—First quality, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $45@$50.

Magnesite Brick—9-in. straights, $100 per net ton; 9-in. arches, wedges and keys, $105; soaps and splits, $120.

Silica Brick—9-in., per 1,000: Chicago district, $65@$70; Birmingham, Ala., $56@$61; Mount Union, Pa., $50@$60.

The Iron Trade

Pittsburgh, Feb. 8, 1921

The chief change in the steel situation is that the United States Steel Corporation's operations are now beginning to decline with considerable speed, more than four months after independent mill operations began to decline, the difference in position being due to the large amount of stable business the Corporation had put on its books in 1920 when it maintained Industrial Board prices while the independents made large advances. During the four months the Steel Corporation has had even heavier production than in the four months preceding, when there were serious transportation difficulties. Independent mill operations are at about 30 per cent of capacity, and the Steel Corporation's production is probably now below 90 per cent.

A mild improvement in buying of steel products is to be expected for March, but hardly such as would warrant production at as heavy a rate, in the aggregate, as now obtains.

Prices of steel products are well maintained, with the exception of quotations for plates. The steadiness of prices betokens no fundamental strength however, being attributable chiefly to the absence of inquiry involving desirable orders. Plates can be had at 2.50c., against the Industrial Board price of 2.65c., maintained by the Steel Corporation and some independents.

Semi-finished Steel—Quotations continue nominal at $45 for billets and $47 for sheet bars.

Pig Iron—Foundry iron is offered at $29, Valley, or $1 under the previous nominal market. Bessemer and basic remain nominally quotable at $32 and $30, Valley basis.

Charcoal and Coke

Charcoal—Willow, 7c. per lb. in bbls., hardwood, 5½c. per lb., in 250-lb. bbls. Barrel charge is 35c. additional.

Connellsville—Furnace, $4.50@$5; foundry, $6@$6.50.

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Increase of Post-War Copper Consumption in Germany

Special Foreign Correspondence of the "Engineering and Mining Journal"

BERLIN, Feb. 1—Soon after the outbreak of the war, the copper shortage made itself felt in Germany and rendered the employment of substitute metals necessary. Of the many materials that were put to a practical test and which proved their serviceableness to a greater or less extent, iron, zinc, and aluminum played an important rôle, and it was generally assumed that a restriction in the consumption of foreign copper in favor of approved inland substitutes would enter into consideration for economical reasons after the war.

Two years have passed since the conclusion of hostilities, and though the raw-material problem presents one of the most burning questions to German industry, owing chiefly to the enormous depreciation of the German currency, it is interesting to know that, contrary to expectations, the consumption of copper is steadily increasing in spite of its high cost. In the electrical industry—which heads the list of the copper-consuming industries, with 40 per cent of the total consumption prior to the war—substitute materials have almost disappeared, and in the other industries, too, the process of "substituting the substitute by the real thing" is progressing apace.

This fact is accounted for principally by two reasons: First, it is increasingly recognized that even the best of substitutes are lacking some of the most peculiar and important properties of copper. Its high conductivity, chemical resistance, malleability, ductility—to mention only the pressing and stamping of small brass parts—are features of which no substitute material of construction can boast.

By far the most important fact, however, responsible for the unanticipated increase of copper consumption, a fact which it was impossible to predict during the war with any fair degree of accuracy, is the enormous increase in cost of labor. The average wages for a turner in Germany prior to the war were approximately 0.60 to 0.70 marks an hour, whereas 6 to 7 marks an hour are being paid at the present time, and experience has conclusively proved that the cost of manufacture for copper and copper-alloy parts is in almost every case lower than for parts made of any other material, particularly of iron. This fact is especially noticeable in the making of smaller parts requiring many operations, where, according to a report by one of the leading German electrical concerns, it was found more economical to make certain small screws of brass rather than of iron, despite the disparity in the costs of material.

Aluminum proved by far the most suitable substitute for copper, and the all-round serviceableness of that material was of great advantage to the German war-material industries, particularly during the later stages of the war, when the scarcity of other metals made itself severely evident. There can be no doubt that aluminum as a material of construction for all-round purposes has come to stay, with the exception, perhaps, of the cable and insulated-wire industry. The employment of aluminum in lieu of copper in this particular industry is gradually decreasing, owing to the fact that the greater electrical resistance of aluminum renders an increase in the sectional area of the wire necessary, the saving in the cost of the metal thus becoming illusory, particularly in view of increased production costs.

In conclusion, it may be stated that the increase in copper consumption is, in a measure, also due to competitive reasons. The German industry meeting with stiffening competition in the world's markets, greater care than heretofore must be bestowed upon the turning out of "quality first" work, and it is realized that "Ersatz" will be unable to hold its own against the "real thing" in the long run—even in the face of lower prices. The realization of this fact finds expression in propaganda and advertising matter where stress is laid upon the absence of all substitutes. "Warranted Peace-Time Material," "No Substitutes Enter Into the Construction of Our Products," "No War Substitutes Employed," are slogans frequently noted.

Average Prices of Principal Metals for Twenty-Six Years—1895-1920

	Copper		Lead		Tin		Zinc			Antimony	Quicksilver	Aluminum	Silver	
	Electrolytic	Standard												
Year	New York	London	New York	London	(f) New York	London	New York	St Louis	London	New York	New York	New York	New York	[illegible]
1895	10 760(c)		3 23		14 05	63 333	3 63			7.560	39 58	58 66	65 250	..
1896	10 880(c)		2 98		13.29	59 49[illegible]	3 94			6 650	37 00	50.75	67 060	
1897	11 290(c)		3 58	12.367	13.67	61 400	4 12			6 750	38 50	39 00	59 79	
1898	12 030(c)		3 78	12.983	15 70	71 204	4 57			8 690	40 70	30 58	58 260	
1899	16 67		4 47	14.933	25.12	122 329	5.75			9 430	43 63	32 72	59 [illegible]	1[illegible] 22
1900	16 19		4 37	16 987	29 90	133 [illegible]	4 39			9 500	51 00	32 72	61 [illegible]	18 00
1901	16.11		4 33	12 521	26 74	118 633	4 07			8 250	47 00	33 00	5[illegible]	20 00
1902	11 626	52 460	4 069	11 262	26 79	120 720	4 84			6 120	48 03	33 00	[illegible]	19 00
1903	13.235	57 970	4 237	11 579	28.09	127 320	5 40	5 191		6 000	41 32	33 00	[illegible]	18 91
1904	12.823	58 884	4 309	11 983	27 99	126 [illegible]	[illegible] 100	4 931		6 371	41.00	35 00	[illegible]	19 50
1905	15 590	69 465	4 707	13 719	31.358	14[illegible]	[illegible] 882	5 730	25 433	10.250	38 50	35 00		20 54
1906	19 278	87 282	5 657	17.370	39 819	18[illegible]	6 198	6 048	27 020	21 730	40 90	35 75		28 04
1907	20 004	87 007	5 325	19 034	38.166	17[illegible]	5 962	5 812	23 771	14 840	41 50	45 00		30 [illegible]
1908	13.208	59 902	4.200	13 439	29 465	[illegible]	4 726	4 578	20 163	8 004	44 84	28 7[illegible]		[illegible]
1909	12 982	58 732	4 273	13 042	29 725	[illegible]	5 503	5 352	22 185	7 466	46 30	22 [illegible]		[illegible]
1910	12 738	57 054	4 446	12 920	34.123	[illegible]	5 520	5 370	23 050	7 386	47 06	22 [illegible]		32 70
1911	12 376	55 973	4 420	13 970	42 281	[illegible]	5 758	5 608	25 281	7 540	46 54	20 [illegible]		4[illegible]
1912	16 341	72 942	4 471	17 929	46 096	209 420	6 943	6 799	26 421	7 760	42 46	2[illegible]		45 55
1913	15 269	68 335	4 370	18 743	44 252	[illegible]	5 648	5 504	22 746	7 520	39 54	2[illegible]		44 88
1914	13 602	61 524(c)	3 862	19 076(c)	34 301	[illegible]	5 213	5 061	22 544(c)	8 763	48 31	[illegible]		4[illegible]
1915	17.275	72 532	4 673	22 917	38 590	[illegible]	13 230	13 054	67 533	30 280	87 01			[illegible]
1916	27 202	116 059	6 858	31 359	43 480	[illegible]	12 804	12 634	72 071	25 370	125 49			[illegible] 40
1917	27.180	124 892	8 787	30 500	61 802	[illegible]	8 901	8 730	52 413	20 690	106 30			[illegible]
1918	24 628(c)	115 530	7 413	30 100	[illegible]	[illegible]	8 159	7 890	54 180	12 581	123 47			[illegible]
1919	18 691	90 796	5.759	28 590	63 328		7 [illegible]	6 988	42 879	8 [illegible]	92 15			114 61
1920	17 456	97 480	7.957	37 832	48 273			7 [illegible]71	44 372	8 485	81 12			110 90

(c) Prices of the London, from 1895 to 1914 [illegible] (f) Prices 1895 to [illegible] Average of nine [illegible] quotations being made [illegible] Average of 11 months [illegible] average [illegible] 99 per cent.

Quotations for copper, lead, tin, zinc, antimony, and aluminum in New York or St. Louis are in cents per pound. Quicksilver [illegible] silver and platinum are quoted in dollars per [illegible]

MINING STOCKS

Week Ended February 5, 1921

Stock	Exch	High	Low	Last	Last Div.	
COPPER						
Adventure	Boston	*60	*60	*60		
Ahmeek	Boston	53	50	51	Sept '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	⅝	½	⅝		
Allouez	Boston	21	21	21	Mar. '19	1.00
Anaconda	New York	40	38½	38⅞	Nov. '20, Q	1.00
Arcadian Consol	Boston	3⅛	2¾	3		
Ariz. Com'l	Boston	8¼	8	8	Oct. '18,	50
Big Ledge	N. Y. Curb	[illegible]	[illegible]	⅛		
Bingham Mines	Boston	8¼	8¼	8¼	Sept. '19, Q	25
Calumet & Arizona	Boston			49½	Dec. '20, Q	1.00
Calumet & Hecla	Boston	250	245	248½	June '20, Q	5.00
Canada Copper	N. Y. Curb			*13		
Centennial	Boston	10	9⅞	9⅞	Dec. '18, SA	1.00
Cerro de Pasco	New York	30¼	27¾	28	Dec. '20, Q	1.00
Chile Copper	New York	12⅛	11¾	12¼		
Chino	New York	23½	22	22½	Sept '20, Q	37½
Columbus Rexall	Salt Lake	33	*32½	*32½		
Con. Arizona	N. Y. Curb			1/16	Dec. '18, Q	05
Con. Copper M.	N. Y. Curb			2⅛		
Copper Range	Boston	34¼	33	33⅜	Sept. '20, Q	50
CrystalCopper (new)	Boston Curb	47	40	*41		
Davis-Daly	Boston	7	6¼	6¼	Mar. '20, Q	25
East Butte	Boston	9	9¼	9⅛	Dec. '19, A	50
First National	Boston Curb	95	87	*87	Feb. '19, SA	15
Franklin	Boston	2¼	2¼	2½		
Gadsden Copper	N. Y. Curb			*25		
Granby Consol	New York	23	22⅝	22⅝	May '19, Q	1.25
Greene-Cananea	New York	23	23	23	Nov. '20, Q	50
Hancock	Boston			3¼		
Howe Sound	N. Y. Curb			3½	Jan. '21, Q	05
Inspiration Consol	New York	35¼	34¾	35¼	Oct. '20, Q	1.00
Iron Cap	Boston Curb	7	6½	6½	Sept. '20, K	25
Isle Royale	Boston	20½	19¾	19¾	Sept '19, SA	50
Kennecott	New York	20¼	18⅞	19	Dec. '20, Q	50
Keweenaw	Boston	1¼	1¼	1¼		
Lake Copper	Boston	3	3	3		
La Salle	Boston			2		
Magma Chief	N. Y. Curb			*21		
Magma Copper	N. Y. Curb	23¼	22¼	23¾	Jan '19, Q	50
Majestic	Boston Curb			*8		
Mason Valley	Boston			1¼		
Mass Consolidated	Boston			2¾	Nov. '17, Q	1.00
Mayflower-Old Col	Boston	4½	4	4¼		
Miami Copper	New York	19⅛	18⅛	18½	Jan '21, Q	50
Michigan	Boston	3	3	3		
Mohawk	Boston	46½	45	46	Nov '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5½	5¼	5⅜		
Nevada Consol	New York	11¼	10⅞	11½	Sept '20, Q	25
New Baltic	Boston Curb			3		
New Cornelia	Boston	16	16	16	Aug '20, K	.25
Nixon Nevada	N. Y. Curb			*5		
North Butte	Boston	12¼	11¼	11¼	Oct '18, Q	.25
North Lake	Boston			½		
Ohio Copper	N. Y. Curb			[illegible]		
Old Dominion	Boston	19¼	19½	19¾	Dec. '18, Q	1.00
Osceola	Boston	27	27	27	June '20, Q	50
Phelps Dodge	Open Mar.		†165	....	Jan. '21, Q	2.50
Quincy	Boston	39	39	39	Mar. '20, Q	1.00
Ray Consolidated	New York	13¼	13¼	13½	Dec. '20, Q	.25
Ray Hercules	Boston Curb	*63	*50	*63		
St. Mary's Min. Ld	Boston	33	33	33	June '20, K	2.00
Seneca Copper	Boston			19		
Shannon	Boston	1¼	1¼	1¼	Nov. '17, Q	.25
Shattuck Arizona	New York	6	5½	6	June '20, Q	25
South Lake	Boston			1		
Superior Copper	Boston	4¼	4	4⅛	Apr. '17,	1.00
Superior & Boston	Boston	1½	1½	1½		
Tenn. C. & C. cfs	New York	8¼	8¼	8½	May '18, I	1.00
Toulumne	Boston	*55	50	50	May '13,	10
United Verde Ex.	Boston Curb	28¼	26	27	Nov '20, Q	50
Utah Consol	Boston	5	4	4½	Sept. '18,	25
Utah Copper	New York	57¼	55¼	[illegible]	Dec '20, Q	1.50
Utah M. & T	[illegible]	2	1	1½	Dec '17,	30
Victoria	[illegible]			2		
Winona	[illegible]			7½		
Wolverine	[illegible]	13	12	12		
NICKEL-COPPER						
Internat. Nickel	New York	15½	15	15½	Mar '19,	50
Internat. Nickel, pf	New York	80¼	80¼	80¾	Nov. '20, Q	1.50
LEAD						
National Lead	New York	72	72	72	Dec. '20, Q	1.50
National Lead, pfd	New York			103	Dec '20, Q	1.75
St. Joseph Lead	New York	[illegible]	11½	12½	Dec. '20, QX	50
Stewart Mining	Boston Curb			6	Dec '15,	05
ZINC						
Am. Z. L. & S.	New York	[illegible]	[illegible]	[illegible]	[illegible] '17,	1.00
Am. Z. L. & S. pfd	New York	28	[illegible]	[illegible]	[illegible] '20, Q	1.50
Butte C. & Z.	New York	[illegible]	[illegible]	[illegible]	[illegible] '18,	50
Butte & Superior	New York	13	[illegible]	[illegible]	Sept '17,	1.25
Callahan Zn-Ld	New York	[illegible]	[illegible]	[illegible]	Dec. '20, Q	50
New Jersey Zn	N. Y. Curb			157	Nov. '20, Q	4.00
[illegible]	N. Y. Curb	[illegible]			[illegible] '16,	03
Yellow Pine	Los Angeles	[illegible]	[illegible]	[illegible]	Sept '20, Q	03

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

Stock	Exch.	High	Low	Last	Last Div.	
GOLD						
Alaska Gold	New York	1	⅞	1		
Alaska Juneau	New York	1⅛	1⅛	1⅜		
Carson Hill	N. Y. Curb.	....	....	22¾		
Cresson Consol. G.	N. Y. Curb	....	....	1¼	June '20, Q	$0.10
Dome Extension	Toronto	*45	*45	*45		
Dome Mines	New York	12¾	12¼	12⅜	Jan. '21, Q	.25
Golden Cycle	Colo. Sprgs.	†*65	†*63	*73	Dec. '20, Q	.02
Goldfield Consol.	N. Y. Curb	*8½	*7	*7½	Dec. '19,	.05
Hollinger Consol.	Toronto	6.70	6.45	6.60	Dec. '20, BM	.05
Homestake Mining	New York	50	50	50	Sept. '19,	.50
Kirkland Lake	Toronto	*50	*49	*49		
Lake Shore	Toronto	1.24	1.20	1.21	Jan. '21, K	02
McIntyre-Porcupine	Toronto	1.87	1.85	1.85	Jan. '21, K	.05
Porcupine Crown	Toronto	*22	*21	*21	July '17,	.03
Portland	Colo. Sprgs	†*55	†*48	*60	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*5	*4	*5	May '19,	.05
Silver Pick	N. Y. Curb	*9½	*7	*7½		
Teck Hughes	Toronto	*11½	*10	*10½		
Tom Reed	Los Angeles	1.15	1.06	1.09	Dec. '19,	.02
United Eastern	N. Y. Curb	2½	2⅜	2 7/16	Oct. '20, Q	.15
Vindicator Consol.	Colo. Sprgs.	†*22	†*17	*18	Jan. '20 Q	.01
West Dome Consol.	Toronto	*10	*9¼	*10		
White Caps Mining	N. Y. Curb	*9½	*8	*8½		
Yukon Gold	Boston Curb	....	....	*60	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*28	*24	*24	Apr. '20, M	03
Batopilas Mining	New York	1	1	1	Dec. '07, I	12½
Beaver Consol.	Toronto	*37½	*36	*37	May '20, K	03
Coniagas	Toronto	2.00	2.00	2.00	Nov. '20, Q	12½
Crown Reserve	Toronto	*18	*18	*18	Jan. '17,	.05
Kerr Lake	Boston	..	..	3	Jan. '21, Q	12½
La Rose	Toronto	*32½	*32	*32	Apr. '18,	02
McKinley-Dar.-Sav.	Toronto	..		*28	Oct. '20, Q	03
Mining Corp. Can.	Toronto	1.15	1.05	1.10	Sept. '20, Q	12½
Nipissing	N. Y. Curb	8¼	8	8¼	Jan. '21, QX	50
Ontario Silver	New York	5½	5	5	Jan. '19, Q	50
Ophir Silver	N. Y. Curb	¾	⅝	⅝	Jan. '12,	10
Peterson Lake	Toronto	*10½	*9	*9½	Jan. '17,	.01¼
Temiskaming	Toronto	..	..	*24	Jan. '20, K	04
Trethewey	Toronto	*19½	*17½	*17½	Jan. '19,	05
GOLD AND SILVER						
Atlanta	N. Y. Curb	*2	*1½	*1½		
Barnes-King	Butte	‡....	....	1.11	Aug. '20, Q	.05
Boston & Montana	Boston	....	....	*63		
Cashboy	N. Y. Curb	*8½	*7	*7½		
El Salvador	N. Y. Curb	9/16	⅜	7/16		
Jim Butler	N. Y. Curb	*19	*17	*19	Aug. '18, SA	07
Jumbo Extension	N. Y. Curb	*7½	*6	*7	June '16,	.05
Louisiana Con.	N. Y. Curb	....	..	¼		
MacNamara M.& M.	N. Y. Curb	*17	*16	*17	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Oct. '20, QX	.50
Tonopah-Belmont	N. Y. Curb	1⅝	1½	1 1/16	Jan. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1⅜	1 3/16	1¼		
Tonopah-Extension	N. Y. Curb	1⅝	1 7/16	1 9/16	Jan. '21, Q	.05
Tonopah Mining	N. Y. Curb	1½	1⅜	1 7/16	Oct. '20, SA	.05
West End Consol.	N. Y. Curb	1⅛	1	1 1/16	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N.Y. Curb	*17	*14	*14½	July '20, M	01
Cardiff M. & M.	Salt Lake	1.15	1.15	1.15	Dec. '20,	15
Chief Consolidated	Boston Curb	3	2¾	3	Nov. '20, Q	10
Consol. M. & S.	Toronto	21	19¼	20	Oct. '20, Q	62½
Daly Mining	Salt Lake	...	....	2.50	July '20, Q	.10
Daly-West	Boston	3⅞	3⅞	3⅞	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	....	....	2⅛	Dec. '20, K	.25
Electric Point	Spokane	*8½	*7½	*8	May '20, SA	.03
Federal M. & S.	New York	8	8	8	Jan. '09,	1.50
Federal M. & S., pfd.	New York	27½	27½	27½	Dec. '20, Q	1.75
Florence Silver	Spokane	*16	*15	*15	Apr. '19,	.01¼
Grand Central	Salt Lake	..	....	*37½	June '20, K	.03
Hecla Mining	N. Y. Curb	4¼	4	4¼	Dec. '20, QX	.15
Iron Blossom	N. Y. Curb	¼	3/16	¼	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	...	....	3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	10	*8½	*10		
Prince Consol.	N. Y. Curb	5/16	¼	5/16	Nov. '17,	02½
Rambler-Cariboo	Spokane	8½	*7½	*8	Feb. '19,	01
Rex Consol.	N. Y. Curb	6	*5	*6		
South Hecla	Salt Lake	.	.	*70	Sept. '19, K	.15
Standard Silver-Ld	N. Y. Curb	1/16	1/16	1/16	Oct. '17,	.05
Tamarack-Custer	Spokane	2.00	1.90	2.00	Jan. '21, K	.04
Tintic Standard	Salt Lake	3.27½	3.15	3.25	June '20, Q	10
Utah Apex	Boston	2⅛	2⅛	2⅛	Nov. '20, K	25
Wilbert Mining	N. Y. Curb	3½	*2½	*3	Nov. '17,	01
QUICKSILVER						
New Idria	Boston			*95	Jan. '19,	.25
VANADIUM						
Vanadium Corp	New York	37¼	35½	36¼	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp	Montreal	[illegible]	80	80½	Oct. '20, Q	1.50
Asbestos Corp., pfd	Montreal			95	Oct '20, Q	1.75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref	New York	43½	39¼	42	Dec. '20, Q	1.00
Amer. Sm. & Ref. pf	New York	82½	81½	82½	Dec. '20, Q	1.75
Am. Sm. pf. A	New York	66	66½	66½	Jan '21, Q	1.50
U. S. Sm. R. & M.	New York	34½	33¼	33½	Jan '21, Q	50
U. S. Sm. R. & M. pf	New York	43¼	43¼	43½	Jan '21, Q	.87½

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Assisting Deflation

WITH THE FALLING OF PRICES and the long-wished-for tendency to return to normal costs of living, we should and do look with disfavor upon any item which seems to be stemming the tide, like the salmon swimming upstream. And the weight of this popular sentiment hastens the shading of profits and the declining course of charges.

With the deflation of business and of currency, it occurs to us that there might well go along a deflation of sentiment and mode of living. The inflated sentiment and manner of life we should define as that which pins its faith on money—and ever more money. Whereas in former years there were campaigns for religious or philosophical or political converts and for higher modes of living, in our modern times these have been entirely replaced by drives for cash. It is true that this money represents tangibly the belief in good causes, is the potent factor in carrying them out, and is more effectual than a mere show of hands: but this faith in the power and necessity of the dollar, and the practice of gathering it in, has been overdone and inflated.

Our living standards also have become puffed up. "No more," recently wrote a woman newspaper contributor, "do we look for the workingman in the slums: we seek for him in the evening in the good hotels, wearing his evening clothes with as good a grace as the rest." Extreme as this is, it is symbolic of the real inflation: even the conventional attire of the white-collar class has been modified by subtle sartorial suggestion many times since we can remember, to the ultimate profit of the manufacturer, the greater consumption of goods, and the more feverish and exhausting struggling of the wage- or salary-worker to fulfill all the set standards.

To these higher standards of luxury the white-collar class has sacrificed its posterity: in a vast number of cases the self-pampering, the nattier dress, larger house, and more costly food appropriately coincide with the termination of the race—the inflated standard is too high for a family to live by.

A deflation of the money-psychology might well promote those more genuine things in life, like character and the art of gentle living, in which modernity is not conspicuous. And this brings us to wonder whether it is really more money that is needed in many of the cases where the demands for it are made, or an increase of organization and efficiency, a return to Puritan simplicity, the study of the promotion of quality rather than quantity, and the fostering of simple worth. And we wonder whether the colleges and Government institutions that clamor ever for more money—even our own Geological Survey and the Bureau of Mines need nothing else but money. And whether our mining societies like the American Institute of Mining and Metallurgical Engineers, and the Mining and Metallurgical Society, both of which are raising their dues this year, are properly deflating, or are expanding against the tide. It is true that the wave of deflation has not yet struck the New York printers, and this is one of the principal costs that both of these societies have to bear: but could not the quantity of the printed matter be at least somewhat reduced and the result be a net improvement?

From our own experience, having tried our remedy upon ourselves, we should say so. Our annual review number this year had 76 pages of text, against 130 pages of last year: and in our own opinion, and that of many subscribers who have commented, this year's issue was a great literary and technical improvement on that of last year. We did not have, as the societies have, any power of assessment against our subscribers or advertisers to continue our money-extravagance and quality-poverty course; we had no government from which to ask for more appropriation, and so we were forced to reform.

We believe that the societies could do the same. The Institute publishes many pages of printed matter that the protesting member receives, whether he will or no. The monthly bulletin of the Mining and Metallurgical Society is surely a modest affair: but the casual remarks of Tom, Dick, and Harry usually occupy some pages unnecessarily. Both societies make the economic mistake of forcing on the member bound volumes, with the bill therefore also peremptorily presented. Here there is a great and irritating waste. By all means do no binding unless for a member who wants it done. A simple inquiry sent to each member would determine how many copies are to be bound and who want them sufficiently to pay for them. Yesterday we pitched a beautifully bound volume of one of these societies, acquired in this involuntary way, into the waste basket; it was of no use to us.

The theory that the members of an engineering society will stand indefinitely for increases in its dues is one that, from certain signs we note, is likely to be exploded. Let us all reconsider and study, not expansion, but the beauties of deflation and simplicity. There is far too much printed stuff already; and the most meritorious present-day literary service is that of boiling it down to essentials.

The Dangers of Organization

LAST WEEK we pointed out the beauty of organization, and cited the aluminum industry as an example, in contrast to our debilitated copper industry. This week we are moved to point out the [illegible] fact that there are dangers in strength and efficiency; dangers that the strong, well-organized industry may not use its smooth-running power for you and me, but against us, and for itself alone. We do not know that the aluminum industry in America (which, as we observed last week, is a monopoly) does so use its power, but the temptation is always great, and at least one of its opponents has presented a very strong statement to that effect.

We publish on p. 336 a letter from a firm dealing with raw aluminum, presumably importers. The Aluminum Company of America has asked for an increase of tariff on raw aluminum. In reply, the writers of this letter have presented a counter-argument to Congress, in behalf, as they state, of a large number of independent aluminum founders and manufacturers. The writers profess themselves in sympathy with the policy of protecting home industry by the principle of the tariff, but they claim that the tariff demanded would, in this case, crush the whole aluminum industry except that controlled by the Aluminum Company of America; and that the Aluminum Company of America does not need any further protection. In support of this last statement, they cite the published earnings of this company for 1920, which totaled $10,000,000, or 60 per cent on the capitalization. They also cite the circumstance that "aluminum is the only non-ferrous metal produced in America on which the price is higher today than its normal price, or higher than the average price for ten years previous to the European war. The Aluminum Company of America has religiously endeavored to maintain a price of 33c., a price 60 per cent higher than the normal price."

The result of the tariff, these opposing importers believe, would be to put out of business those founders and manufacturers who may choose in their purchases of raw aluminum between European producers and the American monopoly, and enable the latter to fix their profits at any rate they desire. This American company, as they point out, owns the mines, furnaces, rolling mills, and factories to turn out the salable aluminum utensil from the ore; controls also Canadian aluminum, and not only the American bauxite mines, but the principal South American mines, those in British and Dutch Guiana. Also the American company obtains its coal from its own coal mines. A very neat and efficient combination, the business man will judge; and the only question which one might naturally ask is, "What are they going to do with it?"

There is doubtless another side to this particular tariff argument from that which our correspondent gives us: but, so far, we confess that we cannot feel that any tariff is necessary. On general principles, this is no time for discriminating against importation of goods from Europe; on the contrary, that is exactly what we must encourage to the utmost. In no other way—for she has little gold—can Europe repay us the vast debt she owes us; in no other way can she rehabilitate herself so that she can buy anew. Also, we have an instinctive faith that such a model combination as the Aluminum Company can maintain itself with the existing tariff. If it is the low exchange which enables European competition, in the company's opinion, to be threatening, that situation will adjust itself naturally, provided we put up no strong tariff walls.

What to do in the case of a great organization which becomes possessed of preponderating power in its industry is our present-day problem. The old remedy of smashing it, popular a decade ago, has no longer any firm adherents. Current thought and theory trend more naturally toward public regulation, in the interests of all. Yet public regulation that goes too far is destructive of that efficiency that inheres in great private organizations, as the Government's experience in handling the railroads shows. Politics is a more expensive burden for the public to bear than even monopolistic over-reaching. We have progressed far in diverse experiments, toward reaching the right solution, but we are not there yet.

Big Business at Home and Abroad

IT IS AN INTERESTING LIGHT upon our theories of economics and the proper control of business to note that the American people are coming to judge with different standards a company that operates at home and one that operates abroad. A striking illustration of that was the Webb Act, which authorized monopolistic business combinations, for the purposes of foreign trade, of exactly the same kind that legislation had been stern in making illegal within the boundaries of the Republic. Were the legislators who so plainly indicated that there was one principle for home and another for abroad interrogated as to their reasons for their theory, they would doubtless reply that it was "a condition, and not a theory, that confronts us." It was, in other words, clear to them that the only way for American business to compete abroad with the highly organized and centralized business of other countries was to adopt the same methods of close organization; and this in itself carries an acknowledgment of the increased efficiency of a high degree of organization, an acknowledgment which must perforce apply also to domestic business.

The same principle is coming up now in taxation: The Dyer bill provides for the Federal incorporation of American companies in China, and exempts them from excess-profits taxation on business done in China. This bill has been approved by the Ways and Means Committee of the House of Representatives, which insures its presentation to the House. The argument, we believe, is that the competitors of American companies in China do not have to sustain excess-profits taxes, which makes it difficult for American companies to compete; in that the "condition, not theory," again confronts us. If Congress decides this principle as before, it will be interesting to observe the further workings of it in the future.

Fallacious Gold Bonus Criticisms

RECENTLY our attention was called to a statement made in criticism of the McFadden Bill which read, "We are fully aware that, under the proposed plan, the mint would still pay the long-established price for gold; but if gold used in the arts costs a higher price, gold coin would become token money." If this be a popular conception of the effect of the McFadden Bill there is little wonder that opposition is being created to prevent its passage. The effect of the bill *in no way alters our existing monetary system.* The monetary function of gold is entirely dissociated from its use in the arts, and the bill is so constructed that the mints, banks, and financial agencies can obtain all the gold they care to and at the long-established price of $20.67 per troy ounce. We hasten to correct this impression and can assure our readers that if the proposed legislation interfered with our existing currency and made the gold eagle a token coin we, and no doubt the sponsors of the bill, would be vehemently opposed to it.

The working of the McFadden Bill would not only stimulate and restore the mining industry to a healthy condition, but would also increase the gold reserve of the country. This dual consequence is brought about by taxing the finished gold article—be it a gold cup, gold watch or a wedding ring—imposing the tax where it is least likely to be felt—on luxuries—and distributing the proceeds to the gold miner so that he may be compensated for the greatly increased cost of producing his gold. The miner's product is sold to the mint, and the standard price plus a $10 bonus per oz. is received. Consumers pay the standard price for their supply of gold. How can such a system possibly reduce gold coinage to a token basis?

Some statements appearing in the press exhibit either a surprising lack of study of the principles and operation of the gold bonus or draw conclusions that are illogical and unwarranted. The *Evening Post* recently stated, "The bounty would enormously stimulate the production of gold, thereby increasing prices and, incidentally, the cost of producing gold. As prices continued to advance, the cost of producing gold would mount, and the bounty would eventually defeat its own purpose." Does the gold producer realize his importance? Does he realize that, according to the *Evening Post*, the increase in his $50,000,000 production to whatever it may become will so profoundly affect our $2,750,000,000 in gold in the Treasury as seriously to disturb prices? We wish we could believe that the power of the gold miner is so tremendous.

The gold miner is undoubtedly finding a ray of hope in the recent decline in commodity prices. However, his most important items, labor, iron and steel products, powder and fuel, have shown little alteration, and until they change gold mining will remain in large degree unprofitable and hazardous. There is a possibility that a decrease in copper production may release labor for the gold mines and that the decline in farm products may not make agricultural pursuits so much more attractive to labor than mining. But that is all conjectural. What the industry needs is immediate relief, and it can get it through the McFadden Bill.

Export Trade With Mexico

A RECENT announcement by the American Chamber of Commerce of the City of Mexico to the effect that a second trade conference of American commercial interests will be held in April in the City of Mexico is of interest. The determination to hold the meeting is the result of the success attending the first conference, which was held last February, and at which time definite steps to promote trade relations between this country and Mexico were taken. The American Chamber of Commerce points out that the United States has established itself as the foremost exporter to Mexico, and that to maintain this position it will be necessary to compete with the tactics and buying inducements offered by European merchants.

Upon the withdrawal of trade competition in Mexico during the war, it was possible for American business houses to demand that their transactions be carried on a cash basis, and this was to a large extent desirable on account of the unsettled condition in Mexico, which made the extension of credits wholly undesirable. But, fortunately, there has been a change for the better in the affairs of Mexico, and business conditions have become so stabilized as to make possible the extension of liberal credit to responsible houses without risk. European merchants are now eager to make offers of liberal credit, and it is, therefore, quite necessary that American sellers should adopt a liberal policy in this regard. Recently Alberto U. Pani, the Mexican Minister of Foreign Relations, in an official statement, said that the government had invited prominent United States bankers to assist in certain financial readjustments of the country and expressed a willingness to fulfill all obligations.

The mining industry in Mexico is undergoing a period of inactivity and retrenchment similar in a way to that which now affects our domestic mines; but this is, of course, temporary. With the return of a healthy demand and normal prices for the various metals, Mexico will again take her place as a large producer of metals, and many of the undeveloped deposits will receive attention. The development of new properties and the continuation of the older mines will require capital. Much of this capital will be obtained in the form of extension of credits for the purchase of American mining machinery, the desirability of which is admitted the world over.

Radium in the Grand Canyon

MME. CURIE, the discoverer of radium, is to pay her first visit to this country in May. "Her express purpose is that while here she be taken to Pittsburgh, where radium is extracted from ore, and to the Grand Canyon, where the ore is found." This we note in the *New York Tribune*, which, take it from the *Tribune*, publishes "First to Last—the Truth." No doubt the reporter has erred in the present case, however, for it is safe to say that Mme. Curie knows better than this. We thought that myth of rare minerals in the Grand Canyon had been pretty well exploded by this time—at least as to the occurrence there of any rare ore in commercial quantities or qualities. Anyway, it was platinum that was supposed to be there, and not radium.

Evidently the State of Colorado has been confused with the Colorado River, along which the one and only really Grand Canyon is situated. The Colorado River, of course, flows through Arizona, and the Arkansas River is in Colorado. Strange that one cannot keep these simple things straight!

We hope that Mme. Curie will visit the Grand Canyon, but, as she rides down the Bright Angel Trail on the back of a mule, she need have no fear that he will stumble into the shafts of any radium mines or even into prospect holes. To see these she will not need to journey far from Denver, though if she feels equal to a little wilder trip, the fields along the Dolores River, in the southwestern part of the state, should prove interesting.

E. & M. J. Index

THE INDEX for Vol. 110 of the *Engineering and Mining Journal* is now ready for distribution and will be mailed only to those who request it. Those who wish a copy of the Index, are requested to send for it promptly. A postcard will do.

WHAT OTHERS THINK

The Proposed Aluminum Tariff

In the preliminary discussion before the Ways and Means Committee of the House of Representatives on the tariff, no proposal from any industry seeking an increase above the present import duty rates met with more opposition or created greater interest among the trade than the proposal of Arthur V. Davis, president of the Aluminum Company of America, that the duty on aluminum ingots, pigs, etc., should be increased from the present rate of 2c. per lb. to 7c. per lb., and the present rate of duty on aluminum sheets from 3½c. per lb. to 11c. per lb.

The request was made on behalf of the Aluminum Company of America, the sole producer of aluminum in the United States, and the only absolute monopoly in the production of metals in the United States. This corporation absolutely controls the entire production of aluminum in the United States and also half of the production of aluminum of the entire world. It not only produces aluminum, but actually competes in aluminum finished articles, like cooking utensils, stampings, novelties, etc., and also competes in the manufacture and sale of aluminum castings and automobile parts. It may further be stated that this corporation, practically controlling the entire aluminum industry in the United States, both the production of the metal itself and the manufacture from the raw material into finished aluminum products, seeks to further extend this absolute monopoly by preventing what little competition there is from abroad, by high and prohibitive rate of duty, thereby practically turning over to this Aluminum Company of America the entire aluminum industry of the United States.

Forty or more independent cooking-utensil manufacturers and several hundred independent aluminum founders of the country, in whose business hundreds of thousands of dollars are invested, and hundreds of thousands of men employed, are absolutely powerless to come to the forefront and defend themselves against this outrageous attempt on the part of the American producer, for they fear the antagonism of this monopoly, which would be in position to hamper or absolutely prevent their manufacturing if they opposed the will of the only producer of aluminum in America, and this would be especially true if a prohibitory tariff on aluminum is established.

If this prohibitory tariff on aluminum is established, the housewives of America will undoubtedly want to know why they have to pay an increased and unwarranted price for aluminum cooking utensils, vacuum cleaners and other household utilities, made in part or in whole of aluminum, which will undoubtedly be the case if the Aluminum Company of America succeeds in gaining an absolute control of the production and marketing of aluminum in this country.

Every owner of automobiles in America will be affected, because a turning over of this aluminum industry into the hands of the Aluminum Company of America, by preventing foreign competition, will mean either high-priced automobiles because of the higher cost of aluminum, or it will mean a lessening of the use of aluminum parts, thereby decreasing the efficiency and quality of the automobiles in America. The automobile industry, through the National Automobile Chamber of Commerce and the Independent Aluminum Founders' Association, strongly presented these facts to the House Ways and Means Committee.

L. M. BRILE.

New York City.

Further Tests of Low-Grade Cyanide at Tonopah Confirm Earlier Results

On p. 104 in your issue of Jan. 15, 1921, I note the following in Mr. Alfred James' article entitled "Sidelights on the Cyanide Process":

"The shortage of cyanide has induced large operators to purchase a low-grade cyanide produced from cyanamide. J. G. Kirchen states his experience with this material (see *Engineering and Mining Journal*, Sept. 25, 1920) on a month's run. I hope Mr. Kirchen will follow by giving his experience on at least a year's run. Faced at the outset with low-grade cyanide, works were erected, patents purchased, chemists of world fame employed, and ultimately an almost chemically pure article was produced. The proper remedy for a shortage of high-grade cyanide is surely greater production rather than the substitution of a low-grade compound, introducing much undesirable material."

I have had our metallurgist, Mr. Hugh A. Burk, collect the data requested by Mr. James, which covers a period of thirty-one-months' mill-run at the Tonopah Extension mill, using 97 per cent NaCN product and treating 276,509 tons of ore; also eleven months' run using a low-grade cyanide product containing 36.3 per cent NaCN, during which time 74,433 tons of ore was treated.

COMPARISON OF RESULTS WITH HIGH- AND LOW-GRADE CYANIDE

				Consumption in Lb. 100 per Cent NaCN	
Grade of Cyanide Product, per Cent NaCN	Assay of Ore in Oz., Ag	Assay of Tailings, Oz. Ag	Extraction Percentage	Per Ton of Ore	Per Oz. Ag Recovered
97.0	12.38	1.01	91.84	1.939	0.171
36.3	13.28	1.12	91.59	2.033	0.167

This record shows that approximately the same extraction was obtained with high- as with low-grade cyanide product. The difference in extraction, which is 0.25 per cent, can be attributed to a small tonnage of ore treated with the lower-grade cyanide product, which ore contained a small percentage of copper, the silver extraction of which was slightly less than our regular run-of-mine ore.

The difference of 0.004 lb. of NaCN consumed per ounce of silver produced is small, and may be attributed to difference in mechanical losses of cyanide rather than in chemical consumption.

Our practice for the last five years has been to feed oxidized lead ore to our tube mill instead of adding lead acetate to our cyanide solutions. The consumption of oxidized lead ore per ton of ore cyanided has been the same when using high as when using the lower-grade cyanide product.

One infers from the foregoing paragraph of Mr. James' article that the manufacture of the low-grade cyanide product was undertaken on account of shortage of the high-grade product. In this I believe he is mistaken, for I know that its manufacture was considered years before the late war, and its object was to produce a cyanide product the NaCN content of which could be sold at a less cost than the higher-grade product.

Our experience, with such cyanide products as we have used, indicates that the value of the product for our metallurgical work is determined solely by the amount of NaCN which it contains.

Tonopah, Nev. JOHN G. KIRCHEN,
General Manager Tonopah, Ltd., Extension Mining Co.

Straightening a Crooked Boundary

I was much interested in the solution of the problem of straightening a crooked boundary given by Alex. Richardson in *Engineering and Mining Journal* of Nov. 13, 1920. As a check or alternative solution to this problem I submit the following:

Using the same example and figure as on p. 953:

(*a*) Assume a trial line from A to E, then	
Area $MAEQ$ =	120,450
Compare with area $MABCDEQ$ =	111,350
Showing area $MAEQ$ in excess by	9,100
(*b*) Assume another trial line A to D	
Then area $MADP$ =	78,300
and area $MABCDP$ =	96,350
Showing area $MADP$ to be deficient by	18,050

As the trial line to E gives an excess and the trial line to D a deficit, the correct position of the end of the new line from A (i.e., the point T) should be somewhere between D and E and the departure D-U in this example would be obtained by the simple proportion:

$$DU : DW :: 18{,}050 : (18{,}050 + 9{,}100)$$

or

$$DU = \frac{150 \times 18{,}050}{27{,}150} = 99.72$$

The general equation is:

$$\frac{DV}{DW} = \frac{\left.\begin{matrix}\textit{excess}\ (+)\\ \textit{deficit}\ (-)\end{matrix}\right\}\ \textit{at}\ D}{\textit{difference between}\ \left\{\begin{matrix}\textit{excess}\ (+)\\ \textit{deficit}\ (-)\end{matrix}\right\}\ \textit{at}\ D\ \textit{and}\ E}$$

taking note of signs.

London. A. O. DOLAN.

For the Very Wealthy Only

I noticed with interest your reference two or three weeks ago to copper as a luxury. Lead, zinc, and copper in manufactured form are luxuries here, beyond the reach of any but the very wealthy.

No sort of copper screen can be had here for less than $1 per sq.ft., and if a mill man wants a piece of copper screen for a trommel, it will cost from $2 to $5 per sq.ft. The prices of most of the articles made out of zinc are even more unreasonable than those of copper articles. Lead, manufactured, costs from 50c. to $2.50 and up a pound.

I wish you would touch this subject up a little stronger, for it is as certain as death that the high price of nearly everything into which lead, zinc, or copper enters is hurting the market very greatly—probably more so than any other one thing.

Park City, Utah. CHARLES MOORE.

Paternalism and Rio Tinto

In your issue of Jan. 1 you state that the miners at Rio Tinto live in a row of gardenless cottages for which they pay a rent which, if capitalized, would purchase the house annually, and that family events, such as births, deaths and weddings, have to be notified to the company. (The statement referred to was quoted from the *New York Sun*.—EDITOR.)

As one who formerly lived for many years at Rio Tinto, I would like to say that although the houses are built on rocky soil, where gardens cannot be easily developed, I am informed that the miners now receive allotments from the company at nominal prices. The statement with regard to house rent is grossly exaggerated. With reference to notification of numbers of persons in a household, this may be to some extent explained where sanitation is dealt with by carts, and distribution of drinking water is, or was, by kegs. Anyone who has visited Spain knows that paternalism is found in places other than Rio Tinto as far as the question of visitors is concerned.

It was evident in this strike that after concessions were offered the men by the company the economic aspect of the strike was ignored by the strike leaders. There seems to have been a Bolshevist element in the latter phase of the strike, which is now being repudiated by the men. R. D. MACKECHNIE.

London.

The Non-Metallic Mining Number

The non-metallic number of *Engineering and Mining Journal*, which appeared Jan. 29, is an interesting innovation, the continuance of which will meet the hearty approval of operators in the non-metallic field. Although considerable information concerning this industry is published, the greater part consists of statistics and matter descriptive of the preparation of the various non-metallics for the markets and not the actual production of the raw material. The non-metallic miner faces many problems, which include almost as great a variety as those met with in metal mining; therefore he is interested in the activities and operations of others who are producing non-metallic ores.

The extension of the weekly market pages to include non-metallic mineral quotations was a valuable addition, and one which increased the already wide scope of service rendered by *Engineering and Mining Journal*. The issuance of the non-metallic mining number is a further step in that direction.

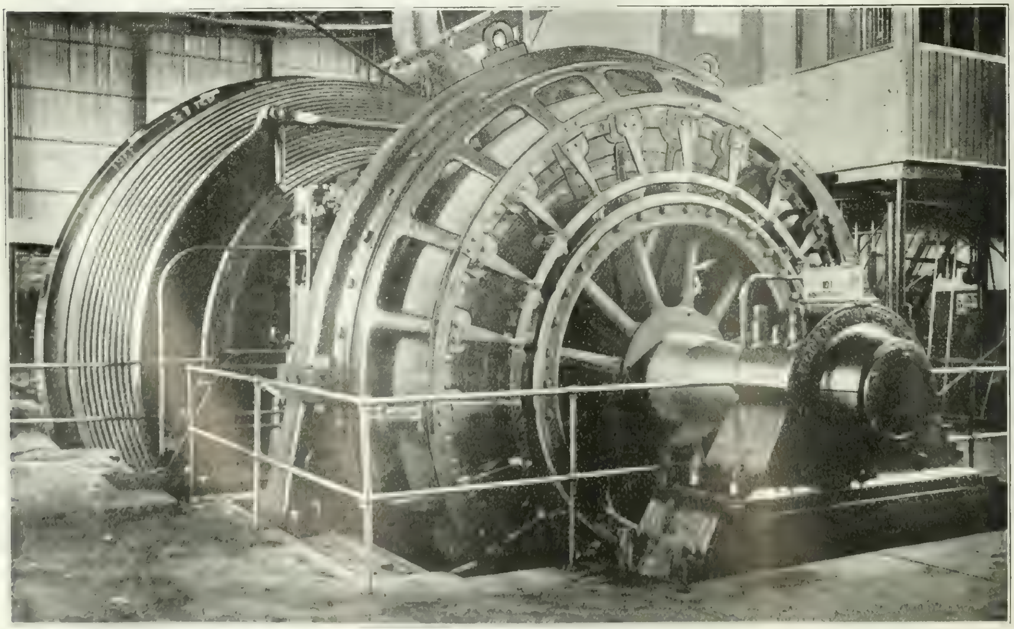
If suggestions are not entirely out of order, I might mention that the non-metallic field is an extensive one, employing about 18 per cent of the number employed in metal mining. I believe readers of *Engineering and Mining Journal* will be interested in articles dealing with the mining of barytes, mica, phosphate, talc, and the other non-metallics that are not frequently mentioned in the technical press.

We like what we are getting, but let's have more of it.

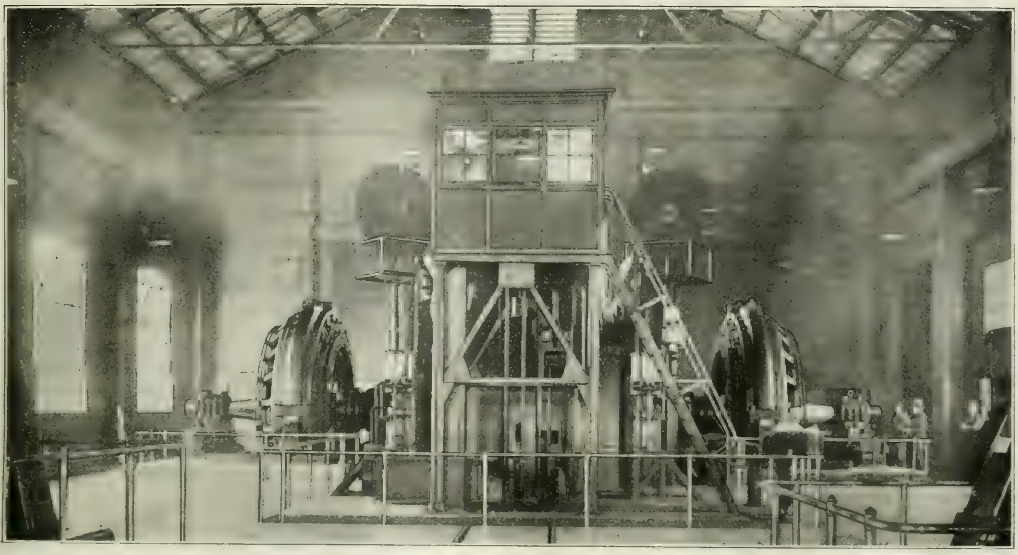
New York City. EDWARD THOMPSON.

Electrically Operated Mine Hoists on the Rand

HOIST HOUSE AND HEADFRAME OF NEW MODDERFONTEIN GOLD MINING CO.

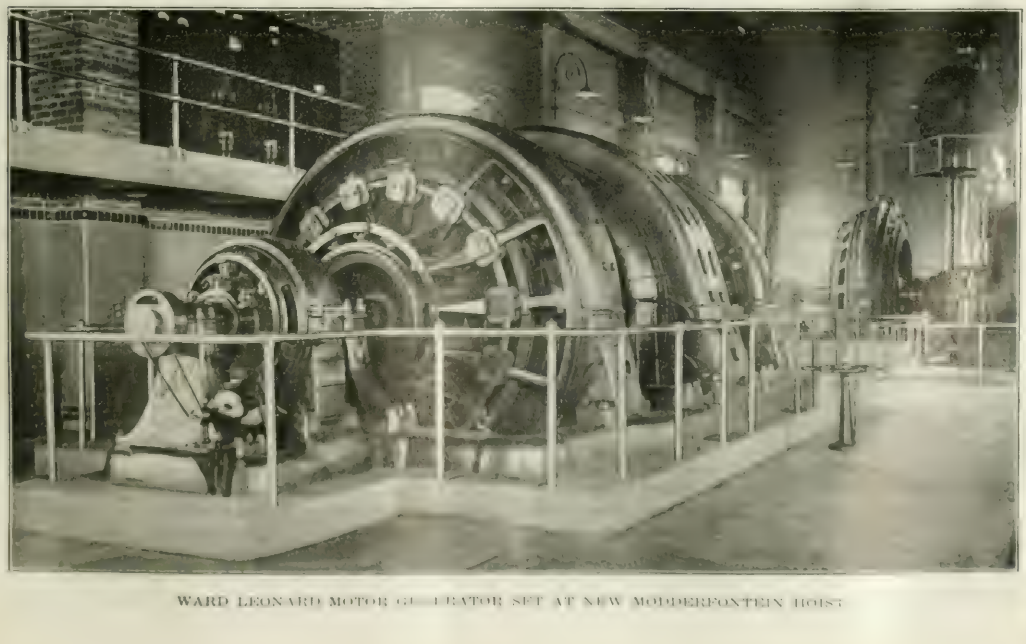


AN ELECTRIC HOIST AT THE CROWN MINES, JOHANNESBURG



REAR VIEW OF MODDERFONTEIN HOIST, SHOWING ENGINEER'S PLATFORM AND CONTROL GEAR

THE New Modderfontein hoist consists of a single cylindro-conical drum carried by a continuous steel shaft 24 in. in diameter and coupled at either end to the motor shafts. The smaller cylindrical portions of the drum are 15 ft. in diameter and are made of cast iron. The large cylindrical and conical portions are made up of two parts each consisting of four cast-steel segments securely bolted together, the diameter of the former being 24 ft. The total weight of the drum shaft and bearings is approximately 180 tons. To the drum shaft are coupled, one at either end, two 2,000-hp. 53½ r.p.m. direct-current motors, which are connected in series. These motors receive power from a motor generator set consisting of two 1,650-kw. generators driven by a 5,000-hp. induction motor. The speed and direction of rotation of the hoist motors are controlled by the Ward Leonard system. The control gear itself is mounted on an elevated platform sufficiently high to enable the driver to obtain a clear view of the drums, ropes and cages as they come to the surface. Below this platform are mounted retarding and overwinding devices consisting of large, slowly revolving cams driven from the main shaft by substantial gear and shafting, which regulate the movement of the driver's lever and, consequently, the controller. The New Modderfontein gold mines are on the far East Rand, which is about twenty-five miles from Johannesburg. Mines are now being started thirty-five to forty miles away, thus making a chain of gold mines about eighty miles in length. The development of electrical hoisting on the Witwatersrand has been notable.



WARD LEONARD MOTOR GENERATOR SET AT NEW MODDERFONTEIN HOIST

A. I. M. E. Holds 123d Meeting

Convention Well Attended—Considerable Interest Manifested in Breakage of Drill Steel, Motion Pictures of U. S. Bureau of Mines on Mining of Asbestos and Sulphur, Steel Manufacture, and the First Non-Metallic Mineral Session—Social Activities Prove Enjoyable

ALTHOUGH the registration of members and their guests attending the 123d meeting of the American Institute of Mining and Metallurgical Engineers, which met at the Engineering Societies Building in New York City, on Monday, Feb. 14, was small during the first day, out-of-town visitors continued to arrive on Tuesday and Wednesday, and the total amounted to over eight hundred when the final rolls were made up. The absence of members west of the Mississippi was quite noticeable and reflected to some extent the effect of present business conditions; more specifically the existing railroad rates, which just now are effecting travel materially.

Always an occasion for the renewal of old friendships and a forming of new ones, the meeting opened most auspiciously, and there was abundant evidence that this annual meeting as well as the other annual get-togethers of the A. I. M. E. forms a real part in the lives of mining and metallurgical engineers.

The creation of an opportunity of combining business with pleasure and securing open discussion on different problems that are met in operation and practice is eminently desirable in any profession, and the committees in charge of the various activities, as in years past, spared no effort to make the 1921 meeting of the Institute a noteworthy success.

Registration began at 9 o'clock on Monday, Feb. 14. The members of the reception committee were on hand at all times, and every effort was made to meet the convenience of the guests. There were no scheduled meetings during the morning of the first day, and the initial general gathering occurred at noon, when an excellent luncheon was served in the assembly room on the fifth floor. This much-appreciated custom was continued throughout the remaining days of the meeting.

CALCULATION OF ORE TONNAGES CONSIDERED

The session on mining and milling, of which R. M. Catlin, of the New Jersey Zinc Co., was the chairman, opened at 2 p.m. A paper, "Calculation of Ore Tonnage and Grade From Ore Samples," by James E. Harding, was read by A. T. Ward. It was stated that the sampling of mineral deposits is done by drilling, and the assay results thereby obtained are used in preparing estimates in practically all large orebodies.

The standard method of making estimates, as described by Mr. Harding, consists of finding the cubic contents of triangular prisms, in the apexes of which the drill holes are placed, by multiplying the surface area by the average depth of the ore in the three drill holes and then multiplying the cubic contents by the specific gravity of the ore or rock to find the tonnage. The assay value is found by dividing the sum of the products of the depth of ore in each hole and the corresponding assay value by the sum of the depths of the ore in the three holes. As the latter part of this method is subject to many mathematical errors, it should not be depended on. Some engineers, therefore, use a discount factor, but as this factor is either arbitrarily selected or is obtained by obscure methods, the results are no better than guesswork.

The standard method is correct when the drill holes are so laid out that the triangular prisms are equilateral in cross-section. But as ore deposits cannot always be drilled into at regular intervals, and because of the human factor, if many holes are drilled, triangular prisms of all degrees of angularity are produced. In such cases it is necessary to assume that the influence of the different holes is not the same in all directions, which assumption of course is absurd.

The area of the triangular prism is usually found by scaling; an orebody of sufficient size to justify churn drilling is too large to be handled conveniently on maps having a scale larger than from 1,000 to 1 to 1,500 to 1, and maps of such scales cannot be accurately measured. A variable is thus introduced in the first operation. In addition, the scaling is frequently done from blueprints, which sometimes shrink as much as 4 per cent between printing, washing, and drying.

The error due to scaling may be eliminated by surveying the location of each hole and calculating its co-ordinates; then from these co-ordinates calculating the length of each line connecting two drill holes. The application of the formula in the method introduces certain discrepancies, so that it is necessary to devise a method that will give results that will check more closely, and the manner in which this is done was described.

In the discussion following the reading of the paper, W. Y. Westervelt stated that he questioned the efficacy of using exclusively mathematical calculations in the estimation of orebodies and said that it was necessary to combine good judgment to get results that could be depended upon. R. S. Botsford suggested the use of intermediate samples wherever possible as a means of checking the general sample average, and that this was desirable was also the opinion of Mr. Catlin, who stated that, "the more samples the better the average." He also gave a short description of sampling reef deposits on the Rand, but said that this system would hardly apply in large orebodies.

STALACTITE FORMATIONS AND AIR DRILLING PROVE INTERESTING TOPICS

A short paper on the "Rate of Formation of Copper Sulphate Stalactites," by Graham John Mitchell, brought out some interesting discussion by J. F. Kemp on the precipitation of minerals. Prof. Kemp stated that J. S. Curtis had measured a stalactite of aragonite in the Eureka, Nev., district over a period of three weeks, and actual measurements showed a growth of ⅜ in. in that time. He also quoted observed growths of galena crystals in northeast Oklahoma and marcasite in Wisconsin.

E. K. Judd presented a paper, "Relation of Air Pressure to Drilling Speeds of Hammer Drills," by H. W.

Seamon. The data in this paper were obtained by 1,500 tests made by the United Verde Copper Co. to determine the most economical air pressure for the operation of hammer drills under the varying conditions of use, and to investigate the variation in drilling speed at different air pressures. Twelve models of drills were used at gage pressures ranging from 40 to 130 lb. No effort was made to harmonize theory and practice; rather the purpose was to formulate empiric rules that would cover the average variation of the results obtained. These rules on the performance of hammer drills, based on the air pressure as the main variable, however, are not necessarily of universal application, but they apparently satisfy the results obtained in this series of tests. Tests were made on the following machines: Ingersoll-Rand—No. 248 Leyner-Ingersoll, No. 18 Leyner-Ingersoll, No. 26 Baby Leyner, BCRW430 Jackhamer, and CCW11 Stopehamer; Sullivan—DR6, DX61, DP33 Rotator, and DT44 Stoper; Waugh—No. 66 Super-Dreadnaught, No. 60 Dreadnaught, and No. 21V Turbo.

The shop tests to determine the power of the drills were made on a Paynter rock drill tester. The higher air pressures were obtained by filling a receiver, of approximately 200 cu.ft. (5.6 cu.m.) capacity, with air at the pressure of the mains, usually 90 lb. (40 kg.) and then pumping water into the receiver until the required pressure was reached. The duration of the runs of the Paynter tester was five seconds, with no appreciable drop in pressure; in the drilling tests, the time ranged from ten seconds at the highest pressure to thirty seconds at 100 lb. These short runs were necessary to avoid too great a pressure drop while the test was being made and to eliminate errors caused by the rapid dulling of the steel, particularly at pressures above 100 lb. The consumption was measured with a New Jersey "Drillometer," which records the rate of flow. Special effort was made to have all the conditions uniform; the only variables were the air pressure, with the corresponding change in the number and strength of blows, and the air consumption.

The conclusions reached as the result of the tests are as follows:

There is little or no increase in mechanical efficiency of the drills above 90 lb. pressure; the distance drilled per air indicated horsepower is greatest for the jackhammer type at 90 lb., and increases at a slow rate for the other machines at the higher pressures; the average thermal efficiency is greatest at about 95 lb.; the factor of desirability, while increasing as the pressure, shows a comparatively slow rate of increase for pressures above 100 lb.; the average drill is made to be used at a pressure of 80 lb., or less; using pressures much exceeding this will invalidate the present replacement agreements with the manufacturers, thereby increasing the upkeep cost; the increased breakage at the higher pressures, with the consequent greater loss of time of the drill runner in changing or repairing the machine, would tend to reduce the factor of desirability, and the increased breakage of drill steel would tend to limit the pressure; although there are not sufficient data on this point to determine the maximum.

In the discussion following, B. F. Tillson spoke in commendation of Mr. Seamon's paper and heartily indorsed the steps that were being taken in the direction of scientific application to work in the field. He also explained the function of the New Jersey "Drillometer" as that of measuring the air flow with multiple orifices.

John W. Roberts presented a paper, "The Time Factor in Depletion of Mines," which brought out several points wherein the situation of the mine owner differs from the ordinary property holder in the matter of tax assessments. The tax regulations fail to carry out the intent of the law that the cost of the ore in the ground shall be considered as part of the cost of the same ore when removed and sold, because of the unwarranted assumption that all the ore in the mine cost the same amount per ton. In the nature of its operations a mining company mines and sells first the most accessible ore—the ore that really cost most—and is then asked to carry the less accessible ore on its balance sheet at average cost. The law permits a reasonable allowance for depletion, and any mining company that makes a reasonable and fair apportionment of the cost of its mineral deposits should be accorded the same fair treatment that is accorded other tax payers. Mr. Catlin, in characterizing a mine as "a wasting asset," said that the tendency was to tax mines on what someone figures they might produce, and also quoted an instance where a tax had been placed on a theoretical profit, whereas an actual loss had been incurred. G. A. Packard mentioned an instance in connection with the income tax whereby he had been assessed on certain dividends received, the reason given being that the commission did not regard such as returned capital inasmuch as the company paying the dividends was solvent. R. E. Davis, in defense of the Treasury Department, stated that he had found a willingness on the part of those in charge to consider the various facts entering into such matters, and that efforts had been made to give the mining companies a fair deal.

Electrolytic Zinc

Discussion of the Work Done at Anaconda Brings Out Some of the Features of the New Tainton and Treng Process Being Developed at Martinez, Cal., Which Promises To Revolutionize the Industry

BY FAR the most important paper that was read before those interested in non-ferrous metallurgy at the New York meeting of the A. I. M. E. this week was that of Messrs. Laist, Frick, Elton, and Caples, entitled "Electrolytic Zinc Plant of the Anaconda Copper Mining Co., at Great Falls, Mont." It was not only the most comprehensive paper, but it provoked the most discussion. In reading the abstract, Percy E. Barbour spoke of the difficulty in compressing such a detailed treatment of the subject into a few words, and those who are interested in the matter were advised to secure the complete paper. Only those facts will be mentioned here which were commented on in the ensuing discussion.

Following the reading of the abstract, E. P. Mathewson, who presided over the meeting, read a letter from

Stanley C. Bullock, of London, who contrasted English practice with that which had been developed at Anaconda. No radical differences seem to exist with regard to the roasting. In England, 97 per cent of the zinc is made soluble and anything below 90 per cent is considered bad practice. This corresponds to the Australian work. Mr. Bullock had only the abstract of the Anaconda paper to refer to, so inquired as to what percentage of zinc was there made soluble. The authors state that it is not difficult to make a calcine containing 82 per cent of its zinc in soluble form in 2 per cent H_2SO_4, from a concentrate that contains 33 per cent zinc to 20 per cent iron, and they hope to increase the percentage of soluble zinc to 85 per cent. A concentrate containing 50 per cent zinc and under 5 per cent iron will yield a concentrate containing about 94 per cent of its zinc in soluble form.

Leaching in England is done, according to Mr. Bullock, with hot solution in a manner described in considerable detail. At Anaconda the leaching, which is continuous, is done in two steps: (1) a neutral leach where all the calcine and approximately one-half of the total acid is added; (2) an acid leach where no calcine and the remainder of the acid is added.

For precipitation, English practice adds calcium carbonate to the hot solution, and the problem is apparently worked out more elaborately than is done at Anaconda. Nickel and cobalt have to be removed, which are apparently not present at the Great Falls plant. Cell-house practice seems to be similar in each case.

Following the reading of Mr. Bullock's letter, Mr. Mathewson introduced Walter C. Smith, who spent a part of last November and December in Martinez, Cal., investigating the electrolytic zinc process which has been successfully developed at the small plant there owned by the Central Mining Company of London. The method employed is that of Tainton and Treng. Some years ago U. C. Tainton made use of exceptionally high-current densities in his electrolytic work, but an attempt at commercial application of his ideas had not been made until this plant in California was built. Although of a maximum capacity of only six tons a day, the facts brought out show that pioneer work of the utmost importance is being done, and the process there being developed promises to be a long step in advance of the method used at Anaconda or elsewhere. Mr. Smith gave many details of the work as he saw it during his visit, and his remarks aroused more interest than any other feature of the afternoon session.

The principal features which distinguish the work at Martinez are the use of a high current density and strong acid. A very high current efficiency results, and a minimum amount of trouble from impurities.

Mr. Smith stated that from 22 to 27 per cent of free sulphuric acid is used in the electrolyte, and a current density of 100 amperes per sq.ft., about 1.77 kw.-hr. being consumed per pound of zinc produced. Before passing to the cells, the electrolyte contains about 70 g. of zinc per liter, and after leaving, 30 g. Antimony gives more trouble than any of the other impurities, as is generally the case. Up to 30 mg. per liter of cobalt or arsenic have been run without losing current efficiency, which averages about 89 per cent of the theoretical. The electrical potential averages about four volts per cell.

Mr. Mathewson then pointed out the high value of the Martinez discoveries, which will mean a much lower-cost plant and the use of solutions much higher in impurities than has hitherto been possible. He even went so far as to say that the furnace production of zinc is likely soon to be obsolete, except in cases where power is extremely costly.

In the test which took place during Mr. Smith's visit, which was made on Nabob and Federal ore and Federal slime, a recovery of zinc of 87.6 per cent, based on the cathode sheets produced, was accomplished, on ore averaging 39 per cent ZnO. Samples of the cathodes were passed among those present; these samples were nearly half an inch thick, very smooth, and of excellent quality.

Further questioning of Mr. Smith brought out the following facts: Silica is precipitated from the colloidal to the granular form by an exceedingly neat method, which has not yet been patented and which therefore could not be divulged. About 3 lb. of glue is used in the electrolyte per ton of zinc produced. This makes the bubbles very fine, thereby keeping down the acid mist and making the use of respirators unnecessary in the cell room.

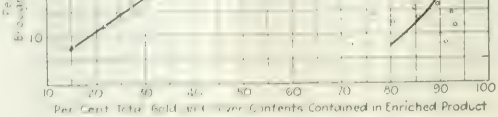
When it was made known that the temperature of the electrolyte was only about 85 deg. F., an inquiry was made as to how the temperature was kept so low with so high a current density. Mr. Smith replied that the system of cooling the electrolyte was one of the features of the installation, and that this subject caused much trouble until finally solved by flowing the solution over lead troughs in which lead pipes containing circulating sea water were imbedded. The electrolyte is cooled after each pass through a cell.

Mr. Hixon inquired whether the use of glue was considered particularly novel, to which Mr. Smith replied that it had been used in copper refining, then in lead refining, and the natural thing to do was to try it in zinc refining.

In the informal discussion following adjournment it was brought out that manganese dioxide causes no trouble whatever and falls from the anodes as sludge as fast as it collects, so that they never require cleaning. The impurities in the cathode zinc produced are too small to determine by ordinary means, and the metal averages about 99.9 per cent in purity.

Selective Converting at Clifton, Ariz.

In our issue of Feb. 5 an unfortunate error was made in the cut accompanying Mr. Ambler's article under the above title. The recovery of precious metals shown was uniformly 10 per cent less than should have been the case. The illustration as it should have appeared is shown herewith.



VARIATION IN PRECIOUS METAL RECOVERY

Steel Chimneys and Their Linings In Copper-Smelting Plants

Discussion of A. G. McGregor's Paper Brings Out Some of the Reasons Why One Stack Will Stand Some Years and Another Rapidly Corrode

IN A PAPER prepared for the February meeting of the American Institute of Mining and Metallurgical Engineers, in New York, by A. G. McGregor, an abstract of which was read by Forest Rutherford, the lining of steel chimneys in copper-smelting plants is discussed. Mr. McGregor refers first to a steel stack used for roaster gases at the Calumet & Arizona smelter at Douglas. This was lined to the top of the bell, 40 ft. from the base, with common brick, using lime and cement mortar. Above this, the stack was lined with building tile 4 in. thick. Six years after the chimney was erected, most of the tile lining for 125 ft. from the top had fallen out and the steel shell was badly corroded. Where the lining remained in place, however, the shell was undamaged. Many of the tiles which had fallen out of place had become soft or flaky and crumbly; others were as hard as when placed. These tiles were of a fire-clay mixture and were used instead of common brick on account of lower cost. The stack was repaired by using new steel in the upper 125 ft., and a 4¼-in. lining of fire brick was laid from the bell to the top of the chimney. Thin mortar—water, sodium silicate, and finely ground silica—was worked into the joints.

At the same plant a steel chimney lined with hollow building tile has been in use for seven years with no signs of deterioration, but in this case the gases handled are from the blast furnaces and reverberatories, which are hotter than the gases from the roasting furnaces.

At Cananea a steel chimney lined with common brick has been used in connection with the blast furnaces for seventeen years. The chimney has been cold a number of times for periods of from several days to a year's duration, but there is no apparent deterioration.

The steel stack at the smelter of the United Verde Copper Co. at Clarkdale, Ariz., has been in use for six years, with no signs of deterioration. This stack is lined with common brick 4½ in. thick and handles gases from the blast, roaster, and reverberatory furnaces as well as the converters.

An unlined steel chimney at the Calumet & Arizona plant at Douglas has given good results for fourteen years, handling gases from the blast furnaces and converters. Another steel stack which is unlined is at the smelter of the International Smelting Co. at Miami. This is used on gases from the converter department and is still in excellent condition after six years' use. Other stacks are also mentioned in which no lining seems to be necessary when handling blast furnace and converter gas.

Based on the examples which Mr. McGregor cites in his paper, the following conclusions are drawn:

Unlined steel chimneys have given satisfactory service for long periods when used for blast furnace and converter gases.

Building tile have proved unsatisfactory for chimney linings or for the construction of walls for flues and dust chambers where exposed to roaster furnace gases or cool reverberatory furnace gases.

These conclusions apply to the ordinary conditions in copper-smelting plants, where waste-heat boilers are used in connection with reverberatory furnaces, and where no particular effort is made to maintain the gases at a high temperature in the flues, dust chambers, and stacks.

In a written discussion of Mr. McGregor's paper, C. R. Kuzell emphasized the fact that the presence of zinc must be considered, as zinc oxide in the gases would neutralize acid fumes and make them harmless, whereas in treating ores containing no zinc, the fumes might be very corrosive. He cited the Clarkdale stack as an example and stated that if the roaster gases (which contain no ZnO) alone were sent up the stack, corrosion would undoubtedly take place.

This phase of the subject was also considered very important by E. E. Thum, who stated his belief that the kind of smoke and the atmospheric conditions were the controlling factors. He could not understand why the reverberatory stack mentioned by Mr. McGregor should give way in one part and not in another. The corrosiveness of converter gases as well as roaster gases was also emphasized. Mr. Thum then dwelt on the importance of considering the amount of the fuming constituents of ores and requested that some one give more data as to the fundamental causes rather than a bare statement of results as had been made in the paper read.

The Copper Queen stack at Douglas was then further discussed by Mr. Rutherford, who was formerly in charge of that plant. This stack, said Mr. Rutherford, had been kept hot for fourteen years, and he felt that this was the secret of its long life. In case of a strike or close-down, arrangements had been made to build a fire in the base of the stack to keep it warm. The use of a lime mortar, with cement, in building a tile dust chamber was described. This was not at all successful, for the $CaSO_4$ formed by the action of the SO_3 in the gas on the lime swelled to about twice the original volume of the mortar and broke down the lining. The Calumet & Arizona company had had the same trouble.

The importance of relative humidity and stack temperatures was pointed out by H. Hixon. The temperature must at all times be kept above the condensation point. Following out this reasoning, he explained the corrosion of a stack in spots by the presence of eddy currents in certain places which became cooler than the main volume of gas, thus allowing condensation to take place, from which corrosion of the stack resulted.

That some other factors entered into the question was pointed out by E. H. Robie, who spoke of a roaster stack which had apparently remained in excellent condition for about five years, whereas the steel flue leading from the roasters to the stack was almost totally eaten away. The same gases were present in each, and the temperature of course was as high in the flue as in the stack. The possibility of the kind of steel used having something to do with the question was mentioned.

Cottrell Treater at Tooele

A Cottrell treater of a radically new design has been installed at the Tooele plant of the International Smelting Co. and formed the subject of an interesting paper read in abstract at the New York meeting of the A. I. M. E. by A. A. Heimrod, the author, A. B. Young, being absent.

Fundamentally, the treater is simply a flue containing rows of vertical plates, forming the grounded electrode, alternated with rows of small horizontal pipes, forming the negative electrode, with proper provision underneath for taking away collected dust. There are advantages in construction over the more cumbersome types, both the vertical-tube and the vertical-box, particularly in the elimination of heavy supporting columns and massive foundations, giving a much lower first cost. There are no right-angle turns to interfere with gas distribution; consequently there is greater efficiency, or, in other words, a greater volume of gas per minute can be effectively treated. Another advantage of the horizontal installation over the vertical is that the principle of the selective precipitation of the various components of the dust and fume as they pass along the electric field may be utilized. Since the treater has been placed in operation, the results have been quite satisfactory, and, in many ways, particularly in regard to the volume of gas that may be treated, have greatly exceeded expectations.

Following the reading of the abstract of Mr. Young's paper, Mr. Heimrod gave some figures to show the simplicity of the flue-type of treater as described, compared with the complex towering structures of the vertical type needed to treat an equivalent amount of gas. The ordinary form of treater built to handle about 20,000 cu.ft. of gas per minute at 1,000 deg. F. would require about thirty tons of steel, 120,000 bricks for lining, and fifteen tons of interior parts for the collecting and discharging electrode system.

The Tooele treater handles dust with practically no fume, and whether this type would be successful with a large amount of fume to separate remains to be proved. Fume requires a much larger power input: where 3 kw. would be required for treating dust alone, from 3.5 to 10 would be necessary where fume was to be separated, the same treater being used in either case. No further discussion was offered.

Non-Metallic Minerals Section Holds First Session

Important Factors in Talc Milling, Quality of Portland Cement, and Waste in the Non-Metallic Industries Considered—Importance of Conservation of Waste Products And Economic Control of Byproducts

ILLUSTRATING the growing importance attached to the development of the non-metallic mineral industries, the Non-Metallic Minerals Section of the A. I. M. E. held its first session in the afternoon of Feb. 14 under the chairmanship of Prof. H. Ries.

The first paper was presented by Raymond B. Ladoo, and was entitled "Important Factors in Talc Milling Efficiency," a résumé of some of the factors which should be taken into account in the designing of a new talc-grinding mill or in improving an old one. The author pointed out that the designing of talc-grinding plants based on a scientific study of the properties of the talc to be ground is rarely practiced, but the value of such study can hardly be over-emphasized. An example of this type of work was afforded by a grinding test made a few weeks ago on a talc (really pyrophyllite) from North Carolina, at Langley, S. C. The object of the test was to find out if this type of talc could be successfully ground on a Raymond roller mill equipped with air separation. A secondary problem was to discover if the fine-grained grit (mostly quartz) found in the talc could be eliminated by air separation. Several tests were run with different adjustments of the mill and samples taken from each test. Screen tests were made on each sample, using screens at close intervals, from the coarsest particle down to 300 mesh, and a microscopic examination was made of the product retained on each screen.

In addition, analyses are being made for total silica in each product, and elutriation tests run to show the amount of colloidal talc present. From the data obtained in this way it will be possible to get a very accurate idea of the distribution of the silica, the distribution of the talc, and the size and shape of the silica and talc grains in each screen product from each test. With this information and with data as to the range of performance of grinding, screening and air separation machinery of various types, it will be possible to lay out intelligently a flow sheet and to predict with fair accuracy the efficiency which may be expected. Had similar methods of study been used in the design of talc mills in the past, much money would have been saved and the general efficiency of talc mills would be much higher.

The paper pointed out the lack of adequate technical consideration for the talc industries' milling problems, and in the course of supplementary remarks the author stated that talc-milling machinery was formerly usually designed by machinery salesmen, but that nowadays considerable experimentation is being performed before the machinery is selected.

Chairman Ries asked Mr. Ladoo if there were any standard specifications for talc, to which the reply was made that there were no definite tests or specifications for talc; consumers usually tried a carload of talc, and, finding it suitable, continued to use it. Frequently one carload would be rejected and the next from the same shipper accepted. Chairman Ries deplored the lack of market standardization in the industry.

Mr. Huntoon and Mr. Ladoo next discussed the advantages and disadvantages of fibrous talc in paper manufacture, the latter contending that the paper industry's impression regarding the fibrous talc variety essential was a myth and that granular talc was more suitable.

Mr. Frechette called attention to the lack of proper specifications for the non-metallics in Canada, and Mr. Ladoo remarked that talc producers have not properly educated the consumers as to their requirements and that the method of dealing in small unstandardized lots through brokers had much to do with some consumers' unsatisfactory results with talc. Mr. Dolbear made inquiry regarding experimentations designed to remove grit in grinding and Mr. Huntoon indicated the importance of a consideration of flotation in non-metallic milling.

Supplementing Standard Portland Cement Tests

Instead of reading his paper, "Judging the Quality of Portland Cement," the author, R. J. Colony, instructor in geology, Columbia University, emphasized certain statements in his paper and furnished lantern slides to illustrate various microscopical petrographic features of portland cement. Prof. Berkey, of Columbia, in the discussion of Mr. Colony's article, stated that the paper endeavored to solve the problem of determining whether a cement will work or last for an extended period before using it. He pointed out how valuable it would be to tell beforehand if a structure built of portland cement would hold up, and that this was one of the few instances where "recasting"—the application of chemical analyses to determine molecular composition—was put to practical use. It is essentially an expert method, combining the principles and use of petrography and chemistry. Prof. Berkey's conclusions coincided with those of Mr. Colony.

THE UTILIZATION OF WASTE IN NON-METALLIC INDUSTRIES

In presenting his paper for discussion Oliver Bowles, of the U. S. Bureau of Mines, stated that the purpose of the paper on "Byproduct Expansion in Non-Metallic Mineral Industries" was to point out the great need of such development and some of the more important lines which it may follow. Americans have the reputation of being wasteful, and wastefulness not only depletes resources but greatly increases the cost of products to the consumer. The non-metallic resources of the country are great, but in many lines they are by no means inexhaustible. Americans are resourceful, and when one commodity is exhausted doubtless some other will be found or manufactured to take its place, but resourcefulness is no excuse for needlessly wasting products that now serve a useful purpose. National resourcefulness might better be employed in finding ways in which much of the waste from non-metallic mines may be put to useful service.

In approaching the subject of byproduct expansion an outlook beyond the confines of a single mining industry is essential. Though competition demands that every miner and manufacturer devote his time and energy to the successful promotion of his own enterprise, it is unwise to attempt to force the byproducts of certain minerals into uses for which other minerals are better adapted. The disposal of waste material in a way that will bring some profit to the producer is in itself no justification for such an enterprise if at the same time it floods the market with inferior products that are of no benefit and may even work injury to the general public. All problems of waste utilization should have in view the establishment of industries that are of some real benefit to the consuming public, and should not aim merely to give one mining industry a boost at the expense of another. For example, an attempt is being made in Great Britain to find a market for toilet preparations made from pulverized slate obtained from the waste heaps in Wales. It is difficult to see in what respect slate may have properties superior to talc for such a purpose, and if the slate preparation is in reality inferior to products now sold, and its introduction promises to open up no new and useful field for an inferior product, the enterprise has no solid economic basis to justify its existence.

Some examples of possible or actual byproduct industries were referred to in the paper. Brief reference may be made to a clay plant in Minnesota that washes glacial drift and sells screened and washed gravel as a byproduct of a brick plant. Reference may also be made to the plant of the Eastern Potash Corporation at New Brunswick, N. J., now nearing completion. This plant is designed to recover potash from greensand, and to utilize the residue for the manufacture of high-grade brick.

THE CAUSES OF WASTE

Mr. Ladoo in a discussion of Mr. Bowles' paper analyzed the causes of waste in the non-metallics. His remarks follow:

"In order to attack this problem of byproduct expansion and waste elimination, it is essential to consider first some of the fundamental causes of waste. Waste may result from careless or improper methods of mining or subsequent treatment; from inherent imperfections or impurities in the rock or ore; from low market value of finished products or high cost of proper treatment, resulting in a low margin of profit; from a mistaken idea of inexhaustibility of ore reserves, or from a demand for only the highest grade of product by the consumer.

"This last cause is one beyond the control of the producer, but it is so fundamental that it deserves special attention. For example, until recently the pottery trade has accepted only the highest grade of feldspar. The feldspar producers have selected this grade of spar and thrown the lower grades mixed with waste on the dump in such a condition that it cannot be recovered, and the workings have been left in such a condition that reopening would be difficult. Now many of our deposits of high-grade spar are exhausted, and the pottery industry is learning to use lower grades. This typical case illlustrates the necessity, first, to educate the consumer to study his industry and establish standard grades and tests specifically adapted to various uses, rather than to demand the highest grades of raw material for all uses; second, to educate the producer to separate and save all grades of material, even though of no present commercial value. Poorer grades of product should be stockpiled, separately from waste, in such a condition that they may be ultimately recovered if a demand develops."

The great importance of transportation in the byproduct expansion of the non-metallics was brought out by W. C. Phalen in a written communication in which he stressed the point that whereas centralization of industries was practised before the increases in rail rates, decentralization of industry was now taking place. As the non-metallic products are practically all of great bulk, the element of transportation costs was very important and efforts should be made to utilize cheaper methods of transportation, such as inland waterways, canals, and the like.

Mr. Metz gave an example of limestone operations, where various grades of products were efficiently used, and C. Q. Payne called attention to the importance of fine grinding, which was also emphasized by Mr. Bowles, who said there was a large field for experimentation in such fine grinding. The fact that often the utilization of byproducts depends upon finding a proper market was pointed out by Mr. Blossom, who said that in the manufacture of sand-lime brick from greensand residues he knew of a case in which no outlet could be found for the sand-lime brick in New York City. Chairman Ries thought the disfavor of sand-lime brick was due partly to its color and weakness.

The meeting was well attended, and the discussion interesting. It is hoped that an even greater interest will be manifested at the next session.

Smoker Program Includes Variety of Stunts

Gold Dust Twins Entertain With Original Number—Moving Pictures Show Recent Athletic Event

E. P. MATHEWSON, the w. k. master of ceremonies, gave the ball its initial roll at the smoker held on Monday evening, and remained, for the rest of the evening, the life of the party. This year this affair was held in the auditorium of the Engineering Societies Building, and the place was packed. Following Mr. Mathewson's introduction of the "Gold Dust Twins," Institute members were given an opportunity to demonstrate their vocal abilities, in which particular they acquitted themselves with considerable credit. Some of the members, with the assistance of a bona fide professor of the black arts, performed several feats of legerdemain. It may be remarked, in passing, that there were few present who expressed themselves as anxious to engage in the great American indoor sport with the aforesaid gentleman as an opponent. He was clever at cards. The program possessed sufficient variety to please—shall we say the most fastidious—for directly preceding a light lunch the entertainment committee staged a particularly effective and original number. With the present trend of custom no affair is complete without at least 2,000 ft. of "movies." The smoker was no exception, and by special arrangement a showing of the Dempsey-Brennan fight pictures, secured particularly for the occasion, was given.

Ludlow Elected at Annual Business Meeting

Sessions Held on Iron and Steel and Special Addresses Made by Rice and Winchell

THE annual business meeting of the Institute was held Tuesday morning at 10 o'clock, with Herbert Hoover, president, in the chair. The minutes of the 1920 meeting were read and approved, following which Mr. Hoover made a brief report on the activities of the Institute during the last year. The report of Secretary Stoughton, and also the reports of the membership, library, and auditors committees, were read and accepted. The tellers reported the proposed slate of officers for 1921 as elected. These are as follows:

President, Edwin Ludlow; vice-presidents, E. L. DeGoyler and Albert Burch. These three, together with R. V. Norris, W. G. Mather, George Otis Smith, W. E. Wrather, and J. C. Greenway, were elected directors.

It was announced that Walter Lewisohn has offered a prize of $1,000 for the best paper by an Institute member on the uses of platinum. This offer was accepted and a vote of thanks tendered to Mr. Lewisohn.

GEORGE S. RICE DESCRIBES DEVASTATED FRENCH COAL FIELDS

Before a large attendance of Institute members at a session in the morning of Feb. 15, presided over by Herbert Hoover, George S. Rice, chief engineer of the U. S. Bureau of Mines, gave an illustrated lecture covering his observations of the devastated coal mines of France and their rehabilitation. First sketching the geographical and geological relation of the numerous European coal fields, Mr. Rice then illustrated by means of lantern slides the statistical position of European nations prior to and after the war. Subsequent slides vividly brought out the tremendous and utter destruction of magnificent French coal mining plants, much of it being the result of deliberate and wanton destructive calculations as well as the effect of battle fire. Elaborate coal plants were shown in photographs as they appeared before the war and at the conclusion of hostilities.

The lantern slides indicated the great task that must be faced in rehabilitating the destroyed areas, and in unwatering the flooded mines, erecting new surface equipment, and supplying adequate housing facilities for the workmen. Mr. Rice also pointed out how, through a cementation process, some of the partly destroyed shafts were being repaired. There was no discussion of the lecture.

H. V. Winchell next read a paper entitled "Geology of Pachuca and El Oro," in which he outlined his views on the origin of the mineral deposits of this important Mexican mining district. There was no oral discussion of his paper.

Simultaneously were held the Iron and Steel session, with J. W. Richards as chairman, and the Institute of Metals division, over which William H. Bassett presided. At the former the following papers were presented: "Measurement of Blast-Furnace Gas," by D. L. Ward and R. S. Reed; "Importance of Hardness of Blast-Furnace Coke," by Owen R. Rice; "Manufacture of Ferromanganese in the Electric Furance," by R. M. Keeney and Jay Lonergan, and "Electric Furnace in the Iron Foundry," by Richard Moldenke. The Institute of Metals division meeting included two papers: "Effect of Temperature, Deformation, Grain Size, and Rate of Loading on the Mechanical Properties of Metals," by W. P. Sykes, and "Artillery Cartridge Cases," by J. Burns Reed and S. Tour.

TUESDAY AFTERNOON MEETING

At the session on Coal held Tuesday afternoon, with R. V. Norris presiding, several papers which were of interest were presented, and these were followed by discussions. The papers were as follows:

Alaskan Coal Fields. By George Watkin Evans.

Mine Water Neutralizing Plant at Calument Mine. By L. D. Tracy.

Run-off and Mine Drainage. By Howard N. Eavenson.

Skip Hoisting for Coal Mines. By Andrews Allen and J. A. Garcia.

Coal Pillar Drawing Methods in Europe. By George S. Rice.

Report and Suggestions of Committee on Standard System of Accounting and Analysis of Cost of Production, National Coal Association.

Pillar Drawing in Thick Coal Seams. By G. B. Pryde and R. A. Magraw.

A simultaneous session was held on Iron and Steel, with A. A. Stevenson presiding, the papers being as follows:

Nitrogen in Steel and Erosion of Guns. By H. E. Wheeler.

Static and Dynamic Tension Tests on Nickel Steel. By J. J. Thomas and J. H. Nead.

Surface Changes of Carbon Steels Heated in Vacuo. By E. H. Hemingway and G. R. Ensminger.

Chemical Equilibrium Between Iron, Carbon and Oxygen. By A. Matsubara.

Molybdenum Steels. By John A. Mathews.

These two meetings concluded the afternoon sessions, the meeting on Industrial Relations having been postponed until the following day.

In the evening an entertainment, followed by dancing, was given at headquarters.

Heat Treatment of Drill Steel of Absorbing Interest

Session Approves Resolution To Urge Research Work in Drill Steel by Engineering Societies

THE comparatively large attendance at the metallurgical session on the morning of Feb. 16, at which heat treatment of drill steel was discussed gave evidence of the importance of the subject. B. F. Tillton, of the New Jersey Zinc Co., presided. An effort was made to consider the various phases of the subject in a systematic manner, questions being taken up under the following heads: (1) Study of steels which give the greatest service before failure by breakage of drill steel; (2) maximum service which might be expected; (3) mechanics of failure; (4) methods of machine development for accelerated tests; (5) correlation of field tests with accelerated laboratory tests; and (6) reclamation of depreciated drill steels. The first four subdivisions cited were covered by the papers presented at the morning session.

Francis B. Foley, of the U. S. Bureau of Mines, attempted to show the causes of the breakage of drill steel by means of data and charts covering tests made at the New Jersey Zinc Co. Mr. Foley was followed by W. Hoffman, metallurgist of the Colonial Steel Co., who said, in the course of his remarks, that in buying steel more attention was usually paid to price than to quality. He emphasized the need for selecting the proper grade of steel. This is the age of highly specialized steels and complex alloys, said Mr. Hoffman.

Charles M. Brown, vice-president of the Colonial Steel Co., was the next speaker. In discussing steels that give the greatest service before failure, Mr. Brown said that the cruciform section so commonly used is the poorest of all, owing to the comparatively small amount of metal in it and to the injury that the bit undergoes in the process of forging. Many companies, he said, have substituted the quarter octagon section. He expressed the opinion that mining companies would largely abandon the cruciform section within the next few years. Chemical analysis must not be relied upon too far, said Mr. Brown. Good material and experienced workmen are required in the making of good steel. The speaker concluded by outlining the points that it is necessary to observe to obtain the maximum service of steel.

The essentials of an ideal drill steel were defined by Frank Kingdon, of the Sullivan Machinery Co., in his paper. He said that all is not being done by steel manufacturers that could be done, but that it is useless to attempt to do more when heat treatment is not properly practiced.

Before the discussion started, Van. H. Manning, research director of the American Petroleum Institute, asked that the session approve a resolution that he read. This urged that the directors of the A. I. M. E. appoint a board to engage in research work in drill steel, and that this research be participated in by all societies interested, the societies being enumerated. The resolution was approved unanimously.

The discussion that followed was brief and was engaged in by Dr. Burgess, of the U. S. Bureau of Standards; Prof. J. W. Richards, of Lehigh University; Dorsey A. Lyon, of the U. S. Bureau of Mines; Prof. Moore, of the University of Illinois; Mr. Hoffman, J. H. Parker, and C. E. Julihn.

Prof. Richards pointed out that cleavage planes in minerals are developed by pressure and suggested that possibly the so-called crystallization was similarly caused by impact. Dr. Lyon said that the Bureau's interest in the subject was that it seeks to prevent waste, and in lowering mining costs it is, directly or indirectly, preventing waste.

Prof. Moore discussed the fatigue of metals. He said that he felt that it has been conclusively shown that steel subjected to prolonged stress of a certain kind will fail at some point that bears no relation to the elastic limit. He gave three definitions of fatigue: First, the old theory that it is due to crystallization; second, that under repeated stress some inherent property of the mineral changes its elastic limit; and third, that it is the gradual spread of damage from some point of previous injury or overstrain. Prof. Moore said he had come across no case that could not be so explained.

Women's Auxiliary Reports Excellent Progress

New Sections Organized and Increased Membership Shown—Announcement Made of First Scholarship To Be Awarded

THE Women's Auxiliary of the Institute held its fifth annual meeting in the Directors' Room on Wednesday morning at 10.30. This meeting followed a short session of the New York Section of the Women's Auxiliary, of which Mrs. W. Y. Westervelt has been director for the last year, at which the announcement was made of the result of the elections in the New York Section for the coming year. The program included the minutes of last annual meeting; reports of the president, treasurer, educational committee, and those from the Anaconda, Butte, California, Denver, New York, St. Louis, Utah, and Canadian sections.

The reports were most interesting and showed excellent work on the part of all the sections. Mrs. Tyrrell, of Toronto, reports the organization of a branch of the Women's Auxiliary in Toronto. The New York Section reported the growth of a large increase in its membership, due to splendid work by its committees, and the Women's Auxiliary as a whole finds its increase in membership this year more than 36 per cent.

Mrs. Hoover in accepting the appointment as chairman of the new Membership Committee spoke with convincing interest. The meeting closed with an address by Prof. James F. Kemp, who spoke of the fundamental needs in education in the profession of mining engineers, a subject of peculiar interest at this time, owing to the fact that the work of the Women's Auxiliary is to raise a fund for scholarships in schools of engineering. The first scholarship, announced at this meeting, goes to James Chrystie of Anaconda, Mont. The meeting was largely attended.

Moving Pictures Shown of Sulphur and Asbestos Mining and Steel Manufacture

On the afternoon of Feb. 16, before several hundred Institute members, motion pictures covering the production of sulphur, the mining and preparation of asbestos and the manufacture of steel were shown. Director Bain of the U. S. Bureau of Mines made a few introductory remarks and stated that the pictures had been prepared with the co-operation of companies interested in the production of each of these minerals and metals, and that they were for public distribution, being prepared with the purpose of correctly presenting authentic pictorial information about the recovery of minerals and metals from their ores and their transformation into the finished article. All of the films were prepared under the direct supervision of M. F. Leopold.

The first set of motion pictures shown was taken in co-operation with the Texas-Gulf Sulphur Co. in its Louisiana sulphur fields.

The American Rolling Mill Co., of Middletown, Ohio, co-operated in the next picture, which presented the making of openhearth steel and its subsequent manufacture into rolled sheets.

Asbestos mining and the manufacture of asbestos goods was the next subject, in which the H. W. Johns-Manville Co. co-operated. The Arizona asbestos property of the company at Chrysotile was pictured and disclosed the comparatively primitive methods of mining and transportation by burros that still have to be used. The Quebec properties of the company, which were next shown, furnished a decided contrast with their extensive and up-to-date open-pit mining operation.

Origin of Gulf Salt Domes Considered

The session on Petroleum and Gas was well attended. Valentin R. Garfias gave an abstract of an excellent paper, "Principles Governing Mexican Taxation of Petroleum," but, for some reason or other, there was no discussion, although Ralph Arnold, the chairman of the meeting, called particular attention to the fact that the paper warranted such. Arthur Knapp's paper, "Modified Oil-Well Depletion," occasioned some slight discussion from R. H. Johnson, who stated that data in tabular form are of value if the executive is not interested in curves.

"Barrel-Day Values," a paper by G. H. Alvey and A. W. Foster, was read by Mr. Alvey. In a discussion of this paper R. H. Johnson expressed the opinion that the barrel-day value was open to objections and was dangerous with business men, who failed to appreciate the value of the variables that should be considered. Mr. Arnold spoke briefly in favor of the efforts to place the oil business on an exact basis. W. G. Matteson "started something" with his paper, "Secondary Intrusive Origin of Gulf Coastal Plain Salt Domes," which he delivered in abstract.

E. Coste took exception to the opinion regarding Mr. Matteson's theory of the origin of the salt brines and said that it seemed impossible to conclude that there was a leaching of the hydrocarbons. Kirby Thomas advanced the opinion that sufficient attention had not been paid to the investigations of the sulphur companies in the Texas fields in consideration of the origin of the salt domes.

Frederick G. Clapp stated that several theories should be advanced before the acceptance of such a one as that presented by Mr. Matteson. E. L. DeGolyer stated that Mr. Matteson's paper was too positive. It is his belief that the Gulf Coast district is a poor region in which to study salt domes and that the sulphur mines offer better opportunity.

H. Hixon spoke briefly on the increase of temperature with depth, and offered the theory that intense pressures produced a condition whereby the crust or dome floated on a gaseous core. Frederick G. Clapp read an abstract of the paper "Isostatic Adjustments on a Minor Scale in Their Relation to Oil Domes," by M. Albertson.

David B. Reger gave an abstract of his paper, "Carbon Ratios of Coals in West Virginia Oil Fields," in which he draws attention to the use of isocarbs in determining the boundaries of possible oil deposits, the isocarb being a line showing an equal fixed-carbon perpercentage.

By invitation, a special paper by Mowry Bates and Bernard H. Lasky was given in abstract by Mr. Lasky and illustrated with slides. This paper covered a complete record from 1912 to 1920 of the production, consumption, prices, costs, and wells drilled in the mid-continent field.

A continuation of the morning session on "Breakage and Heat Treatment of Drill Steel," was held in the afternoon, with B. F. Tillson presiding. Papers were presented by Messrs. Sturtevant and Gilman, and by Dr. Burrows. Mr. Gilman's paper was particularly enlightening, inasmuch as he presented actual specimens of heat-treated steel and explained in detail the conditions under which they had been considered.

Efficiency of Workmen Discussed in Industrial Session

The session on Industrial Relations, originally scheduled for Tuesday afternoon, was presided over by Robert Linton. Two papers, "The Health of the Underground Worker," by A. J. Lanza, and "Dust Ventilation Studies in Metal Mines," by Daniel Harrington, were presented, following which a symposium on employment problems was held. J. Parke Channing read a paper by J. N. Houser, of the Service Department of the Tennessee Copper Co., and a paper was also presented by S. R. Rectanus, both of these dealing with the hiring and placing of men. It was stated in a communication by S. Rolle that in 1917 the hiring and firing of men at North Butte by the bosses was discontinued and the same placed in the hands of the labor department. Another letter from E. A. Hewitt, superintendent of the Consolidated Coppermines Co., stated that the labor cost was the largest item of the total expense and yet many metal mining companies are unwilling to spend anything in this direction. The discussion following was opened by Mr. Channing, who stated that two employment bureaus with which he was familiar had been very successful. It was a question in his mind whether mining school graduates or practical men made the best foremen. Another speaker urged that it was essential to teach the foremen the policies of the company and that time spent in their education was well worth while. A letter was read by Mr. Rolle on open-shop conditions in the Joplin district. This stated that no colored labor was employed and very little foreign; the men were free at all times to consult the foremen, and operators preferred a shortage of labor to the complexities of foreign help.

Annual Banquet at Waldorf A Success

Herbert Hoover and Edwin Ludlow Only Speakers —W. L. Saunders, Toastmaster—Dinner Followed by Dance

THE annual banquet at the Waldorf-Astoria on Wednesday evening was most successful from every point of view. It is estimated that fully 500 people were present. A most pleasing feature was that the toastmaster, W. L. Saunders, introduced but two speakers, the retiring president, Mr. Hoover, and his successor, Mr. Ludlow. This program, so thoughtfully prepared by the dinner committee, won for the latter kinder thoughts than any other procedure on their part could have done. As is well known, Mr. Saunders is a modern Joe Miller, and he drew liberally on his fund of jests and stories in introducing Mr. Hoover, though, as for that matter, the latter needed no introduction.

Mr. Hoover's address was short. He outlined the growth of the Institute and pointed out that it had gained more new members in the past year than ever before in its history. He drew attention to the financial position of the society and deprecatingly referred to recent criticism in San Francisco to the effect that the officers were not pursuing the right financial course. An increase in dues to an amount comparable with that charged by some of the other great national societies had been contemplated. It had also been proposed, said he, to make the dues higher in the New York district than elsewhere, in view of the greater advantages enjoyed by members here. This, however, had been considered inadvisable.

The work of the Near East Relief was touched upon briefly, at the request of some of Mr. Hoover's friends. The entire $33,000,000 needed for European relief would be subscribed by the end of February, he stated, saying, "I know that you will be glad to hear that twenty-eight states have already oversubscribed their quota."

A ballad lauding the achievements of Mr. Ludlow, reminiscent of the adventures of Phoebe Snow on the Road of Anthracite, was recited by Mr. Saunders in introducing the incoming president. The toastmaster's efforts were rewarded with liberal applause.

Among the distinguished guests at the head table was Dr. Henry S. Drinker, the retiring president of Lehigh University and one of the founders of the Institute. Dr. Drinker received an ovation when his presence was alluded to by the toastmaster.

Following the dinner a dance was given, which was attended by the majority of those present. Altogether, the evening was one of which those who were present will have many pleasant recollections.

Address of President Edwin Ludlow at the Dinner Of the A. I. M. E. on Feb. 16, 1921

I DEEPLY APPRECIATE the honor which has been conferred upon me by my election to the presidency of this Institute, as I feel that it is the highest honor any engineer can receive; and I also feel that I am especially fortunate in being called to take the presidency in the year following Mr. Hoover, as I may be enabled in that way to carry on the work which he has initiated.

The constructive work that Mr. Hoover has inaugurated during the last year has been of inestimable benefit in bringing not only this Institute but the entire engineering profession into a place in the public esteem to a degree which it had never before occupied. This work Mr. Hoover will now carry on in the broader field of the Federated Engineering Societies, of which he is president. Through that organization the engineers of this country, in all branches of the profession, will be welded into one compact body reaching from the Atlantic to the Pacific, making the united engineering profession a power for maintaining American ideals and standards throughout the land.

The engineering profession has never as a whole occupied its proper place in civic life, but through this organization the engineers will have the opportunity to take a greater interest and a more authoritative position, not only in the affairs of the nation but in the civic affairs of the communities within which they reside. Through the territorial grouping proposed by the Federated Engineering Societies, and the [illegible] control vested in the American Engineering Council, with its headquarters in Washington, they will have an opportunity of making their power felt as a unit.

There has never been a time in all our history when sane, conservative influences were more needed than the present, to advise the legislative branch of the Government, and, if this opportunity is not met, the engineers will not fulfill their high duty as citizens for which their education and experience have fitted them.

During the Great War it became essential that the Government should practically be under a dictatorship, and the power of the Executive had to be used in that way, but the results of the November election showed that the people were absolutely determined that there should be no continuation of that executive control. The great lesson of that election was the insistence of the people that representative government should once more prevail.

And another lesson which that election taught was that the autocratic rules and regulations of some of the labor unions, with the dictatorial powers that have been assumed by men who have worked themselves into leadership in these unions, would no longer be submitted to. What the labor situation has been leading to is described by Walt Mason in the following lines that contain more truth than poetry:

> I hired some honest working men—
> (To find such men long leagues I [illegible])
> To come around and fix my den,
> Which time and weather had [illegible]
>
> The carpenter arrived in state,
> He was attired in raiment [illegible]
> His [illegible] car was [illegible]
> Eight cylinders, the blame thing had

The plasterer, a stalwart man,
Gave evidence that he was flush,
For he rode in a fine sedan
Upholstered in the richest plush.

The painter came, as he agreed—
A man of rather haughty mien;
He used to drive an old bay steed,
But now he tools a limousine.

The tinsmith came, an able cuss,
Who labors through a six-hour day,
And I admired his handsome bus—
A Model 21 coupé.

And there was one who came to delve
A ditch where concrete would be poured.
His wagon was a Super-Twelve
Whose powerful engine chugged and roared.

They parked their cars around my shack
Until the street both ways was blocked,
And of the toiler's burdened back
Throughout the day they warmly talked.

They spoke of capital that sat
In gilded ease and wore a grin,
And on ill-gotten gains grew fat
While honest toil grew lank and thin.

They talked all day of tying cans
To plutocrats and men of means,
And then drove 'way in rich sedans,
Touring cars and limousines.

This situation, the truth of which can be recognized in spite of the exaggeration, is the direct cause of the demand which has become insistent from the Atlantic to the Pacific for an open shop, which will allow labor to be paid for the work it accomplishes, and be more representative of American ideals and American organization.

To the closed shop can be directly traced the ability of men of the Brindell type to become the powerful factors in the control of labor, and to use that power to demand a heavy toll on all construction, as has been so distinctly brought out in the recent investigations in this city. Corresponding investigations in other cities will undoubtedly develop more Brindells.

The country demands not the elimination of all unions, but the restoration to labor of the right to receive wages based on ability and industry, and not a minimum of work for a maximum of pay. The union rules, putting the good and the poor workmen on an equality, violate all the principles that have built up this nation. To restore the efficiency and ambition of labor it is necessary for the employer to be able to deal directly with his employees, and not through some outsider who knows nothing of the local conditions and who has a direct interest in keeping employer and employee as far apart as possible, to preserve his own power.

Some of the largest organizations, such as the Bethlehem Steel Co., have adopted a representative form of government in their shops by which there is one delegate elected for each 300 employees, who sits on a board and is able to voice any complaints of the men in his division. In such plants the employee does not need to call in the help of outsiders.

In the anthracite industry the operators and the miners went into a joint meeting for the arranging of a new contract on the ninth of March, last year, and were almost continuously in session for the following six months. There was hardly a time during that period when a new scale could not have been arranged, if the operators had been willing to grant the demand for a closed shop, but it is to their credit—and speaks well for their tact and patience—that they were able to carry on those negotiations and bring them to a successful conclusion without a general strike and without granting the closed shop.

A clear definition of the open shop was given by the Anthracite Commission appointed by President Roosevelt in 1902, in the following words:

"The commission adjudges and awards: That no person shall be refused employment, or in any way discriminated against on account of membership or nonmembership in any labor organization; and that there shall be no discrimination against or interference with any employee who is not a member of any labor organization by members of such organization."

This clause has been repeated in every contract made between the anthracite miners and the operators since 1902, and during that time there has been no protracted strike. This is in sharp contrast with the bituminous field and its closed shop, where strikes have been called, in violation of contracts and irrespective of agreements, at seasons when it was thought coal was so necessary that the extortionate demands would have to be granted.

The greatest problem of the reconstruction which is now going on is the adjustment of wages and working conditions. The country cannot be brought back to a normal productive basis until labor is once more as efficient as before the war, and the point of view of the producers must once more be turned to their cost and efficiency sheets instead of to their balance sheets.

The brunt of this work falls on you engineers, who are on the firing line, with the demand of your board of directors, on one hand, to reduce costs, and, on the other hand, the threat of your labor that if there is any reduction in wages a strike will be called. On your tact and good judgment to tide over this period and to effect such adjustments as are necessary to restore output and reduce costs to a normal figure, and to do this without the disorganization which would come from long and protracted strikes, the prosperity of the country depends. Your problem is a hard one, and the united engineering profession, as well as the business men of the whole country, wish you the best of success.

Edwin Ludlow

"EDWIN LUDLOW, the incoming president of the Institute, has a reputation in mining commensurate with that which his eminent brothers, Admiral Ludlow and General Ludlow, had in their spheres of engineering activity," said R. V. Norris the other day.

"Affectionately known as the 'baby superintendent' in Shamokin, Pa., shortly after his graduation from the Columbia School of Mines, in the class of 1879, he has spent a life time in coal mining, generally as operating executive, his experience beginning and ending in anthracite work, but being largely in the then Indian Territory, Mexico, and West Virginia.

"As to his ability as an engineer, his mine workings and plants were of the highest grade, the work of a leader in engineering practice. As an organizer and executive he has ably and successfully filled great positions. In these, and as first vice-president of the Institute, he has demonstrated his capacity for the titular leadership of his profession.

"I predict an administration notable for constructive progress attained by wise consideration of his associates and unselfish devotion to the duties of his office."

No one in the Institute or without is better qualified to speak of its new president and what he has accomplished than Mr. Norris. The mining engineer engaged in coal work has much in common with his brother who is concerned with the winning of the metals and the various non-metallics other than coal, but the two do not often meet except through the medium of the A. I. M. E. Mr. Ludlow needs no introduction to the profession at large, which has come to feel on familiar terms with him as an officer of the Institute, and the organization is to be congratulated that in picking a coal-mining engineer to lead it during the coming year its choice fell on him.

Mr. Ludlow was born at Oakdale, N. Y., on Long Island, in 1858, and upon his graduation from Columbia took service as a civilian with the United States Engineering Corps under General William Ludlow, his brother. His first work included river and harbor surveying on the New Jersey coast, and within two years he had acquired sufficient experience to take charge of the department's hydrographic work, which was the highest position in the service that was then open to civilians. In 1881 he gave this up for something more adventurous in Mexico, and with two other engineers engaged on the reconnaissance of the Mexican National R. R. from Laredo, Tex., to Mexico City. The party, which had one servant and one pack animal, took eight months to cover the eight hundred miles, and its members reached their destination only to find the company in such financial straits that their work was discontinued.

This seeming misfortune resulted in Mr. Ludlow entering the coal-mining industry. Returning to the United States, he took a position with the Mineral Railroad & Mining Co., an anthracite subsidiary of the Pennsylvania R. R., with headquarters at Shamokin, Pa. Two years later he was appointed superintendent of the Union Coal Co., which had just leased two of the mineral company's collieries, and in 1885 he became superintendent of the latter company. In the course of the four years during which he held the last position he installed the first water-tube boilers and chain conveyors used in the anthracite regions.

In 1889 Mr. Ludlow was called to supervise the development of a virgin coal field in Indian Territory, now Oklahoma. Preliminary geological studies of this district had been made by H. M. Chance, and Ludlow's instructions were to extend the known areas of workable coals, so that the line of the Choctaw Coal & Ry. Co., which was then under construction, should be most advantageously located for working them, and to develop mines to produce a large tonnage for the road. The field was about eighty miles long. The importance of this district today demonstrates the effective way in which Mr. Ludlow performed his task.

Pioneer work again summoned him after ten years in Oklahoma, and he went to Mexico, where as the head of an American company he became the first operator in the now well-known Sabinas field in northern Coahuila. Here as general manager of the Mexican Coal & Coke Co. at Las Esperanzas, it is said, he transformed the desert into a flourishing mining camp within the space of three years. As the new industry throve, competition increased, and to meet this and at the same time provide funds for sinking a 900-ft. shaft, the deepest coal shaft in Mexico, he installed what was then the most modern battery of Koppers waste-gas ovens on the continent.

Finally, Mr. Ludlow was called to the large mining districts of the East. In 1911 he became vice-president and general manager of the New River Collieries Co., and a year later was chosen vice-president of the Lehigh Coal & Navigation Co. and placed in charge of its mines. At this time W. A. Lathrop said of him: "Mr. Ludlow brings to his new position a long experience with mining problems and management, and the company is to be congratulated upon having secured his services." He remained with the Lehigh company until July 1, 1919, when he resigned to enter into practice as a consulting engineer in New York.

Of his new office as president of the A. I. M. E., Mr. Ludlow has said: "I regard it as the highest honor that can be paid to an engineer—one that has to be taken seriously and one that carries with it the responsibilities that are vested in the presidency of a very large and growing organization."

Last Day of Meeting Includes Only Social Sessions

There were no technical sessions scheduled for Thursday, the last day of the Institute meeting, but a number of the visitors availed themselves of the opportunity to take in the visits which had been planned by the Entertainment Committee. The Museum of the American Indian, Heye Foundation, was opened for the first time for a private view for members of the Institute. In the same vicinity, the Museums of the Hispanic Society of America, the American Numismatic Society, and the American Geographical Society of New York were visited. At noon, a luncheon was served at the May Flower restaurant, and during this time President Ludlow introduced some of the prominent men connected with the management of the museums visited. The party then proceeded to New York University. Later in the afternoon a tea was tendered to the visiting ladies by Mrs. Herbert Hoover at the Cosmopolitan Club.

A recital of the various programs would be incomplete without a mention of the special arrangements which were made for the entertainment of the ladies during the various sessions of the meeting. On Monday afternoon there were several auto parties made up for the purpose of visiting different points in the city. In the evening, a performance of "Good Times" at the Hippodrome was attended. On Tuesday afternoon a visit was made to the art galleries of Senator William A. Clark, and this was followed by a reception. Wednesday afternoon there was a fashion show at Lucile's, to which the men were also invited. It must be remarked that there was a good attendance of the latter

HANDY KNOWLEDGE

Blowing Engines With Plate Valves

By N. L. Stewart

Written for Engineering and Mining Journal

During 1918, a new converter blowing engine with air cylinders of 64-in. diameter by 60-in. stroke, and with plate valves, was put into service at the Garfield smelter, at Garfield, Utah. Up to that time all the piston-type blowing engines in use had been equipped with mechanically operated valves. It was found, however, that the new engine could be obtained at a lower cost if equipped with plate valves. The machine was guaranteed to give satisfactory results with these plate valves, and for this reason the order for the new engine specified that it would be so equipped. The plates are about 7½ in. in diameter, and there are 232 on the two cylinders. This includes both inlet and discharge valves. The plates are made of hardened steel about $\frac{1}{32}$ in. thick, and are therefore quite flexible. Each plate is held in place by three studs, each stud having a light coil spring.

The plate valves have been entirely satisfactory in every respect. They are simple and accessible, and can therefore be cheaply and quickly renewed. The operators in the power house now prefer them to the mechanically operated valve.

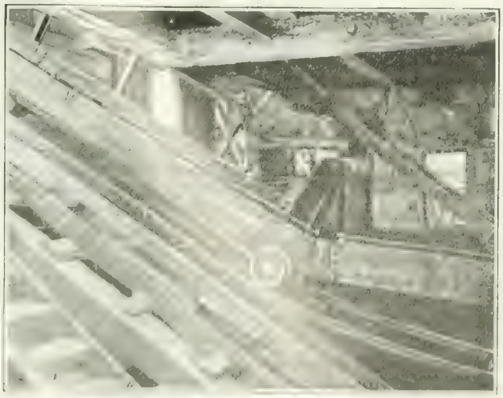
Plate valves are much used in ordinary air compressors, but I do not think, up to date, that they have been used extensively in blowing engines for copper plants. The particular engine mentioned above was built by the Allis-Chalmers Manufacturing Co.

Changing Skips and Man Cars In Incline Shafts

By George J. Young

Written for Engineering and Mining Journal

Changing skips and man cars when the angle of the shaft or slope is comparatively flat is easily effected by placing a switch on the skip track and connecting it to curved tracks leading off to the side and terminating in a pocket or else in a horizontal plane. For steeper angles, the simple method shown in Fig. 1 is satisfactory. In this example, one or more receiving decks are constructed above the principal landing level. The decks are overhung, but have clearance when either skips or man cars are in regular operation. Hinged to the edge of the deck is a pair of curved rails which connect with a short length of track upon the landing deck. The ends of the rails are scarfed, and the flanges of the rails a short distance back from the points are forged out and curved down so as to clasp the head of the skip tracks. A cross bar connects both curved tracks below the point of meeting. It is riveted to the flanges of the curved rails and contains an I-bolt on either end, to which are attached wire ropes. The ropes pass over small sheaves above, and the ends are either attached to a hand-operated winch or to counterbalance weights.



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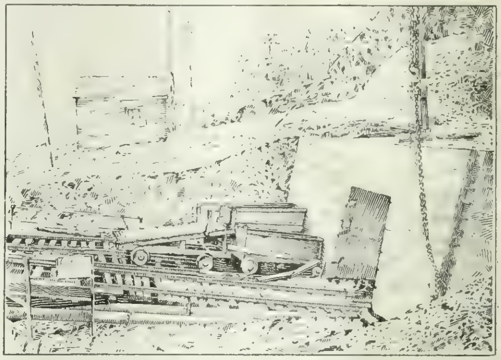


FIG. 2. SKIP CHANGING ON MINE SLOPES

The method of operation is obvious. At underground stations a similar arrangement can be used for unloading mine cars. In Fig. 1 a man car is shown just as it is being removed. The photograph was taken at the Empire mine, Grass Valley. Fig 2 shows the method for removing skips employed in the Birmingham district, Alabama. The incline shaft shown is the No. 1 slope of the Raimund mine, of the Republic Iron & Steel Co.

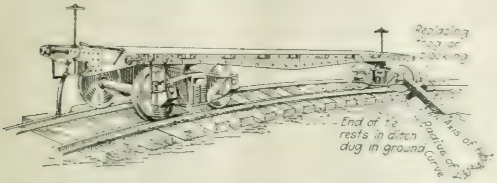
Use of Railroad Tie in Replacing Derailed Truck

By H. H. Hunner

Written for Engineering and Mining Journal

A railroad tie may be used to advantage when a truck becomes derailed on a sharp curve that has considerable super elevation, the wheels being off, having dropped on the lower side. With a loaded car there is a strong thrust toward the inside of the curve as the wheels leave the frogs or blocking used in replacing and drop onto the rails. If the flange on the inside wheel lands on the tread of the inside rail, which frequently happens under the conditions mentioned, the inward thrust of the tilted load will again derail the pair of wheels.

A simple but effective means to counteract this sideward thrust on the truck wheels as they leave the frogs will be found in the use of a railroad tie or equally stout pole or timber. When the frogs are placed ready for the shove ahead, one end of the tie or pole should be placed against the truck frame where it will take hold in the push without injuring the journal box. The outer end is swung toward the frogs to make an angle of 30 to 40 deg. with the radius of the curve and lowered to the ground.


Replacing frog or blocking
End of tie rests in ditch dug in ground
Radius of Curve
Axis of tie

RAILROAD TIE USED TO COUNTER INWARD THRUST WHEN ATTEMPTING TO REPLACE DERAILED TRUCK

A hitch is then dug a foot or more deep to give the lower end of the tie a full bearing when dropped into the hole. Flat rocks or blocking may be used to crowd between the lower end of the tie and the side of the hitch when the tie is placed in position for the trial. A man can safely stand on the lower end of the tie to keep it from pushing up. The earth gives enough to avoid breaking any parts of the truck, and by the time the wheels drop to the rails the tie is exerting a strong crowding effect counter to the inward thrust on the truck.

I have replaced trucks in this manner without the use of frogs by blocking up to clear the rail and crowding over. I have also used the same method on a four-wheel ten-ton industrial derrick. If two wheels of the derrick miss the rails in dropping from the frogs on a sharp curve, the other two are very likely to join them. In using the tie shover on the derrick, I braced the tie against the lower frame of the derrick.

Novel Use of Air Lift for Regular Mine Drainage

By Avery H. Reed

Written for Engineering and Mining Journal

Almost everyone connected with mining is familiar with the air lift as a pumping device for occasional use under special conditions, such as preliminary pumping operations and as an aid in dewatering old mines and flooded mines; but it may be unusual to find in use an air lift installed for daily mine drainage practice, such as that at the Big Four fluorspar mine, situated at Marion, Ky.

The ordinary practical result attained with the air lift is that of pumping out water to one-half the depth of a shaft or mine. For example, if the shaft is 100 ft. deep vertically and an ordinary air lift is installed at the bottom, it can be used practically until the water level stands within 50 ft. of the bottom. Further operation of such an air lift may continue for a while to bring out water and lower the water level somewhat, but finally, and before all of the water can be pumped out, the air lift will cease to function. It is impossible to dewater a shaft or mine completely with an ordinary air-lift installation. The reason is that the mathematical principles involved prescribe so much submergence of the air lift below the level to be drained for its successful operation; and as much as 50 per cent submergence is essential for efficient results.

Of course, if shaft sinking could be kept ahead of mining operations by a distance equal to the vertical height of the latter, there would be the 50 per cent submergence necessary for practical use of the air lift; but such practice is out of the question for obvious reasons.

At the Big Four mine we have installed a novel air lift. We have a vertical shaft 110 ft. deep with a crosscut to the vein at 100 ft., leaving 10 ft. for a sump. With the shaft full of water to within 10 ft. of the top of collar, we dropped 110 ft. of 8-in. standard pipe in one corner of the ladderway. The bottom joint of the pipe, resting on shaft bottom, had been punched full of $\frac{1}{4}$-in. holes, thus forming a strainer. The shaft was floored over, and a heavy churn drill was centered over the 8-in. pipe, and an 8-in. hole drilled 140 ft. in rock. After the drilling was completed, we added 14 ft. of 8-in. pipe, extended above the shaft collar, upon which was fastened the casing-head that supported the 4-in. standard Sullivan air lift, with umbrella discharge. This we installed in the 8-in. pipe and 8-in. drill hole. A suitable discharge box was provided under the umbrella for the water to flow through 5-in. pipe to an elevated tank which is used for storing the mill water supply.

The innovation is the manner in which we provided by means of the drill hole for sufficient submergence of the air lift, to give us practical use of the lift for regular mine drainage. As stated, the water is discharged 14 ft. above the shaft collar. This makes a total depth of 264 ft. to the bottom of the drill hole. The foot-piece of the air lift, with 9 ft. of 1-in. tail pipe attached, was set 16 ft. off bottom, or 248 ft. below the level of discharge, thus establishing 50 per cent submergence below the bottom of the sump, whence the mine water drains into the drill hole through the provided strainer.

The mine was closed down to install the air lift. On resuming operations, we began to work only a single day shift, letting the mine water accumulate over night. Type Y Fairbanks-Morse crude-oil engines are used as prime movers, for all motive power. One engine attendant, who works twelve hours, starting early in the morning, is able to pump out before the day crew comes on shift. During the day, one or both of the two compressors are kept running, primarily to furnish compressed air for the drills. The air valve on the air lift is left "cracked" a little, which suffices to keep the lift running and in this way constantly serves to drain the mine.

The normal flow of water in the mine is about 100 gal. per minute. Before the air lift was installed, constant operation of two No. 6 regular pattern Cameron pumps, actuated by compressed air, was required night and day to keep the mine drained. Pump trouble was frequently experienced, with consequent loss of time. Now we operate practically a "fool-proof" pumping device, and after several months' running have never been down on account of pump troubles. This use of the air lift is especially applicable to the drainage of shallow mines.

THE PETROLEUM INDUSTRY

Petroleum and Asphalt in Venezuela*

Oil Formation in Cretaceous Sandstones and Limestones and Tertiary "Coal Series" —Extent of Productive Region Large—Record of Commercial Activities And Output Since 1915 Indicate Country To Be an Important Source of Supply

BY **ARTHUR H. REDFIELD**
Foreign Minerals Section, U. S. Geological Survey

Written for *Engineering and Mining Journal*

TWO distinct oil-bearing districts may be recognized in Venezuela. One includes the basin of that arm of the sea known as Lake Maracaibo, in the northwest of the republic. The second comprises the shores of the Gulf of Paria from the northern part of the Orinoco delta to the Promontory of Paria. The total area of the Maracaibo district is 27,500 square miles; that of the Paria region equals 2,100 square miles. Only a small part of the oil fields about Lake Maracaibo has been proved by drilling. The Paria district has been celebrated for years for the production of asphalt, but no oil in commercial quantities has yet been extracted there.

The geology of the Maracaibo oil region, as far as it is known, presents similarities of stratigraphy and structure to the Colombian oil fields, particularly those of the Magdalena-Santander district, to which it is geographically contiguous. The mountains of the Maracaibo district are apparently a topographic and a geologic continuation of the Colombian Andes. Though there is some lack of agreement in the assignment of the respective formations to their places in the geologic column, there is a lithological similarity which all recognize. As in Colombia, the manifestations of oil are most abundant in the Cretaceous sandstones and limestones and in the Tertiary, especially in a "coal series," the Cerro de Oro terrane, ascribed to the Miocene, though its Colombian counterpart has been considered Oligocene.

STRUCTURAL CONTINUITY WITH TRINIDAD FORMATIONS

An equally striking similarity of stratigraphy can be traced between the formation of the Maracaibo and Paria districts of Venezuela, and also between the formations of the Paria district of Venezuela and those of Trinidad. As in the former instance there is no question as to the lithological similarity of the strata on the two sides of the Gulf of Paria, the disagreement is only with regard to the geologic horizons to which they are ascribed.

A continuity of structure is apparent throughout the three regions. In the Magdalena-Santander district of Colombia the trend of the principal anticline of the De Mares concession is northeast-southwest. The minor anticline folds with which the geosynclinal basin of Lake Maracaibo is wrinkled bear about N. 61 deg. E. In the Paria region the prevailing structure is one of minor folds and faults with a general bearing of N. 75 deg. E.

The Venezuelan oil is prevailingly asphaltic. Discoveries of paraffine-base oils have been reported, but the petroleum obtained from the wells so far drilled has revealed on analysis an asphalt base. So too, though reports of light-gravity oils have been published, the oils actually extracted in recent years have ranged from 0.928 to 1.02 specific gravity. Not more than 3 per cent of gasoline or 7 per cent of kerosene has been obtained from Venezuelan petroleum in refinery practice.

The commercial production of petroleum in Venezuela began in 1917. Table I gives the production, amount refined, and exports of crude oil:

TABLE I. PRODUCTION, REFINING, AND EXPORTS OF VENEZUELAN OIL, 1917-1919

	Production		Refined at San Lorenzo		Exports to Curacao		Exports to Other Destinations	
	Metric Tons	Barrels	Metric Tons	Barrels	Metric Tons	Barrels	Metric Tons	Barrels
1917....	18,255	119,734	8,871	58,185	9,383	61,541	1	6
1918....	50,710	332,607	24,648	161,666	25,298	172,489	764	5,012
1919....	64,628	423,895	54,000*a*	354,000*a*	10,600*a*	60,522*a*	(*b*)	(*b*)

(*a*) Estimated. (*b*) No data.
In 1919, 686 metric tons (4,499 bbl.) of crude oil was used as fuel at the wells.

No phenomenal yields of petroleum have been obtained from any of the seven wells that were in active production in 1919. The highest known output of the Zumbador well, in the Mene Grande field, was 229.86 bbl. a day. The Zumacaya well in 1919 produced 342.7 bbl. a day. The Zuba well in 1919 had a daily production of 118.46 bbl. In the first half of 1920, the Zumbador well gave 837 bbl. a day; the Zumba well 131.6 bbl. a day; and the Zumaya well 30.5 bbl. a day.

Commercial production in Venezuela has been attained only by the Caribbean Petroleum Co. It is true that the Compañía Petrolia del Táchira, a Venezuelan company, under a title granted Sept. 3, 1878, produced and sold locally for many years small quantities of kerosene refined by crude methods from oil won in shallow wells in the municipality of Rubio, District of Junín, State of Táchira, but little is known of its activities, which have been conducted on a small scale. Its production from 1905 to 1907 averaged 50 metric tons a year. No later statistics of its output are at hand.

The production of asphalt in Venezuela by companies in recent years is shown in Table II.

TABLE II. ASPHALT PRODUCED IN VENEZUELA, 1917-1919.

Company		1917 Metric Tons	1918 Metric Tons	1919 Metric Tons
New York & Bermudez Co	Guanoco, State of Sucre..	52,991	46,453	45,932
South American Company	Gen. Urdaneta and of Lagunillas, State of Zulia	72	50	....
Cía. Anónima Minerales Petroliferos Riopauji...	Rio Pauji, State of Trujillo...	1,009	....	....
Total...		54,072	46,503	45,932

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Drilling, in the main, has been carried on by the cable-tool system. In the Pedernales field, however, difficulties with soft formations led the Bermudez Co. to adopt the rotary system, which has also been tried in the western Buchivacoa field.

At first the larger part of the Venezuelan crude oil was shipped in barges to the Royal Dutch refinery on the Island of Curaçao, Dutch West Indies, but in 1919 the Venezuelan plant at San Lorenzo took over four-fifths of the output of the Mene Grande wells. The San Lorenzo refinery is designed to supply only the Venezuelan trade. Exports to foreign markets are made from Curaçao refinery.

The Curaçao Refinery—Near Willemstad, on the Island of Curaçao, Dutch West Indies, a modern refinery on the Trumble system was completed in 1917 by the Curaçaosche Petroleum Maatschappij (Curaçao Petroleum Co.), a subsidiary of the Royal Dutch-Shell group. Its capacity is stated at 1,000 tons daily. So far, however, no great amount of petroleum has passed through the refinery.

Shipments to Curaçao from the Venezuelan fields are made in tank barges towed by slow tugboats, a trip of several days. These have not been altogether satisfactory. Late in 1919 a number of monitors were purchased from the British government by the Shell Transport & Trading Co., to be converted into tankers for conveying the oil from Venezuela to the Curaçao refinery. At that time, however, only one barge of 800 tons was engaged in this service.

The San Lorenzo Refinery.—The San Lorenzo refinery, built at a cost of over $300,000, has a daily capacity of 400 tons (2,624 bbl.) of crude oil. It began operations on Aug. 16, 1917, and received 8,871 metric tons (58,185 bbl.) of crude oil in that year; 24,678 tons (161,666 bbl.) in 1918; and 54,000 tons (354,000 bbl.) in 1919. Its sales of refined products in 1918 and 1919 are shown in Table III.

TABLE III. SALES OF REFINED OILS FROM THE SAN LORENZO REFINERY, 1918 AND 1919

	1918		1919	
	Liters	Barrels	Liters	Barrels
Kerosene	2,142,962	13,479	3,323,086	20,902
Gasoline	914,130	5,750	2,186,271	13,751
Mineral turpentine	....	.....	1,350	8.5
Benzine	....	.....	306	2

OIL AND ASPHALT RESERVES

Various large estimates have been made of the reserves of petroleum in Venezuela. These range from 150,000,000 to 250,000,000 metric tons, based on estimates of the probable oil-bearing territory and the richness of the oil sands. These estimates will undoubtedly have to be revised in the light of the experiences of the producing companies. Of the 1,028 areas of 500 hectares (1,234.5 acres) each, selected by the Caribbean Petroleum Co. in 1913 for exploration and possible development, 767 areas had been renounced to the Venezuelan government by Dec. 31, 1919, after examination or drilling. It was expected that more would be renounced in 1920 after detailed geologic examinations. On this basis the estimated reserves of available petroleum may have to be reduced to 40,000,000 or 60,000,000 metric tons. Altogether, Venezuela has not lived up to expectations.

No estimates are available as to reserves of asphalt. The deposits of Bermudez Lake give evidence of constant renewal, and other asphalt lakes exist also, both in the east and in the west, which, however, have not been commercially developed.

The Maracaibo district includes the lowlands and eastern slope of the Sierra de Perijá on the Colombian border, to the shores of Lake Maracaibo, an area about 200 miles long from north to south and 75 miles wide; the lowlands and northern slope of the Cordillera de Mérida south of Lake Maracaibo, to the shores of the lake, a belt roughly 150 miles long from southwest to northeast and 50 miles wide; the lowlands and hills east of Lake Maracaibo to a width of about 50 miles and a length of about 100 miles, and the coastal belt of the State of Falcón, south of the Peninsula of Paraguaná, roughly 150 miles long from east to west and 50 miles wide. The district comprises practically all of the State of Zulia, the western half of the State of Falcón, as well as portions of the states of Trujillo and Lara.

At the base of the sedimentary formations of the Maracaibo district is a complex of crystalline gneisses, schists, and igneous rocks, undoubtedly as old as the Paleozoic and probably pre-Cambrian, and metamorphic Paleozoic shales. Overlying these unconformably is the pre-Cretaceous (?) series of Lagunillas conglomerates and breccias, followed by the alternating coarse red micaceous sandstones and coarse yellow to white sandstones (Lower Cretaceous) which outcrop in the Cordillera de Mérida. These are overlain by 500 ft. of limestones, in three divisions, the lower dark bituminous San Cristóbal limestones, the succeeding blue limestones of Táchira and Barbacoas (Lower Cretaceous), and the higher crystalline Capacho limestones (Upper Cretaceous?).

The Eocene has been recognized in the Maracaibo district, consisting of a dark-gray shale with a few intercalations of sandstone. The Capacho limestones are overlain unconformably in places, however, by Oligocene black carbonaceous shales, to a thickness of 3,000 ft. Unconformably above the shale is the Cerro de Oro terrane (probably Miocene), correlated by Sievers with the Lower Caroni series of Trindad and with the Guaduas formation of Colombia. It is 2,500 ft. thick, composed of shales, thin sandstones, and intercalated coal seams. An Upper Tertiary series, apparently corresponding to the Upper Caroni series of Trinidad, and consisting of interbedded sandstones and clays, rests unconformably on the preceding.

Unconformably overlying the Upper Caroni series is the Maracaibo series of loosely consolidated silt and gravel belonging either to the late Tertiary or the early Quaternary. The Maracaibo series is covered by recent gravels and loam.

The present repository of petroleum in western Venezuela is found in the Cretaceous limestones. Not only these, but later formations, especially the Cerro de Oro terrane, have become impregnated with oil. It has been suggested that the Oligocene black shale is the parent oil rock.

STRUCTURE OF THE MARACAIBO DISTRICT

The Lake Maracaibo oil region lies in a great geosyncline, in which minor folds are in evidence on both sides of Lake Maracaibo. Most of these folds are sharp, pronounced anticlines with marked recurring dome structures somewhat similar to those of California. The axis of the Maracaibo geosyncline and of the minor folds which parallel it bears about N. [illegible]

Along the navigable rivers which empty into Lake Maracaibo from the south and southwest evidences of oil are numerous. A score of small streams descending from elevations of 100 to 200 ft. above the level of the rivers are constantly covered with oil scum. Petroleum exudes from fissures in the banks of the streams. At one point a hole dug three feet deep and two feet square filled with petroleum in about six hours. Well-known oil springs occur near Betijoque. Indications of petroleum are found on the north branch of the Tocuyo River. A heavy oil exudes in the Miranda district. Asphalt seeps, running 94 per cent pure, are found near Fort San Carlos on the Limón River. Seepages of petroleum are found near Santa Cruz de Mara, where the "coal series" (Cerro de Oro terrane) outcrops. The Flores Asphalt Lake, about twenty-five miles west of Maracaibo, points to the existence of a petroliferous formation.

COMPANY ACTIVITIES

The Caribbean Petroleum Co.—The only active producer of petroleum in Venezuela previous to 1919 was the Caribbean Petroleum Co., of Camden, N. J. The company after a thorough exploration by a party of thirty-five geologists, headed by Ralph Arnold, selected in 1913, for preliminary work of development, 1,028 areas of 500 hectares (1,235.5 acres) each, situated on both sides of Lake Maracaibo.

The principal holdings of the Caribbean Petroleum Co. are in the Mene Grande field, seventy miles east of Maracaibo and sixteen miles inland from San Lorenzo; in the Miranda district, east of Lake Maracaibo; at Perijá, fifty miles west of the city of Maracaibo; and in the Santa Cruz de Mara district.

Drilling by the Caribbean Petroleum Co. in the Mene Grande field began in January, 1914. The first well drilled struck oil at a depth of 390 ft. and produced about 10 bbl. a day. In the next two years, five other wells were sunk ranging from 600 to 1,700 ft. in depth. Oil was found in all; most of the wells had to be capped. The Zo. No. 1 well drilled in 1918 gave oil at 797 ft. A second well was abandoned at 227 ft. Of the two wells completed in 1919 one was abandoned at 1,359 ft. and the other had reached 1,078 ft. at the end of the year. More wells were authorized for 1920.

The following statement shows the condition of the productive wells in the Mene Grande field in the fall of 1920:

CONDITION OF PRODUCTIVE WELLS IN MENE GRANDE FIELD IN FALL OF 1920

Well	Drilled	(Feet)	Initial Production, Metric Tons	Present Conditions
Zumacaya No. 1	1915	583	40	Capped
Zumaque No. 1	1914	390	40	Capped
Zumaya No. 1	1914	1,667	400	Producing
Zumba No. 1	1915	882	250	Choked with sand
Zumbador No. 1	1915	869	300	Producing
Zumbel No. 1...	1915	552	400	Choked with sand
Zo. No. 1......	1918	797	40	Dammed with cement to exclude water
Zumaque No. 2..	1919	903	100	Dammed with clay and cement to exclude water

Commercial production has been attained so far only in the Mene Grande field. The output by wells in this field has been as follows:

PETROLEUM PRODUCED IN THE MENE GRANDE FIELD 1917-1919 AND SIX MONTHS OF 1920

	1917		1918		1919		Jan.-June, 1920	
	Metric Tons	Barrels	Metric Tons	Barrels	Metric Tons	Barrels	Metric Tons	Barrels
Zumbador No. 1...	10,240	67,164	36,103	236,800	36,862	241,775	23,102	151,526
Zumba No. 1....	8,015	52,570	11,548	75,743	6,592	43,236	4,522	29,660
Zumbel No. 1..	.....	......	.....	......	336	2,202	652	4,276
Zumaque No. 2...	.....	......	.....	......	102	670	15	98
Zumacaya No. 1....	.....	......	.....	......	528	3,463	76	498
Zumaya No. 1....	.....	......	.....	......	19,068	125,066	842	5,523
Zo. No. 1...	.....	......	3,059	20,064	1,141	7,483	76	498
Totals...	18,255	119,734	50,710	332,607	64,628	423,895	29,285	192,079

For storing the oil, three steel tanks holding 55,000 bbl. each have been built at the wells. A 6-in. pipe line leads from the wells to the company's refinery at San Lorenzo, a distance of fifteen miles.

Work was started by this company in 1917 in the Santa Isabel field in district of Miranda, State of Zulia, adjoining the Bolívar holdings of the Venezuelan Oil Concessions, Ltd. A road twenty-six miles long was built from Altagracia to Santa Isabel, the field headquarters. Drilling in this field was continued throughout 1920.

In the Perijá field the first well, of the Caribbean Petroleum Co., drilled in 1915, showed oil in considerable quantities at 1,227 ft., and was shut in. Two more wells started in 1916 were completed in 1917 and 1918 respectively, without satisfactory results. In 1919 one well was drilled to a depth of 2,235 ft. without success. This final failure induced the company to renounce many of its holdings in the Perijá field.

Development of the Mara fields (Iniciarte and Cachirí de Palmarejo) in the Municipality of Ricaurte, State of Zulia, was begun in 1917. A wagon road completed by the company in 1915 leads from Lake Maracaibo to the Iniciarte field, a distance of forty miles; a branch of the road leads to the Cachirí de Palmarejo field, forty-five miles from the lake. Three wells were drilled in 1917 near Iniciarte, to depths respectively of 900 ft., 811 ft., and 2,018 ft. Shows of oil were obtained, but not in commercial quantity. When a well begun in May, 1918, was carried to 1,980 ft. without a commercial yield of oil, the company renounced its concession to a number of areas in this field.

Three wells in the Cachirí field were drilled in 1917 down to basalt, to depths of 1,950 ft., 430 ft. and 736 ft. respectively. No commercial quantities of oil were found. A well drilled in 1918 encountered igneous rock at 745 ft., and was abandoned.

DRILLING IN LA SIERRITA FIELD CONTINUED IN 1920

In the La Sierrita field, district of Mara, State of Zulia, a well was started in October, 1919. Despite delay occasioned by a lack of water, requiring the laying of a pipe line to the Ciénega de Sinamaica, twelve miles distant, the well had been carried by the end of the year to 1,146 ft. through clay, shale, and sand. Drilling was continued during 1920.

There remained to the Caribbean Petroleum Co. at the end of 1919 in both the Maracaibo and the Paria districts 261 areas, comprising about 322,466 acres. Some additional areas were probably surrendered during 1920 after intensive geologic study.

The Venezuelan Oil Concessions, Ltd.—The Venezuelan Oil Concessions, Ltd., of London, holds a concession covering 8,128 acres in the district of Maracaibo, on the west side of Lake Maracaibo, and in the district of Bolívar, on the east side of the lake. Development of the Bolívar area began late in 1913, with the drilling of wells at La Rosa and Santa Rita. The Santa Rita well was drilled to a depth of 1,600 ft. without striking oil, and was then abandoned. In the La Roca well, oil sand was met at a depth of 800 ft.; and at a depth of 1,500 ft. a sand giving oil of 30 deg. Bé. was struck. A great quantity was given at first; but after ten days the output had decreased to 10 bbl. a day. No attempt was made to pump the well, which was abandoned.

The Venezuelan Oil Concessions, Ltd., fought a losing fight with the mosquitos, which decimated its workers with malarial diseases. The drilling system originally adopted proved unsatisfactory, and new equipment was ordered in the United States. The outbreak of the Great War prevented the delivery of this equipment. Nevertheless in the next three years five more wells were drilled, ranging in depth from 600 ft. to 1,800 ft., and spread over a wide area. Oil is said to have been found in five of the seven wells, of which those near Santa Barbara are believed to be of commercial value. Particulars concerning two of these wells are given in the following table:

DATA ON WELLS OF VENEZUELAN OIL CONCESSIONS, LTD

Well	Year Drilled	Depth, Feet	Initial Production, Metric Tons	Present Condition
No. 1	1918	1,424	16	Capped
No. 4	1919	1,697	18	Capped

Drilling in the Barroso field was started in June, 1918; but the well was discontinued after an accident to the casing. A second well begun in the latter half of that year was abandoned at 536 ft. In the spring of 1920 there was practically no activity in the Bolívar holdings of the Venezuelan Oil Concessions, Ltd.

The Colon Development Co.—The principal holdings of the Colon Development Co., of London, are in the Colon district, State of Zulia, especially in the vicinity of El Cubo, near the Colombian border, 100 miles southwest of Encontrados, and are contiguous to the Barco concession in the State of Santander del Norte, Colombia.

GUARD AGAINST INDIANS NECESSARY

The geologic exploration and the subsequent development of the Colon field were considerably hindered by the depredations of the Motilones Indians, necessitating an armed guard about the field camps and drilling machinery day and night. Drilling began early in 1914. The first well was abandoned at a depth of 700 ft. The second well, on the Rio Oro, reached over 1,000 ft., giving an initial output of 200 bbl. a day of light-gravity oil. Three wells were drilled along the Rio Tarra, the deepest to 2,362 ft. A sixth well was carried to 328 ft. during 1919.

The Colon Development Co. had drilled up to May 1, 1920, six wells, as described. Three of these were found productive and capped, as is shown in the following statement:

DATA ON PRODUCTIVE WELLS OF COLON DEVELOPMENT CO.

Well	Year Drilled	Depth Feet	Initial Production, Metric Tons	Present Condition
Orden No. 2		1,045	39	Capped
Toldo No. 1		830	117	Capped
Tabla No. 3	1918	1,909	21	Capped

British Controlled Oilfields, Ltd.—The British Controlled Oilfields, Ltd., is operating the Buchivacoa concession of 3,000 square miles in the State of Falcón, acquired from the Venezuelan-Falcón Oil Syndicate, Ltd. The property is said to contain a sharp, narrow anticline traceable for fifty miles from northeast to southwest. Toward the west, the anticline pitches southwest and shows recurring dome structures. Seepages of a light oil are numerous.

Development is taking place in two main divisions. In the western division, of which the field headquarters are at Altagracia, two wells have been drilled. Both the rotary and the cable systems of drilling have been used. The first well gave a small quantity of oil at a depth of 1,800 ft.; the second showed oil at a depth of 1,000 ft. Supplies are hauled to the camp forty-five miles east of Altagracia by tractors, over a wagon road built by the company. Water is brought by a pipe line. Oil, when met in commercial quantities, will be transported by a pipe line to be built to Altagracia or to the Caribbean coast, fifty miles to the north.

The field headquarters of the eastern division are at Dabajuro, eight miles south of the Caribbean coast; and the drilling camp is twenty-four miles to the southeast. Three standard drill rigs were under constrction at the end of August, 1920. Supplies for the camp are taken from Maracaibo by schooner to a small port near Punta Zazarida, where a small pier is being built. A wagon road to the camp is under construction.

The Riopaují Co.—The Compañía Anónima Minerales Petrolíferos Riopaují was formed in Maracaibo, with Venezuelan capital, to exploit deposits along the River Paují, thirty miles east of Lake Maracaibo. A large working capital was named; but only $50,000 was raised at the outset for actual development. Exploration work was carried on by the Riopaují company in 1915 and 1916. The company drilled one well in 1917 to a depth of 1,417 ft., finding evidences of oil, but no commercial quantities. No activity in oil-drilling was reported during 1918 or 1919. The Riopaují company mined 1,009 metric tons of asphalt in 1917.

The South American Co.—The South American Co., organized in the United States, owns asphalt deposits in the municipality of Lagunillas, district of Bolívar, State of Zulia, and has an interest in the deposits in the municipality of General Urdaneta, district of Sucre, State of Zulia. The South American Co. produced seventy-two metric tons of asphalt in 1917; fifty tons in 1918; and none in 1919. Its ownership of certain asphalt deposits is disputed by the Caribbean Petroleum Co.

AMERICAN COMPANIES DEVELOPING

The Maracaibo Oil Exploration Co.—The Maracaibo Oil Exploration Co., of New York, organized in the fall of 1919, has made four locations covering 700,000 acres in the State of Zulia and has formed four exploration companies. Camps have been established, and drilling material has been shipped via Maracaibo. The principal locations of the Maracaibo Oil Exploration Co. are at Los Barrosos, in the district of Perijá, adjoining the properties of the Caribbean Petroleum Co., and at a point south of Lake Maracaibo.

Sun Company—The Sun Co., of Philadelphia, is reported to have secured concessions in the State of Falcón.

The Venezuelan Oilfields, Ltd.—Five concessions in the State of Falcón have been acquired by the Venezuelan Oilfields, Ltd., organized under the laws of the State of Delaware. The territory has been thoroughly explored by geologists with a view of development. The company plans, in the event of obtaining oil, to lay a pipe line and run a small railroad to the coast. This company is also reported to be examining areas in the southern end of Lake Maracaibo.

The North Venezuelan Petroleum Co., Ltd.—The acquisition of a concession to 100 hectares (247.1 acres) in the districts of Acosta, Zamora, and Silva, State of Falcón, by the North Venezuelan Petroleum Co., Ltd., of London, was reported in September, 1920. The principal deposits lie in the vicinity of Piritu.

To Be Continued

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

American Engineering Council Studying Weaknesses in Our Producing Systems

Herbert Hoover Addresses Engineers at Syracuse—Points Out Advantages of Maximum Production—Efforts Made to Attain It

The executive board of the American Engineering Council of F. A. E. S. met with the convention of engineers at Syracuse, N. Y., beginning Feb. 14. Herbert Hoover, president of the council, opened the session with an address, from which extracts are here given:

"American Engineering Council has organized a preliminary survey of some of the weaknesses in our production system. This survey will attempt to visualize the nation as a single industrial organism and to examine its efficiency toward its only real objective—the maximum production. In a general way this inquiry will bear upon the whole question of deficiency in production—industrial waste in a broad sense.

"The waste in our production is measured by the unemployment, the lost time due to labor conflict, the losses in labor turnover, the failure to secure maximum production from the individual, due either to misfit or lack of interest. Beyond this again is a wide area of waste in the poor coordination of great industries, the failures in transportation, coal and power supplies which re-echo daily to interrupt the steady operation of industry. There are again such other wastes due to lack of standardization, to speculation, to mismanagement, to inefficient national equipment, and a hundred other causes. There is a certain proof of deficient production by comparisons of our intense results in 1918, when, with 20 per cent of our man-power withdrawn into the army, we yet produced 20 per cent more commodities than we are doing today.

"The whole basis of national progress, of an increased standard of living, of better human relations, indeed of the advancement of civilization, depends on the continuous improvement in productivity. The greater field for increasing standards of living lies in the steady elimination of the wastes. The primary duty of organized society is to enlarge the lives and increase the standards of living of all the people—not of any special class whatever. We are therefore proposing to make a preliminary examination of the volume of waste in certain industries, the proportions that lie in each field.

"The assumption of positive limits to production due to oversupply has no proper foundation in the broad view of industry as a whole. There is no such thing as the nation overproducing, if it produces the right commodities. The commodities or services produced by the whole nation can be absorbed by the whole nation if they are of the right character. An increasing production would mean a directly increasing standard of living. When one hundred million men divide their united output they can have twice the amount to divide when they double their output. The problem is to direct the effort to commodities or services that they can use. There is no limit to the increase of living standards except the limitations of human strain, scientific discovery, mechanical invention, and natural resources.

"The absorption of increased productivity lies in the conversion of luxuries of today into necessities of tomorrow, and to spread these through the whole population by stimulation of habit and education.

"Today we have also capacity for the production of some commodities even beyond export demand under present financial conditions. As a matter of practical remedy, we must either reorganize these financial relations or abandon some part of this kind of production and turn our idle men to making things with which we are not yet fully supplied. I am not suggesting that the forces of production can be shifted by imperial direction. The practical thing that can be done is to eliminate some of the wastes and misfits in our production, and depend on the normal processes of business and human desires to absorb them.

"The largest area of waste lies in the large periods of slack production and unemployment. Our studies of industries show that we usually expand our equipment just at the periods of maximum demand for their products, instead of doing our plant expansion during periods of slack consumption. We thus make double demands on labor, and we doubly increase unemployment in periods of reduced consumption. All industry could not be so stabilized as to do its capital construction in periods of depression in commodity demand. Nevertheless, there are some industries that could, by the co-operation of the Government and by co-operation among themselves, be led in this direction.

"Another variety of intermittent employment, and thus great waste, characterizes certain industries now operating with unnecessarily wide seasonal fluctuations, as for instance the bituminous coal industry. Mining engineers have already pointed out the directions in which remedy lies; through storage, through railway rate differentials, and other remedies. Through constructive action, an army of men could be released from this industry of necessity, to convert some luxury into a necessity of tomorrow. This is no plan to control prices or profits, although through it both the producer and consumer in coal could be placed upon a sounder basis than today. The interest of the consumer and producer, is, however, even less important than relief from the intermittent employment and unemployment within this industry.

"The second largest area of waste in productivity is the eternal labor strikes and lockouts. The varied social and economic forces involved in this problem need no repetition here. Fundamentally, this is not alone a struggle for division of the results of production between capital and labor. Strikes and lockouts cause an even greater loss due to the element of purely human friction, a loss outside the area of dispute on wages and hours. We shall yet have to reorganize the whole employment relationship to find its solution. We are studying the progress made in this line.

"Yet another variety of loss lies in the unnecessarily faulty distribution of our labor supply due to seasonal and to shifting demands. An adequate employment service is indeed the first need in effecting the reduction of these wastes. Probably the next largest fraction of waste in productivity lies in a too high degree of individualism in certain basic products and tools. A standardization of certain national utensils would make for economy in distribution, operation, and repairs. This does not mean that we stamp out individuality; it means basic sizes to common and everyday things.

"Another type of waste lies in our failure to advance our industrial equipment. The Super-Power Board will demonstrate the saving of 25,000,000 to 50,000,000 tons of coal annually by the electrification of our eastern power supply. The St. Lawrence Waterway Commission will demonstrate the saving of 5c. to 10c. a bushel to the farmers of fifteen states, by unlocking the Lakes to ocean-going vessels. Nor will this injure our present systems of canals and waterways, for we have ever found that prosperity in one industry blesses all.

"We do not believe it is necessary to effect these things by the Government. The spirit of co-operation has already solved many things; it has standardized some things and is ripe for initiative toward co-operation of a widespread character. The leadership of our Federal Government in bringing together the forces is needed.

MEN YOU SHOULD KNOW ABOUT

M. W. von Bernewitz has severed his connection with the Mines Handbook at Tuckahoe, N. Y.

H. H. Hunner, of Cornwall Ore Bank Co., is spending two weeks in the Lake Superior iron districts.

Frederic R. Weekes, of New York, N. Y., has gone to Nevada and California on professional business.

Glenville A. Collins, consulting mining engineer, has moved his offices from Seattle, Wash., to Vancouver, B. C.

Dorsey A. Lyon, supervisor of experiment stations, U. S. Bureau of Mines, has returned to Washington, D. C., after an extended Western trip.

John M. Fox, superintendent of the Belmont Wagner Mining Co., at Telluride, Col., has resigned that position and is now in San Francisco, Cal.

M. M. Duncan, vice-president and general manager of the Cleveland-Cliffs Iron Co., will leave soon for Europe, where he will make observations on mining conditions.

Walter L. Maxson has left Canon City, Col., on account of the closing down of the operations of the New Jersey Zinc Co. at that place, and is temporarily in Butte, Mont.

Sir David Paulin and **Young J. Pentland**, of Edinburgh, Scotland, directors of the Arizona Copper Co., Ltd., are in Clifton, Ariz., on a tour of inspection of the company's properties.

M. Y. Williams, geologist on the staff of the Geologic Survey of Canada, and a petroleum geologist, has resigned to become professor of paleontology at the University of British Columbia, Vancouver.

T. Wayland Vaughn, of the U. S. Geological Survey, is on his way to Haiti, to inspect geologic surveys being made there by the U. S. Geological Survey in co-operation with the local government.

Blandford C. Burgess has resigned his position with the Iron Cap Copper Co., Globe, Ariz., to take charge of the development of promising silver-lead claims in the Saddle Mountain district, Pinal Co., Ariz.

G. B. Dennis, of Spokane, Wash., founder and for many years president of the Northwest Mining Association, was given the first honorary presidency and life membership, by a resolution passed at the recent meeting of the association.

W. Earl Greenough, mining engineer of Spokane, Wash., who has been occupied since early in 1920 on behalf of the Hecla Mining Co., in work relating to its recent apex litigation, is spending two weeks examining mining properties in California. He will visit Los Angeles and San Francisco before returning.

Colonel H. C. Rizer, the genial chief clerk of the U. S. Geological Survey, was the guest of honor at a lunch given by all his associates on Jan. 15 to celebrate his completion of thirty-five years of service with the survey. He also received a flood of letters, "smokes," and other tokens of regard from his many associates.

Colonel Rizer was a schoolboy in his native state of Maryland at the opening of the Civil War. As soon as his parents consented he enlisted as a private. At once he was appointed first sergeant of his company, and eventually rose through all higher grades to come out of the service at the close of the war as colonel of his regiment. The study and practice of law occupied him for the next fifteen years, chiefly in Kansas, where he also edited a weekly.

H. C. RIZER

Early in the history of the survey Rizer made the acquaintance of Major J. W. Powell, with others of the staff of the second director, and was disbursing agent of the Geological Survey during 1883 to 1886. For three years he was away, serving as secretary to the Board of Railway Commissioners of Kansas. Major Powell again offered him a survey position at higher pay, so in 1889 he returned to "one of the pleasantest associations of his life," and in 1890 succeeded Mr. Pilling as the latest incumbent of the chief clerkship.

The colonel has filled that office continuously ever since, and today, at over eighty, is still serving genially, gladly and helpfully. His life's work has been to serve the many material needs of one of the most strenuous of our leading scientific bureaus, and the testimony of all its directors backs a host of associates in assuring him that it has been well done. All "that which should accompany old age, as honor, love, obedience, troops of friends," is his indeed.

Dr. J. Austin Bancroft, Dawson professor of geology at McGill University, Montreal, has obtained leave of absence for a year beginning in May, and will serve as assistant general manager of the Granby Consolidated Mining, Smelting & Power Co.'s mines, Anyox, B. C. **E. E. Campbell**, former assistant general manager, has resigned to become general superintendent of United Verde Extension Mining Co., Jerome, Ariz.

W. Burling Tucker, district engineer in charge of the southern California field division of the California State Mining Bureau, has resigned to engage in mining in Mexico. He was succeeded on Feb. 3 by **Charles S. Haley**, a mining engineer graduated in 1907 from the University of California and with experience in the Western States, California, Alaska, and South America. Mr. Haley's headquarters are in the Pacific Finance Building, Los Angeles, Cal.

Edward Doheny, mining engineer, left Mexico to visit in Merrill, Wis., in September, 1920, and has not been heard from since that time. He was traced as far as Chicago, Ill. Mrs. William Doheny, his mother, will appreciate any information concerning him. Mr. Doheny's description is as follows: Age, twenty-one; height, about six feet; weight, 150 lb.; complexion, fair; black hair; blue eyes. Mrs. Doheny's address is 205 Fifth St., Merrill, Wis.

SOCIETY MEETINGS ANNOUNCED

The American Society of Mechanical Engineers will hold its spring meeting on May 23 to May 26, inclusive, at Chicago, Ill. The Congress Hotel will be the headquarters. Among the sessions planned are conferences on Fuels, Management, Material Handling, and Power.

OBITUARY

W. P. Snyder, late head of the Shenango Furnace Co., died at his home in Pittsburg, Pa., on Feb. 3. Mr. Snyder was a highly respected and well-known mining man, and visited the Mesabi iron range, where his company operates many large properties, many times a year. He took great pride in the fleet of boats operated by his company, and during his administration he had built the largest ore-carrying boat on the Great Lakes.

Joseph Moore, Jr., president of the Wedge Mechanical Furnace Co., Philadelphia, Pa., died suddenly at his home, 1821 Walnut St., on Feb. 11. Mr. Moore, who was seventy-one years old, was a financier and a writer as well as a manufacturer and had traveled extensively.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

WEEKLY RÉSUMÉ

As the result of the decision last October in the Utah Apex-Utah Consolidated lawsuit, the Utah Consolidated company has filed a statement and accounting with the Utah District Court, showing the tonnage and value of ore illegally extracted from the Utah Apex workings. The Silver King Coalition Mining Co. at Park City, in the same state, has decided to rebuild its mill that was destroyed by fire the last week in January. In Colorado, the Legislature has voted to abolish the office of Inspector of Ore Buyers. At Washington the Senate Committee has allowed an appropriation for a mining experiment station at Butte. A higher duty on lead ore has been asked in a petition made by the Utah Legislature, and in Montana a similar request has been made for a tariff on manganese ore.

In Butte, the Anaconda company has perpetuated the testimony of three aged witnesses respecting the title to certain claims, regarding which a dispute with the Davis-Daly company is said to be not impossible. In the Coeur d'Alenes, the Amazon-Dixie Mining Co. has increased its capital stock, and the Caledonia Mining Co. has suspended the payment of dividends. At Eureka, Utah, the Chief Consolidated has cut its quarterly dividend in half. At Marysville, Cal., the parts of the Guiana Development Co.'s new dredge are said to be ready for shipment to South America.

Jones & Laughlin Still Drilling on Eastern Gogebic

The Jones & Laughlin company are still proceeding with their exploratory work on the Gogebic Range, having a diamond drill at work on the south-east quarter of section 8, town 47 north, range 45 west. The drill is located just east of the Sunday Lake fault which threw the formations to the south, forming the orebodies that are being mined in the two open pits, and they hope to find merchantable ore in the same horizon that the Sunday Lake mine and the Castile mine have developed their orebodies. The drill is located north of the footwall and dips south. The drilling is being done under the direction of Archibald, of Negaunee, with James Trebilcock in local charge. Drilling was done in this vicinity several years ago, when some ore of good grade was found, and the present work is to determine what tonnage may be expected.

Utah Consolidated's Accounting In Apex Suit Filed

Claims Profit on Tonnage Taken from Plaintiff's Workings Was About 25 Per Cent of Damages Asked

According to the statement and accounting just filed by the Utah Consolidated Mining Co., of Bingham Canyon, Utah, with the Utah District Court, the tonnage mined by it from the disputed workings of the Utah Apex Mining Co. was 117,000. The profit made on this was $658,000. In the suit decided on Oct. 20 last the damages asked by the plaintiff were $2,500,000 or almost four times this amount. The action of the Utah Apex Mining Co. is awaited with interest. The complete story of the Utah Apex-Utah Consolidated apex suit was given in the Oct. 30, 1920, issue.

FIRST UNIT OF MESABI IRON CO.'S PROPOSED CONCENTRATOR AT BABBITT, MINN., ON EASTERN END OF MESABI RANGE

Silver King Coalition Company To Rebuild Mill

New Plant To Use Gravity Concentration and Flotation—Judge Offers Plant

The Silver King Coalition Mining Co., Park City, Utah, will rebuild its mill recently destroyed by fire. The loss is practically covered by the insurance and it will be possible to use most of the old foundations, although the mill will be made smaller and more compact. The new mill will use straight gravity concentration and flotation. It is reported that the Judge Mining & Smelting Co. has offered the Coalition the use of its concentrator for the treatment of a part of its mill ore.

Mesabi Iron Co.'s First Unit More Than Half Complete

New Plant at Babbitt a Pilot Mill to Certain Extent—Appealed to Jackling as Did Utah Copper Project

The important iron enterprise of the Mesabi Iron Co. under charge of D. C. Jackling, as president, and the New York firm of Hayden, Stone & Co., as financial sponsors, and situated at Babbitt, on the Mesabi Range, will probably be treating iron ore early in the shipping season of 1921. Its first unit is now about 65 per cent completed, and almost everything in the way of machinery is either on the ground, completed at the shops, or under guarantee of delivery very soon.

As is generally known in the iron trade, the plan of this works calls for the quarrying of hard, low-grade, magnetic taconite that is now lying exposed without cover, its transportation on the company's railway over its own land to a mill, the crushing and fine grinding of the material, separation of the iron from gangue minerals, in this case chiefly silica and phosphorus, and the agglomerating of the enriched ore in Dwight-Lloyd machines. The final product will vary, in accordance with the desire of customers, from an ore of say, 61 or 62 per cent iron, natural analysis, and about 0.025 per cent phosphorus, to an ore that is richer. Experiments have shown that a product can be made that is between 69 and 70 per cent iron and containing but a trace of phosphorus.

The company owns a vast quantity of the lean iron-bearing material that it proposes to concentrate, and its appeal to Messrs. Jackling, Hayden, Stone and their associates was along the lines of the appeal that the immense tonnage of Utah Copper made to them, twenty years ago; the entire scheme is being worked out along the lines between which Utah Copper and its associated enterprises have been successfully developed. They recognize that no small tonnage and no trifling operation can succeed, and the unit now approaching completion is but a beginning of what will result, if this first unit meets the expectations of the company. It is said that Mr. Jackling expects it to become much the largest metallurgical plant in the world, and the tonnage of available material in the possession of the company is such that this expectation can well be realized.

Something more than $750,000 was spent in an initial experiment at Duluth, and now more than $3,000,000 is being put into the first or pilot mill. This, too, can be classed as to a certain extent an experiment, for many new ideas and practices, some of them quite revolutionary, have been worked out by the engineers of the company, and remain to be subjected to large scale, commercial test.

Colorado To Abolish Office of Inspector of Ore Buyers

The office of Inspector of Ore Buyers, which was created a few years ago by an act of the Colorado legislature to curb the activities of "high graders," who were causing the metal mining industry losses amounting to many thousands of dollars, will be abolished. Recently, the fees collected have been so small that they have not justified the continuance of the office. With the consent of the state civil service commission the duties of the inspector will be performed in the future by the regular clerical force of the office of the Secretary of State.

Recent Production Reports

In January, Alaska shipped to the United States 6,513 gross tons of copper ore, matte, etc., containing 5,241,634 lb. copper; also 87 oz. palladium, 18 oz. platinum, $145,448 in gold ore and base bullion, 6,371 oz. gold bullion and $59,346 in silver ore and base bullion.

Arizona Copper produced 2,300,000 lb. copper in January, against 2,650,000 in December.

East Butte produced 1,664,880 lb. copper in January, compared with 1,538,760 in December.

Phelps Dodge produced 8,701,000 lb. copper in January (8,318,000 in December) as follows: Copper Queen Branch, 4,660,000; Moctezuma Copper Co., 2,362,000; Burro Mountain Branch, 1,319,000, and custom ores, 354,000.

Calumet & Arizona produced 2,438,000 lb. copper in January.

New Cornelia produced 2,170,000 lb. copper in January.

Cassidy Collieries Decisions Favor Granby Co.

The Granby Consolidated Mining, Smelting & Power Co., of British Columbia, all but entirely won its two appeals against a decision of Justice Gregory, who some months ago gave a judgment in favor of the Esquimalt & Nanaimo Ry. Co., affecting the rights of Granby and its coal operations at Cassidy, on Vancouver Island. In two judgments delivered Granby wins absolutely in what is known as the Dunlop case and the propriety of the provincial legislation in this regard is upheld. Justice Eberts dissented from the remainder of the court in this judgment.

In the Ganner case, title to the property is found to be vested in the Granby company, but there is a finding that in case of assessment of damages against Granby in respect to the coal rights these shall be considered as to the coal "in nature." The outside price at this rate is stated to be a matter of $150 an acre, so that in respect to the total of 200 acres the outside amount of the claim that Granby may have to settle is unofficially estimated at $30,000. The original charge against Granby, had the cases gone against the company, might have run from half a million to a million dollars. Justice McPhillips dissented in the Ganner case. Counsel for the E. & N. announced that the case would be appealed.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Opponents of McFadden Gold Bill Present Arguments

Sponsor Claims They Avoid Question That Jewelers Are in Effect Receiving a Subsidy

Further arguments were made on Feb. 8 before a subcommittee of the Committee on Ways and Means as to the merits of the McFadden Gold Bonus Bill. The hearing was given over largely to the opponents of the measure. The presentation was under the direction of G. Niemeyer, who represented the Jewelers' Vigilance Committee, Inc., the United States Gold Leaf Manufacturers' Association, and the Gold Pen Manufacturers' Association. Mr Niemeyer argued that any justification that may have existed for the McFadden Bill is now disappearing, owing to the rapid decline in the price of materials and commodities. He placed great emphasis on the point that fraud and waste would result if the McFadden Bill should become a law. The bounty of $10 per oz., he argued, would make a $20 gold piece worth $30.67. "It would be easy," he said, "to keep a $20 gold piece in a bank and bring up gold worth $30.67, because gold is not easily identified." He declared that the bounty would enable the profitable gold mines to earn an enormous profit. He predicted that the tax on the use of gold in the arts would not meet the bonus and that on the 1918 basis an appropriation of $32,000,000 would have to be taken from the public treasury.

Morris L. Ernst, counsel for the interests opposing the bill, argued that the bill would be unconstitutional.

E. W. Kemmerer, professor of economics and finance at Princeton University, was one of the witnesses presented by the jewelers. He declared that the question is an international one, but that apparently it is being considered simply on a national basis in this country. It would be necessary, he said, to [illegible] the [illegible] of the world's supply of gold. He cited numerous authorities who regard the plan as impracticable, and [illegible] it [illegible] the [illegible] of [illegible] and [illegible] law.

Representative McFadden introduced into the record the report which he made to the American Bankers' Association. He pointed out that the [illegible] had avoided the question that they were in effect receiving a subsidy in purchasing gold at less than the cost of production. He presented to the committee a large number of letters and endorsements from bankers, state legislatures, chambers of Commerce and individuals favoring his bill. In effect, his argument was that stilted and academic reasons are being urged to camouflage a very simple situation. He held that it is very evident that the countries of the world soon will draw importantly upon our gold supply and that it is an urgent necessity that we increase our production. He stated that he fails to see the wisdom of telling our gold miners that they must shut down.

Many of the economic questions raised by the jewelers were answered by H. N. Lawrie, [illegible] and J. F. Callbreath, of the [illegible].

Mine Rescue Car [illegible] E. D. Gardner as [illegible] at Reno, Jan. [illegible] for the purpose of [illegible] at the University of Nevada. From Feb. 14 to Feb. 24 the car will be at [illegible].

Experiment Station for Butte, Perhaps

Senate Adds $25,000 to Appropriation — Senator Walsh Describes Camp's Importance

So as to make possible the establishment of a mining experiment station at Butte, the Senate has approved an amendment to the Sundry Civil Bill, increasing by $25,000 the amount to be available for the establishment, maintenance, and operation of mining experiment stations. In urging that the amendment be adopted, Senator Walsh of Montana called attention to the fact that eight mining experiment stations already have been established but that none as yet has been located in the city of Butte, which he referred to as "the greatest mining camp in the United States and perhaps in the world." Within the radius of one mile at Butte, Senator Walsh told the Senate, one-fifth of the copper production of the world is brought to the surface. As a result of this copper mining activity, he said, Montana is able to lead all other states in the production of silver and is fast becoming one of the most important producers of zinc. He also called attention to the fact that it is the plan of the Bureau of Mines to study mining rather than metallurgical problems at the Butte station in case an appropriation is allowed. He also called attention to the fact that the State Mining College is located at Butte which would co-operate with the Bureau of Mines. At the request of Senator Walsh, the Bureau of Mines furnished him with the following statement of the objectives of its study into mining problems.

Government's Helium Plant Given Trial Run

Encouraging results were obtained at a trial run made at the helium plant at Petrolia, Texas, where the Bureau of Mines is co-operating with the Helium Board of the Army and Navy in the production of helium from natural gas. H. S. Mulliken, the special technical assistant to the Director of the Bureau of Mines, has just returned from an inspection visit to the plant.

The Bureau of Mines is co-operating with the Army and Navy in the study of the helium problem. It involves the protection of the gas field in which helium occurs. So far as is known, the United States is the only nation in which large helium resources exist. An intensive effort is being made at this time to devise cheaper processes for separating helium from the other constituents in natural gas.

War Mineral Awards

Awards recommended during the week ended Feb. 5 by the War Minerals Relief Commission totaled $2,069.93. The recommendations were as follows (the name of the claimant, the mineral, the amount recommended, and its percentage relationship to the amount claimed, are shown): Earle N. Young, manganese and tungsten, $371.29, 27 per cent; Frank C. Livingstone, chrome, $116, 41 per cent; Dan W. Powers, chrome, $1,582.64, 54 per cent.

Utah Legislature Asks Higher Duty on Lead

Montana Petitions for Tariff on Manganese Ore To Protect Industry in State

A petition has been presented to Congress by the Governor and the Legislature of the State of Utah asking that the import duties on lead be increased as soon as possible "to enable domestic producers to resume and continue operations."

A petition asking for an import duty of 1c. per lb. on manganese ore was presented by the legislature of Montana. The petition pointed out that large sums have been spent in the West during the war in the development of manganese deposits but that they were unable to continue operations due to importations of cheaper ore.

Dyer Bill To Aid Business in China Approved

American business men operating in China recently appeared before the House Ways and Means Committee in an effort to overcome the handicap of excess profits taxation, from which their competitors are free. The committee approved the Dyer bill by a vote of ten to three. This bill provides for the Federal incorporation of American companies in China and exempts them from excess profits taxation on business done in China. The bill was returned to the Judiciary Committee and will likely be before the House in a few days.

NEWS BY MINING DISTRICTS

Special London Letter

Conditions in Mining Industry Disappointing—Burma Corporation Reported Seeking Control of Lead Market — Brakpan and Springs Mines Compared

By W. A. Doman

London, Feb. 1—Things are not moving very brisky in the mining world. In fact there seems to be a general feeling of disappointment. The continuous drop in the price of metals, and the slow process of European economic reconstruction, from which so much was expected, seem to [illegible] [illegible] a disheartening effect. First of all on the public, because they see share prices going against them, and secondly on the minds of directors who are unable to procure sufficient funds for carrying on. Various schemes are in course of incubation, but some of them have already proved abortive. As regards tin undertakings, the Cornish companies experience even greater difficulty in attracting funds than if they were operating at the other side of the world. The Jantar, a Nigerian company, offered distinctly good terms for £25,000 of debentures; shareholders have not put up the money, and there is talk of ceasing operations until an improvement occurs in the price of tin. Companies are hit both ways. If they ask too large a sum the public will not find it; if on the other hand only a small amount is wanted difficulty exists in negotiating the scrip and in these days negotiability is a great desideratum.

It is reported that the damage done by the fire at the Port Pirie works of the Broken Hill Associated Smelters will take twelve months to repair. Unfortunate though this undoubtedly is, it may not be entirely without its advantages. The Zinc Corporation is working on short time and is treating only tailings, its mine being left alone for the time being. This is a great blow to the public who have held Zinc Corporation Preference shares as a sound mining investment, and who now are receiving no return.

The December quarterly reports of the Brakpan Mines and Springs Mines, (South Africa) both under the control of the Consolidated Mines Selection Co., are interesting as showing variations in reef widths and values in the same district.

	Brakpan	Springs
Ft. on reef	3,107	2,523
Average value, dwt.	12.12	22.0
Average width, in..	29.75	16.85
Payable, feet	1,615	1,330
Per cent, pay.......	52.0	53.3
Average value, dwt.	18.96	27.23
Over inches	31.29	22.68

Taken in the way in which the Rand mining companies regard development there is really little difference between the 593 inch-dwt. of the Brakpan and the 617 inch-dwt. of the Springs. In the estimate of ore reserves the figures compare thus:

	Tons	Value dwt.	Stop. width in.
Brakpan	2,526,517	8.88	70.0
Springs	2,726,178	8.76	63.5

The Consolidated Mines Selection is still assisting the Springs Mines financially, and during the last three months of the year took up 9,000 shares at the agreed price of £3 per share. Another member of the Consolidated Mines Selection group, the Daggafontein Mines, is being financed and has drawn a further £100,000, the loan now amounting to about £450,000. The total development in this mine to date is 12,988 ft., of which 6,219 ft. are on the reef, and of the 6,010 ft. sampled the average value is 23.38 dwt. over an average reef width of 10.8 in. Here again can be seen a great difference in width when compared with Brakpan and Springs.

A report is current that the Burma Corporation is connected with a scheme called the Associated Lead Manufacturers, Ltd., to acquire the control of H. J. Enthoven & Sons, Walkers, Parker & Co., Locke, Lancaster, and other firms for the pooling and sale of output, and almost of domination of the lead market. So far as the East is concerned, Burma Corporation has the field largely to itself. Before and during the war much of the Australian lead was disposed of in the East—in fact some of it is said to have reached this country via China.

BRITISH GUIANA

Demerara Bauxite Co. Shuts Down—December's Diamond Output Greater Than Entire 1919 Production—Gold Drops

BY L. T. EMORY

Georgetown, Jan. 28—The exportation of bauxite from British Guiana increased greatly in 1920, when it jumped to 29,399 long tons, having been 1,967 tons in 1919, 4,199 in 1918, and 2,790 in 1917. Nothing was produced in 1916, mining operations having begun late in that year. The small production of 1919 was owing largely to the decision on the part of the Demerara Bauxite Co., Ltd., to erect a crushing and drying plant, so that dried ore could be shipped and handled by mechanical means. Construction operations and lack of shipping seem to have been the cause of the small production for the year.

Since 1916 the company has completed ore docks, a crushing and drying plant, and its own town (Mackenzie) with modern improvements opposite Wismar, at the head of navigation for ocean going vessels, which is seventy-two miles up the Demerara River from the sea. It has built ten miles of standard gage railway from Mackenzie up the east bank of the river to its crown land lease, Three Friends, near Akyma, and cleared quite a large tonnage of ore of overburden. The investment covering this work runs into several million dollars.

As long ago as 1897 and again in 1919 Prof. J. B. Harrison, Director of Science and Agriculture, noted in his reports the existence of bauxite on the Demerara River. It was not until 1913, when Francis G. Harvey, a civil engineer, took samples of ore from the Three Friends property to London, that any interest was shown in the deposits.

Mr. Harvey tried to interest British and German users of ore without success, but finally got in contact with an agent of the Aluminum Company of America. During 1914 and 1915 agents of the Aluminum company bought up about 20,000 acres of privately owned land extending for fifteen miles on both banks of the Demerara River above Christianburg and obtained crown and colony land leases, including in all 3,600 acres.

In the fall of 1916, a local company was organized called the Demerara Bauxite Co., Ltd., to take over these holdings. This company is nominally a subsidiary of the Northern Aluminum Company of Canada, which in turn is owned or controlled by the Aluminum Company of America.

REMAINING CROWN LANDS STILL WITHDRAWN FROM ENTRY FOR BAUXITE MINING

Soon after the granting of concessions to the Demerara Bauxite Co., then in process of formation in the fall of 1916, all remaining crown lands were withdrawn by the imperial government from entry for the purpose of mining bauxite for the duration of the war. Although the war has been over for two years and draft regulations for the control of bauxite lands have been submitted by the local department to the Colonial Office in London, no action has been taken to reopen the remaining lands for entry.

The present operating company is said to have bought up all privately owned lands known or thought to contain ore. Its crown land leases are believed to be the cream of the crown land deposits which are commercially available from the viewpoint of location. It therefore, has practically a monopoly of the industry and is in such a strong position that there is little chance of competitors entering the field.

The Demerara company suspended operations about Jan. 25, closing down its mines and drying plant for an indefinite period. All common labor except watchmen, cleaners, grass cutters, and other necessary workers, were laid off, but most of the superintendence and technical staff are being held. The managing director has given overproduction of metal and the financial situation in the United States as causes of the shutdown.

DIAMOND PRODUCTION MAKES GREAT INCREASE

Diamond production also increased largely in British Guiana in 1920. An output of [illegible] carats was declared at the Department of Lands and Mines during the year, totalling [illegible] stones. This is equal to almost three times the average yearly production of the five years previous. During December, [illegible] carats was entered, exceeding the entire production for 1919 by about 4,500 carats. This rush at the end of the year was due to the miners returning from the interior to the coast lands to spend the Christmas holidays. The enormous increase was attributable in part to the opening up of new districts, but principally to the high prices paid by buyers in Georgetown during the early months of the year, which induced a number of miners to leave the gold fields and other work. Prices vary considerably with the size, quality of the stone, and need of the seller. Early in the year a good one-carat stone (rough) would bring $80, but this price was cut in half during the closing months.

The stones brought down to Georgetown during December were from the following districts: Mazaruni district, 12,264 carats; Puruni River district, 7,255; Potaro River district, 550; and Cuyuni River district, 1,175. The Potaro River district shows the greatest percentage of increase in production over the same month last year.

The production of diamonds in the colony for the last five years has been as follows: 1916, 16,409 carats; 1917, 17,908; 1918, 14,196; 1919, 16,706; and 1920, 39,362.

The largest individual stone found in 1920 came from the Mazaruni district and was entered at the Department in October. It weighed 21 5/16 carats, but was not of such good quality as the 27½-carat Gushway diamond, which came from the same district last year and sold in London for about $8,000.

The diamond washing industry in the colony is almost entirely in the hands of small producers. The washers, or "pork knockers," work singularly or in small groups. The diamonds are recovered from gravel beds along the creeks, and are usually panned by hand. The "pork knocker" is usually of African descent and is grubstaked by shop keepers or claim owners. These men band together for mutual help and protection on the trips to and from the interior, which are made by boat, or they help pull the provisions boats of the shop keepers up the rivers. They seem to be immune or nearly so to malaria and other diseases which make the bush so deadly to the white man.

Practically all the diamond producing areas are on crown land, and the mining regulations for taking [illegible] are very liberal, but the difficulty of transporting supplies up the cataract-blocked rivers, which are the only ways of travel through the unbroken tropical jungle to the diamond fields, has deterred mining companies from going in for the development of [illegible].

GOLD OUTPUT DROPS [illegible] ELSEWHERE

During 1920 a [illegible] of gold was entered [illegible] of Lands and Mines [illegible] royalty, a decrease [illegible] against the 1919 [illegible] all the gold [illegible] comes from claims [illegible] lands, and though there are several small dredges operating in the Potaro River district, the bulk of the gold comes from alluvial washings worked by so-called "pork knockers."

The production for the last five years is as follows: 1916, 37,129 oz.; 1917, 29,538; 1918, 24,546; 1919, 16,216; and 1920, 12,092. This steady decrease in production does not seem to be due to the working out of the gold-bearing areas, as the known limits of these areas are being extended all the time, but is owing to the increased cost of provisions as compared with the price paid for raw gold and the diversion of the miners to the diamond fields and to other occupations on the coast offering higher wages.

CANADA

British Columbia

R. T. Ward Moving Equipment from Properties at Cariboo

Stewart—The Premier is shipping ore over the winter trail to Stewart at Tidewater at the rate of about 250 tons a week. The snow has packed on the road and two caterpillar tractors are proving serviceable. On each trip they draw four sleighs carrying either machinery for the new mill or ore. The survey of the proposed aërial tramway from mine to coast is reported to have been completed and the work will proceed as soon as the directors approve the expenditure.

Ashcroft — A large quantity of hydraulic placer mining machinery is being moved from the Bullion and Horsefly properties at Cariboo by R. T. Ward, who recently sold these claims after successfully asserting his title and that of his associates in a legal battle with John Hopp, which was carried to the Privy Council, England. The claims are said to have changed hands at a considerable figure and the nature of future operations is such that the long disused equipment is not required. It, therefore, has been sold in Vancouver.

Trail—Ore shipments received at the Consolidated smelter during the week ended Feb. 7 totaled 7,453 tons. Shippers were as follows:

Mine Location	Wet Tons
Bluebell, Riondel	71
Black Prince, Slocan City	57
Company Mines	7,325
	7,453

Princeton—Steps are being taken to develop a deposit of strontium ore, the discovery of which was reported about two years ago. The property is situated about three miles from Princeton.

Vancouver—Dr. M. Y. Williams, a member of the staff of the Geological Survey of Canada, has been appointed to the mining department of the applied science faculty of the University of British Columbia. Dr. Williams is a graduate of the School of Mines, Queen's University. He continued the study of geology at Yale.

Ontario

Premier at Porcupine Taken Over by New Company

Cobalt—The Nipissing during January produced silver of an estimated value of $139,882 and cobalt valued at $18,200. The mill ran only three-quarters of the month owing to the annual cleaning up.

The vein found on the Bailey about the end of 1920 has been opened up on the 5th level for about 80 ft., averaging about 2 in. in width with shoots of high-grade ore at intervals and about 3 ft. of wall rock on each side carrying good milling ore.

Porcupine—The large underground crusher of the Dome Mines which broke down some time ago has been repaired.

The property originally known as the Standards and more recently as the Premier on which about $100,000 was expended and some rich ore opened up has been taken over by a new company named the Premier Paymaster, capitalized at $2,500,000. The main shaft will be sunk to 500 ft. at which depth extensive lateral work will be undertaken.

The Union Mining Corporation, which owns a group of mining claims in Whitesides township, about 25 miles west of the producing Porcupine area, has decided to proceed with development by sinking to 500 ft. with crosscuts at each 100-ft. level. Mining equipment will be brought in before the spring break-up.

Kirkland Lake—At the King-Kirkland the shaft sunk on a promising vein is down about 40 ft. and considerable visible gold has been found. A mining plant is being installed.

Manitoba

Herb Lake—R. J. Kennedy, superintendent of the Bingo, has reported that the main shaft is down 40 ft. At the bottom of the shaft there is about 45 in. of gold-bearing vein matter as compared with a 7-in. vein on the surface. Five other veins run parallel to the main vein and crosscuts will be run to cut them at the 200 level. About 60 tons of high-grade quartz carrying free gold has been sacked.

CHOSEN

Oriental Consolidated's Output Drops Owing to Mine Fire

Unsan—The Oriental Consolidated's January clean-up was $75,000, as compared with $104,650 in December. The Tabowie mill crushed only 4,847 tons of ore in December, owing to lack of tonnage caused by the Tabowie mine stope fire. The fire walls, bulkheads and sprinking systems were brought to the point where the rest of the mine was safe from damage by Dec. 21, since when the company has been busy retimbering, stoping ore, hoisting and pumping water, and installing a duplicate set of gas-tight bulkheads consisting of iron doors screwed to iron frames set in masonry.

NORWAY

Sulitjelma Company's Administration Reorganized

Christiania — The shareholders of Reymersholm, the Swedish company which owns Sulitjelma, has been informed that the working loss of the latter company in 1919 amounted to 2.5 million kroner. This was partly due to unfortunate contracts with Norwegian buyers and partly to the heavy fall in copper prices. The profits were thereby considerably reduced, and, in addition, the company had to pay taxes in Norway and Sweden to an amount of no less than 2.7 million kroner. As a result there were difficulties in the way of the distribution of the decided-upon 7 million kroner of free shares. Mining operations which, owing to the circumstances prevailing, were curtailed in September, 1919, were again resumed in the early part of 1920, and have been continued without break. The output of pyrites for last year was about 85,000 tons, against an estimated 90,000 tons, and the production has been disposed of by gradation. The placing of the production for 1921, which it is reckoned will be greater, should also be considered disposed of. A thorough reorganization of the Sulitjelma Co.'s administration has, in all essentials, been carried out. The offices in Christiania and Helsingborg have been done away with, and the business management has been established in Stockholm which is now the company's seat. The directorate has been reduced from eight to three members, and, in that connection, four of the company's directors resigned their positions and were not replaced by new. With this simplifying of administration a considerable saving will be effected. The Reymersholm's company's total capital and reserve amounts to 47,800,000 kroner.

MEXICO

Sonora

Business Reviving on West Coast—New York Interests Churn-Drilling Piedras Verdes Property in Alamos District

Business activity is reviving on the west coast of Mexico. The Southern Pacific is operating two Pullman sleepers from Nogales, one running to Guaymas and the other to Mazatlan, leaving Nogales every Sunday, Tuesday and Thursday night. The Pullmans are nearly always crowded with Americans, including numerous classes. The mining industry is represented by prospectors, promotors, mining engineers and a few operators. There are numerous land promotors and men investigating the agricultural possibilities. Few bona fide investors are to be noted. Traveling salesmen are making regular trips. As yet business is extremely dull, but apparently the present activity is the forerunner of a big boom, provided the conditions in Mexico continue to improve.

The Southern Pacific is now operating to Ruiz, which is about forty miles from the city of Tepic. No attempt has been made to rebuild the line from Navajoa to Alamos nor the line from Corral to Tonichi. The rebuilding of both of these lines will be a big undertaking. It is nearly eight years since the last trains were run, and now the right of way has grown up with brush, in many places has been washed out, and in general is in bad condition. The bridges that were not burned need repairing, and all the track ties will have to be replaced. The result is that the mining districts of Alamos and Tonichi are practically dead.

Alamos District—Emos Yeager is operating the mill on the Minas Neuvas property. The old tailings dump is being run through a cyanide plant, which is driven by electrical power generated by a steam plant and is equipped with Hardinge mills. No ore is being mined. Work has been carried on intermittently for several years, and there is still a large tonnage remaining in the old dumps. The average grade is from 7 to 10 oz. silver per ton.

The Piedras Verde property is being churn-drilled by New York interests, with J. Erdlets in charge of operations. Two drills are operating, and it is reported that two more are ordered. Fifteen Americans are working. Roads are being improved and permanent buildings are being erected. The results of the drilling are not announced.

Nothing has been done at the famous old Promontorio since September, 1920. During the eighteen months preceding that date S. L. Pearce and C. C. Groesbeck were rebuilding the mill and getting the mine in condition for operations. The interests behind the proposition failed to raise the necessary capital, and plans for continuing work have fallen through.

Obermiller & Wilson are operating a five-stamp gold mill in the Minetas district, eighteen miles north of Alamos. It is reported they have secured an option on a property thirty miles east of Fundicion.

Don Joaquin Mauge is the agent in charge of the Quintero Mining Co.'s property near Alamos. Nothing has been done at this famous old silver mine since 1909. The company is controlled by French interests.

Coahuila

Smelter Preparing To Resume Operation

Torreon—A move on the part of the smelters in this district to resume operations this month has caused a general revival of the mining industry. Many of the producing properties which have been closed down for the past three months will soon be shipping again. Applications for titles to new mines are being filed with the mining agents in nearly all of the principal mining districts.

The Santa Cecilia Mining Co., composed largely of Americans of Torreon, has filed on a group of several claims in the old Ramirez Mountains of the San Juan de Guadalupe district. The new group lies contiguous to the San Acasio mines which produce silver-lead ores.

Saltillo—The Peralita y Anexas Mining Co., at a meeting of stockholders held in Saltillo, decided to duplicate its capital stock by the issuance of new shares to be divided among the present stockholders in proportion to the amount of stock each possesses. The new issue will be paid for at the rate of one peso per month per share. The capital acquired by the new issue will be devoted to development work.

A. V. Cerda, of Saltillo, has filed on a group of eight claims in the mining district of Monclova, which he will develop for silver and lead. The survey will include the old abandoned mines, San Agustin and El Guero, the latter being formerly owned by H. M. Diffembach. George G. Blackaller has charge of the survey of the properties.

CALIFORNIA

Parts for Guiana Development Co.'s New Dredge Ready at Marysville for Shipment to South America

San Francisco—Continued reports of decreasing costs by reason of greater labor efficiency emanate from the mining industry generally. There have been very few instances of wage decreases.

The following comparative statement of accidents in relation to number of shifts worked has been issued by the Empire Mines of Grass Valley, and indicates the steady progress that is being made to decrease the number of accidents in that mine:

	Total Shifts	Total Accidents	Shifts per accident
1916	109,721	255	430.2
1917	139,315	221	630.3
1918	121,575	183	664.3
1919	139,787	189	739.5
1920	131,961	162	814.5

At the Empire mine a miner's accident committee makes a monthly inspection of the mine and surface plants. Three days are required for the inspection. A safety society among the miners meets regularly and discusses accidents with a view to prevent their recurrence.

Sutter Creek—The Central Eureka Co. is operating thirty stamps continuously and occasionally when the bins are full its full complement of forty stamps. For the week ended Feb. 5 [illegible] tons was milled. The south drift on the 3,800 level has opened up in ore for its entire width. Concentrates are averaging $100 per ton.

Grass Valley—Empire Mines Co. is said to be sinking an additional 400 ft. and the 80-stamp mill is operating at full capacity. Local rumor credits the Empire as negotiating for the control of the Champion, Pittsburg and other properties.

Forest—The Kate Hardy Mining Co. is preparing to install a twenty-drill compressor and is said to have decided upon the erection of a 10-stamp mill.

Portola—The Engels Copper Co. is operating. The Mason Valley company in the Plumas County copper belt is said to be planning active work in the near future.

Claude M. Eye addressed the local section of the A.I.M.E. at San Francisco, Feb. 8, on "The Development of the Mineral Resources of the Philippine Islands."

Marysville—A special train of eight cars has been chartered to load the mechanical equipment and parts of a 7-cu.ft. dredge purchased by the Guiana Development Co. from the Yuba Manufacturing Co., Marysville, Cal. The dredge parts will be loaded upon a steamer at San Francisco for transportation to Dutch Guiana, S. A. The necessary lumber will be shipped from Tacoma and the dredge buckets from New York.

ARIZONA

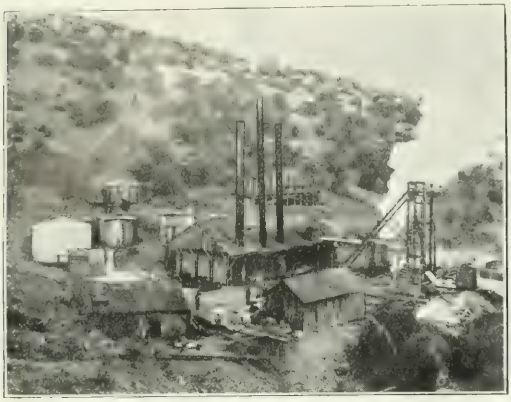
New Company Organized To Work Dumps at Tombstone

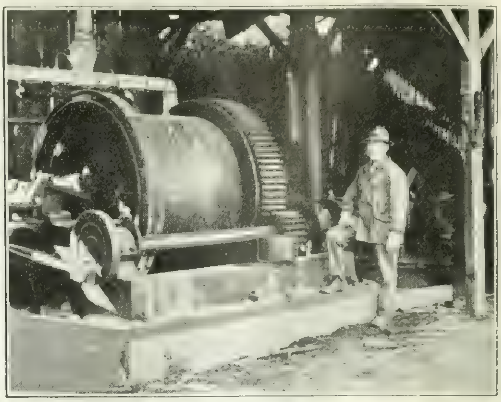
Tombstone—Local business men have financed the National Metals Recovery Co. which has secured a lease on seven of the old dumps in the district. The old Guard mill is being overhauled and will be put in operation at once. Its capacity is 200 tons per day. The ore in the dumps was thrown there when no attention was paid to a streak that did not assay better than $100 per ton. All work is under the supervision of J. W. Stockholm, formerly of Bisbee.

The Tombstone Co-operative Co. is building a 120-ton concentrating and cyanide plant to treat the ore of lessees in the camp. V. G. Mellgren is manager and will have the mill running in sixty days.

The Solstice Mining Co. has completed sinking and timbering its shaft, and will start breaking ore at once. Holland and Cavanough have installed a new 40-hp. gasoline engine in the mill on their lease.

Phoenix—A start has been made on the great suit brought in Gila County in which the Inspiration Consolidated Mining Co. and the International Smelting Co. have attacked the state method of determining taxable value on the basis of profits within five-year periods. Judge Frank Lyman, of Maricopa County, presided, the local magistrate considering himself disqualified. Will E. Ryan and Alexander Baker appeared for the state and offered demurrers to the complaints. E. W. Rice, of Globe, represented the complainant corportions. Payment of about $1,000,000 to the state in alleged excess taxes is involved as well as the larger point of right of taxation on anything but a physical property valuation.


PLANT OF HARDSHELL MINING CO., PATAGONIA, ARIZ.


NEW HOIST AT HARDSHELL MINE

Patagonia—The new shaft of the Hardshell Mining Co. has been unwatered by bailing, and the station pump on the 425 level is in operation. A ventilating system has been installed, and crosscutting toward the vein is in progress. In the old workings the ore from the Gardiner stopes is being handled through a new raise from the 325 level. The first-class ore is averaging about 100 oz. silver a ton and nearly 70 per cent lead. Second-class ore is running about 25 oz. silver and 35 per cent lead. The crosscut from the bottom of the new shaft will be advanced to cut the Hardshell vein, and the upper workings will be unwatered by means of a drift and raise to connect with the bottom of the winze from the 325 level.

NEW MEXICO

C. & A. To Restrict Output of Eighty-five Mine—Altering Co-operative Co's. Mill

Lordsburg—Ore shipments from this district for January amounted to 54 cars, or 2,594 tons, valued approximately at $10,000.

Until market conditions improve the C. & A. Mining Company will restrict the output of silicious ores from the Eighty-five mine, confining the shipments to such ores as are taken out in the regular course of development work which will be continued on the plan as followed last year. The main shaft has reached a depth of 1,120 ft. and a station has been cut at 1,050 ft.

Changes and improvements are being made in the mill of the Co-operative Mining Co. A new road is being built and development work is going forward steadily. A depth of 300 ft. has been reached in the inclined shaft.

Work upon the new mill of the Great Eagle Fluorspar Co. is progressing. The 150 hp. gasoline power plant for mine and mill is completed.

Hatch—The Nakayr Mining Co. shipped 6 cars of fluorspar to the C. F. & I. Co. at Pueblo, Col., during January.

COLORADO

Lincoln Mines Mill at Cripple Creek Ready for Operation

Telluride—Shipments of concentrates for January were as follows: Tomboy, 42 cars; Smuggler-Union, 41; Liberty Bell, 15; total, 98 cars.

Aspen — The Cowenhoven tunnel is being cleaned out and relaying of track and retimbering are in progress preparatory to resuming development work in properties tributary to the tunnel. The work is under the direction of J. T. Boyd.

Cripple Creek—The Lincoln Mines & Reduction Co. has made trial runs in its new 400-ton mill, and is ready for regular operations. The treatment of ore from the Rex property, which contains considerable manganese, has been devised by F. G. Gasche, general manager of the company. It is claimed that ore running 11 per cent Mn can be concentrated to 54 per cent Mn, and that the mill can recover 90 per cent of the gold value in the ore. The company plans to sink a new 3-compartment shaft on Ironclad hill, and drive a double-track tunnel into the hill to connect with the shaft. Electric haulage will be installed.

UTAH

Chief Consolidated Cuts Dividend in Half—Miner Electrocuted at Woodlawn

Salt Lake City—At the Howell in Big Cottonwood canyon the tunnel, which is being driven for the downward extension of orebodies found in higher workings, is in 2,900 ft., and is within 50 or 60 ft. of its objective. At the Woodlawn, not far from the Howell, a miner was electrocuted while trying to put out with water a fire caused by a short-circuited wire.

Eureka—Ore shipments from the Tintic district for the week ended Feb. 5 totaled 172 cars. Shippers were: Tintic Standard, 67 cars; Chief Consolidated, 37; Iron King, 15; Eagle & Blue Bell, 13; Iron Blossom, 12; Victoria, 7; Dragon, 7; Gemini, 4; Centennial Eureka, 4; Grand Central, 2; Gold Chain, 2; Bullion-Beck, 7; and the Colorado mine, 1.

The Chief Consolidated, owing to high operating costs (which include the cost of the new three-compartment concrete-lined shaft recently completed) is paying for the quarterly dividend just due 5c. a share instead of the usual 10c., the total this time being $44,211. Reduced operating costs, which will result from the use of the new shaft are expected to make it possible soon to return to the usual quarterly payments. Like other Utah properties the Chief is hampered by high taxes, smelting, and freight rates. The new shaft has been connected with the old workings on the 1,000 level, and a second connection is to be made on the 1,800, and this, it is expected, will greatly improve ventilation. The 1,800 level will also be connected with the Eagle and Blue Bell mine, which adjoins.

Mine rescue car No. 11 has been in Eureka and on the evening of Feb. 8 an open meeting devoted to mine-rescue and first-aid work was held, a general invitation having been given, and an effort was made to make the program of popular interest. Motion pictures were shown to impress upon the public the necessity of safety and health measures. The meeting was addressed by A. G. MacKenzie, secretary of the Utah chapter of the American Mining Congress, and by members of the state board of equalization. The car was open to inspection by the public during the period of its stay in the camp.

Park City—Shipments for the week ended Feb. 5 amounted to 1,263 tons of ore and concentrates and 35 tons of spelter, as compared with a total of 2,121 tons the week preceding. The shippers were: Judge and allied companies, 785 tons and 35 tons of zinc; Silver King Coalition, 273; and the Ontario, 205. The other companies in the camp made no shipments.

NEVADA

Conditions Normal at Tonopah, Divide and Virginia City

Tonopah—Conditions are normal in the district. Gross ore tonnage is about 1,250 tons per day. The Tonopah Belmont has resumed work below the 1,300 level. At this depth values in the Belmont vein, the principal producer, were low where developed. At present drifting in an intermediate level below the 1,300 is being done. Fair ore has been found and results are more satisfactory than at any other time at this depth. The Rescue Eula had a prosperous year in 1920, total production being given as 4,380 tons with a gross value of $109,000. Net profits were $11,000. Mine conditions are good with the east and west faces on the 1,100, or deepest level, in ore. These developments give promise of a considerable undeveloped tonnage between the 1,100 and 900 levels. The McCane shaft of the Tonopah Extension has connected with the 1,540 level workings of the Victor shaft, and a station is now being cut preparatory to crosscutting. The south crosscut on the 1,880 level of the Victor shaft is being run to pick up the Murray vein and its branches. This being the deepest work in the district results are being watched with interest.

Divide—In the Divide district many small properties are doing development but the Tonopah-Divide mine is the only producer. Favorable reports are current regarding improvement in values on the 300 level of the Rosetta, but ore in commercial tonnage is questionable. The Tonopah-Divide reports finding a new orebody in the hanging wall of the main vein on the 270 level which is now being developed by drifting. Favorable news regarding the southeast drifts on the 800 and 1,000 levels appears to be lacking. Progress is normal in both faces.

Arrowhead—In the Arrowhead mine shaft sinking has been resumed and the east and west drifts on the 260 level driven ahead. The values in the east drift have improved.

Virginia City—Conditions are normal in the district. The Consolidated Virginia reports important ore has been found on the 2,250 level in the north drift, and on the 1,650 level. The management have stated that they expect to mine and mill 4,500 tons of ore per month soon at a total estimated cost of $6 per ton. This is an optimistic statement considering the small tonnage and mining conditions.

Gold Hill—The Goldfield Development Co. is completing its camp at Gold Hill, 26 miles from Goldfield. Shaft sinking has been discontinued temporarily at a depth of 50 ft. and adequate surface equipment is being provided. In the West Divide mine a 2-ft. width of ore assaying $200 per ton has been opened on the tunnel level. The Silver Pick is making regular shipments of two cars of $40 ore per week to the Millers plant of the Tonopah Mining Co.

Reno—About three miles north of Reno, in the Peavine district, some shipping ore has been found in the Fravel-Paymaster and Standard Metals mines at a depth of 300 ft. The principal values are in silver.

IDAHO

Amazon-Dixie Increases Capitalization —Caledonia Suspends Dividend Payments

Wallace—The Amazon-Dixie has authorized an increase in its capital stock from 1,500,000 shares to 2,500,000 shares for the purpose of taking over the Leslie Mining Co., which owned a group of seven claims adjoining and on the same vein. Stock in the Amazon-Dixie will be issued, share for share, in exchange for Leslie stock. Leslie ground is now being explored by extension of the main Amazon-Dixie tunnel. The Amazon-Dixie shaft, which has been sunk 400 ft. from the main tunnel level, is being unwatered and will be sunk 400 ft. further. Good showings of lead-silver ore have been exposed in the tunnel and in the 200 and 400 shaft levels, the ore improving with depth, and it is expected that when the new level is opened the amount of ore in sight will justify the construction of a mill. The Amazon-Dixie company is controlled by Cleveland capitalists. The property is situated at Sildix station in Montana near the Idaho line.

The West Sunset Mining Co., controlled by the Days, through an arrangement with Senator Clark, of Butte, who owns the Sunset mine, is extending a drift from the shaft of the latter into the West Sunset at a depth of 1,000 ft. The drift is now near the common end line and shows about 10 in. of high-grade lead-silver ore in a vein 12 ft. wide. This shaft is at a high elevation and if the results of the work are satisfactory it is expected that the West Sunset company will extend a tunnel from the Amazon-Manhattan, another Day controlled property, a distance of about a mile and which will open the ground at a depth of 2,000 ft. and provide a direct outlet to the Ray-Jefferson mill, also owned by the Days.

Kellogg—The Caledonia Mining Co. has suspended dividend payments. This announcement has been made by Stanley A. Easton, president, who states that efforts will continue to find a new orebody, but that no certainty attaches to this work. "Ultimately liquidating dividends will be resumed to finally distribute among the stockholders of the company the balance which may remain after the ore resources have been entirely realized and the obligations of the company fully discharged." For several years the Caledonia company paid 3c. per share per month with an occasional extra dividend. Then the rate dropped to 1c. per month, and since last July the rate has been 1c. quarterly. The company has paid a grand total of $4,141,950 in dividends.

MONTANA

Anaconda Perpetuates Testimony of Three Aged Witnesses Bearing on Ownership of Disputed Ground

Butte—There is a possibility that Anaconda will temporarily suspend operations at its sampler in Butte, where custom ores are received and assayed, and ship all custom ores direct to its smelter at Anaconda. No announcement has been made.

A feature of the week's news was the perpetuating of the testimony of three old pioneers of the district, upon petition by the Anaconda company for use in possible litigation between the Anaconda and the Davis-Daly over apices in contiguous claims. It was explained by officials that this does not necessarily mean litigation, but because of the advanced age of this trio of old-timers and the serious sickness of one of them it was deemed wise to have their testimony, whether it would prove of worth to one side or the other. The ground in controversy lies to the northwest of the Colorado shaft and embraces a portion of the vein that is known to be rich.

But one shift is being worked at the Pittsmont property of the East Butte and but one furnace in the smelter. It is not likely there will be a further curtailment. It is planned to reduce the running time of the flotation mill from seven to five days a week in consequence of the reduction of output by the Davis-Daly company, which ships its copper ores to East Butte. This plant has a daily capacity of 600 tons, which East Butte is unable to furnish under the generally curtailed program.

Receipts from ore shipments during the last year from Tuolumne Copper's Main Range mine amounted to $265,000, with the expenditures for the twelve months $259,000, showing a profit for 1920 of approximately $6,000. During this period a pumping plant was installed at a cost of $10,000, together with a new boiler plant and development work practically was continuous throughout the year. Shaft sinking continues with the sump now well below the 1,300-ft. level. The 1,600 is the first objective. The shaft cut a new 9-ft. vein which shows promising stringers of bornite and pyrites, carrying up to 2 per cent copper, from 2 to 4 in. wide.

Station cutting has been completed by the Butte & Plutus at the 300 level of the Plutus claim and crosscutting both northerly and southerly has begun. The Norwich vein lies to the north an estimated 125 ft. and the Mapleton fissure is about 150 ft. south. Both have ore lying nearer the surface.

Although the mining of zinc ore by Elm Orlu has been suspended because of the closing of the Anaconda's electrolytic zinc plant at Great Falls the production of copper ore is continuing on a limited scale. Development, however, of both zinc and copper ore is continuing.

THE MARKET REPORT

Daily Prices of Metals

Feb.	Copper, N. Y. net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
10	12.75	28.50	32.50	4.60	4.25@4.35	5.00
11	12.75	29.00	33.00	4.60	4.25@4.35	4.90@5.00
12	.....	.....	.....	....	....	....
14	12.75	29.00	33.00	4.60	4.25@4.35	4.90@5.00
15	12.75	29.00	32.75	4.55@4.60	4.25@4.30	4.90@5.00
16	12.75	28.25	31.50	4.50	4.25	4.90@5.00

*These prices correspond to the following quotations for copper, "delivered": 13c. for the week.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Feb.	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
10	71¾	72¼	78	165	170	22	22½	26	27
11	71⅜	71¾	78	168	172	21¼	22	25	26
12		...	..	....	....	...	...	...	...
14	71	71⅜	77½	172	175½	20¾	21⅝	24¾	25¾
15	71⅝	71⅝	77	170¼	173½	21¼	22	24⅞	25⅝
16	72¼	71⅝	76	163	167½	20¾	21½	24¾	25¾

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Feb.	Sterling Exchange	Silver New York, Domestic Origin	Silver New York Foreign Origin	Silver London
10	388	99½	62⅛	36½
11	388	99½	62¼	36¼
12		99½	...	36⅛
14	388	99½	60¾	35⅜
15	390¼	99½	60¼	34⅞
16	391¼	99½	59½	34

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, Feb. 16, 1921

The dullness which has characterized the non-ferrous metal market since the first of the year continues, with no improvement in sight. Consumers are out of the market except for current requirements, which are small. It is distinctly a buyer's market and producers are tempted to shade prices on large lots particularly if for prompt delivery. Neither sellers nor buyers are interested in futures.

Copper

The export demand continues better than that from domestic consumers, although it is not large. The price has held firmly at recent levels, and metal may be had for delivery spread over February, March, and April at these figures. May delivery commands about ⅛c. more, and June delivery a premium of about ¼c. Sellers should not take too seriously reports by possible buyers that 13c. delivered is too high and that copper can be obtained for 12.75c. We have had reports of only one carload sold below 13c., and this brought 12.95c. Second-hands seem to have little copper on hand and are not pressing it on the market. In fact they are prone to quote somewhat higher prices than producers.

Stocks of copper are low in London, and standard seems especially scarce, as the price of that grade is now within £3 15s. of the figure quoted for electrolytic.

Lead

On Tuesday, Feb. 15, the American Smelting & Refining Co. reduced its official price of lead to 4.60c., New York and St. Louis, the previous figure being 4.75c. This was in accord with the recent New York market, and the reduction was also probably influenced by the possibility of bringing Spanish lead to this country.

Inquiries have not been quite so numerous as usual during the last week, but some good business has been done, nevertheless, a few fairly large buyers having come into the market. Sales for carload lots, however, have been fewer. The New York market held firm at 4.60c. until the A. S. & R. met that figure in its official quotation; whereupon at least one interest dropped to 4.50c. and sold at that figure. The St. Louis market has been more unsettled. A plentiful supply of common lead is apparently available at the prices which we quote, but the demand is quiet. Chemical and corroding grades of lead are more popular just now, the former commanding ¼@⅜c. premium over the desilverized article, with the customary additional advance of 10 or 15 points for corroding lead.

Producers are not anxious to sell for shipment later than March, and ask a premium of about ⅛c. for such business.

Zinc

Very few sales of zinc have been made, and stocks continue to pile up, in spite of the greatly curtailed production. Stocks of zinc of all grades on hand in this country are reported to have increased from 71,000 to 75,900 tons during January. Galvanizing plants are still in large measure closed down, and a resumption is unlikely until the price of steel recedes materially. A start has been made by the independent steel producers. Zinc producers who have high-grade zinc for sale report a fair demand for small tonnages at 7.25c., delivered, in Eastern districts.

Tin

This metal seems to be quieter than ever, if such a condition is possible. The reduced price of the Straits government which we announced last week seems to be an assured fact, and the move is considered a wise one. Holding up the supply does not seem to have strengthened the price of Straits materially so far. Other grades can in many cases be substituted, particularly electrolytic, which, for practically all purposes, is of equal value. It can be obtained at prices a fraction of a cent under those asked for Straits.

Straits tin for future delivery: Feb. 10th, 33.25@33.75c.; 11th, 33.25@33.75c; 14th, 33.50@34.00c.; 15th, 33.00@33.50c.; 16th, 32.25@32.75c.

Arrivals of tin, in long tons: Feb. 10th, Straits, 150; China, 20; 12th, China, 5; 14th, Singapore, 150; 15th, London, 185.

Silver

Since our last report, the London spot price has fallen from 37 to 34d., and the future price from 35 to 33¾d. This narrowing of the difference between spot and futures from 2d. to ¼d. indicates that the recent squeeze in London, occasioned by the demand for near-by delivery, is now over. The New York price has also declined from day to day, in sympathy with the London market, and business continues on a small scale. Although the China New Year holidays and the accompanying settlement period have passed, there has been no resumption of buying for China account, and as a consequence the San Francisco market remains purely nominal.

Mexican Dollars—Feb. 10th, 47¼; 11th, 47¼; 14th, 46; 15th, 45⅝; 16th, 45¼.

Gold

Gold in London: Feb. 10th, 105s. 10d.; 11th, 105s. 6d.; 14th, 105s. 6d.; 15th, 105s. 1d.; 16th, 104s. 7d.

General stock of money in the United States Feb. 1: Gold coin (including bullion in Treasury), $2,853,480,649; standard silver dollars, $269,746,326; subsidiary silver, $271,511,384; United States notes, $346,681,016; Federal Reserve notes, $3,484,226,195; Federal Reserve Bank notes, $225,938,400; National Bank notes, $719,653,927; total, $8,171,237,897. The gold coin has increased, in the last month, about $69,000,000 and the Federal Reserve and bank notes have decreased $267,000,000.

Foreign Exchange

Sterling continues to advance, and $4 probably will soon be reached. Other foreign exchanges have also exhibited firmer tendencies. On Tuesday, Feb. 15, francs were 7.38c.; lire, 3.68c.; and marks, 1.70c. New York funds in Montreal, 13⅞ per cent premium.

Other Metals

Aluminum—List prices of 28@28.5c. are nominal. Outside market 24@25c.

Antimony — Chinese and Japanese brands, 5¼c.; market quiet. W.C.C. brand, 6¼ per lb. Cookson's "C" grade, spot, 9⅝c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony[1] (200 mesh), 7@7½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 7c.

Bismuth—$2.25@$2.35 per lb., 500 lb. lots.

Cadmium—Nominal, $1.40 per lb., in 1,000 lb. lots.

Cobalt—Metal, $4.50 per lb.; black oxide, $3@$3.10 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $325 per oz.

Magnesium — Crude, 99 per cent, $1.25@$1.35 per lb., f.o.b. Philadelphia

[1]**Molybdenum Metal in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.**

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 38@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—$70 per oz.

Quicksilver—Nominally $50 per 75-lb. flask. San Francisco wires $43. Quiet.

[1]**Rhodium**—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 50@55c. per long ton unit, f.o.b. Atlantic ports.

Manganese Ore—35@40c. per unit, seaport; chemical ore (MnO_2) $60 per gross ton, lump; $65@$70 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

[1]**Tantalum Ore**—Guaranteed minimum 60 per cent tantalic acid, 40c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¼@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Feb. 12.—Zinc blende, per ton, high, $[illegible], basis 60 per cent zinc, premium, $[illegible]; Prime Western, $[illegible]; fines and slimes, $[illegible]@$17.50; average settling price, all grades zinc, $26.09.

Lead, high, $52.80; basis 80 per cent lead, $45; average settling price, all grades lead, $50.17 per ton.

Shipments for the week: Blende, 5,193; lead, 1,439 tons. Value, all ores the week, $207,680.

With only $20 basis offering at the close of last week, most of the 4,400 tons sold this week was purchased on $22.50 basis, with week-end offerings again on $20 basis. Buyers think today this will be the ruling price next week, with one more purchasing company out of the market, and this one of the heaviest purchasers. Lead continued without change in basis price, with increased shipment, and demand fully equal to the production.

Platteville, Wis., Feb. 12—No market for zinc ore. Shipments for the week: Zinc ore, 537; lead ore, 90 tons. Shipments for the year: Zinc ore, 5,182; lead ore, 480 tons. Shipped during week to separating plants, 466 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $2,000@$3,000; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, $23; ground (white), $45; ground (off color) $30@$32 per net ton, less than carload lots, f.o.b. New York. Crude, first grade, $10 per ton, f.o.b. cars, Missouri; floated, $28 per ton in bbls.; $26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis.

Chalk—English, extra light, 5@5½c.; light, 5@6c.; dense, 4½@5c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$12; washed, $12@$15; powdered, $18@$22; bags extra, per net ton, f.o.b. mines, Georgia; crude, $8@$12; ground, $15@$40, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $25@$35; powdered, $30@$35, f.o.b. New York.

Feldspar—Crude, $8@$[illegible] per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$[illegible], f.o.b. North Carolina points; $[illegible] per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $[illegible] per ton, f.o.b. Illinois mines, and $25.50, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, $60; lump, $17.50, f.o.b. [illegible], N. M. In Canada

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

85 per cent calcium fluoride sells for $20 per ton, f.o.b. Madoc; output limited. Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines.

Fuller's Earth—$16 per ton, carload lots, f.o.b. mines.

Graphite—Ceylon lump, first quality, 8@9c. per lb.; chip, 7c.; dust, 5½c. No. 1 flake, 7½c.; high-grade amorphous crude, 3c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Dolomite, 1@2 man size, $1.60@$1.65; 2@8 in., $1.55@$1.65 per net ton, f.o.b. Plymouth Meeting, Pa.; fluxing, $1.65@$1.75 per net ton, f.o.b. Howellville, Pa.

Magnesite, Calcined — High - grade caustic calcined, lump form, $35@$40 per ton, carload lots, f.o.b. California points. In Chicago district, $57.70; Atlantic seaboard, $61@$63.

Dead - Burned — $38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); all f.o.b. New York.

[1]**Monazite**—Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $13; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $8.35; 68 per cent, $7.85; 68@66 per cent, $7.60. Finely ground Tennessee rock sells for $8.50 per net ton for 13 per cent phosphorus content, agricultural application; for acid-making, 14 per cent, $9; both prices f.o.b. Centerville, Tenn.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 16c., c.i.f. Atlantic seaport; furnace size, 16½c.; Spanish lump, 14@16c.; domestic fines, f.o.b. mines, Georgia, 12 @ 14c.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Sand (Glass)—Dry glass sand, $4 per net ton, f.o.b. cars Mapleton, Pa. Sand, f.o.b. Ottawa, Ill., is $3 per ton; $2.50 on annual contracts. Sand at Klondike, Gray Summit and Pacific, all in Missouri, is $2.50 on contract; some outside sales have been made at $4. St. Louis, open market, at $3.50; contract price on large quantities, $2.50; on small quantities, $3

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$45, talcum powder grade. Southern talc, powdered, carload lots, $12@$15 per ton; less than carload, $25, f.o.b. cars; freight to New York $5.25 per ton, carload lots; less than carload lots, $9.25. Imported, $40@$50; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 10@11c. per lb.; sulphide, powdered, 14@15½c. per lb. in carload lots.

Sodium Nitrate—$2.85@$3 per cwt. ex vessel, Atlantic ports. Market quiet.

Sodium Sulphate—For 95 per cent material, $20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; $32 per ton, New York.

Potassium Sulphate—Domestic, $220@$230 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 16@17c. per lb. of chromium contained; 4 to 6 per cent carbon, 16@17c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $100, f.o.b. furnaces; resale, $90, delivered; English, $100, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $40@$45, f.o.b. furnace.

[1]**Ferromolybdenum**—**Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2 per lb. of contained metal, f.o.b. works.**

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $55@$60; 50 per cent, $80@$85; 75 per cent, $145@$150.

Ferrotungsten—Domestic, 70 to 80 per cent W, 55@60c. per lb. of contained tungsten, f.o.b. works. Foreign, 60c.

Ferro-uranium—35 to 50 per cent U, $7 per lb. of U contained, f.o.b. works.

Ferrovanadium—Basis 30 to 40 per cent, $5 per lb. of V contained, plus 75c.@$2 differentials and according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York list price, 21¼c. per lb.; wire, 15⅝.

Lead Sheets—Full lead sheets, 8½c.; cut lead sheets, 8⅝c. in quantity, mill lots.

Nickel Silver—33½c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets, 19⅝c.; sheathing, 19⅝c.; rods, ⅜ to 3 in., 16⅝c.

Zinc Sheets—$11 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $80 per net ton, shipping point; arches, keys, wedges, $85; splits, soaps, $100.

Fire Brick—First quality, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $45@$50.

Magnesite Brick — 9-in. straights, $100 per net ton; 9-in. arches, wedges and keys, $105; soaps and splits, $120.

Silica Brick—9-in., per 1,000: Chicago district, $65@$70; Birmingham, Ala., $56@$61; Mount Union, Pa., $50@$60.

The Iron Trade

Pittsburgh, Feb. 15, 1921

In the last week the finished-steel market began what may be called technically a break, but the buying disposition was so light that the break made little progress. Many mills were ready to shade prices by several dollars a ton, but buyers refused to furnish the incentive by offering substantial orders. In trade circles the movement is commonly attributed to the action of the Midvale Steel & Ordnance Co., which began openly to offer some of its products at less than the Industrial Board schedule.

At present concessions of $3 to $5 a ton appear possible on sheets, bars, shapes, and plates, with possibly a greater concession in bars and plates. Pipe is moderately firm, as is tin plate from production; tin plate from stocks in second hands has been offered as for some time at large concessions.

Steel ingot production in January was at about 90 per cent of capacity by the Steel Corporation and at 25 to 30 per cent by the independents, making a general average of about 55 per cent, against 80 per cent during the first nine months of last year. Independent mill operations have not materially changed since January, and the Steel Corporation rate is declining, being now at 80 or 85 per cent, still too high a rate to warrant a question as to whether the Corporation will cut prices.

Pig Iron — Foundry iron remains quotable nominally at $29, Valley. A merchant producer has voluntarily reduced asking prices to $29 on bessemer and $27.50 on basic, representing $3 on bessemer and $2.50 on basic reduction from previous nominal quotations. There is no inquiry for any grade.

Charcoal and Coke

Charcoal—**Willow, 7c. per lb. in bbls., hardwood, 5½c. per lb., in 250-lb. bbls. Barrel charge is 35c. additional.**

Connellsville — Furnace, $4.50@$5; foundry, $6@$6.50.

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

The Financing of the Copper Surplus

By Arranging a $40,000,000 Loan, Producers Have Transferred the Financial Burden of Carrying the Bulk of the Unsold Copper to the Public—Further Curtailment of Production Necessary If Measure Is To Accomplish Its Aim

THE outstanding development in the copper market since the first of the year is the successful effort of the copper companies to induce the public, through the intermediary of the usual banking interests, to provide the necessary funds for carrying 400,000,000 lb. of the copper surplus. This stock of refined copper has been given a value of 10c. per lb., and one- to four-year notes to the value of $40,000,000 have been issued to cover the loan. The copper companies are to pay interest at the rate of 8 per cent and over (8.30 per cent on the four-year notes if held to maturity), and have individually guaranteed the payment of principal and interest according to the following proportion of the indebtedness:

	Percentage of Proportion	Allotments of Surplus
Anaconda Copper Mining Co.	12.26	49,040,000
Phelps Dodge Corporation	10.90	43,600,000
Inspiration	8.45	33,800,000
Utah Copper Co.	8.20	32,800,000
Chile Exploration	7.58	30,320,000
Calumet & Hecla	6.00	24,000,000
Braden Copper	5.95	23,800,000
Kennecott Copper	5.06	20,240,000
American Smelting & Refining	5.00	20,000,000
United Verde	5.00	20,000,000
Greene Cananea	4.63	18,520,000
Nevada Consolidated	4.45	17,800,000
New Cornelia	4.07	16,280,000
Ray Consolidated	4.00	16,000,000
Chino Copper	3.66	14,640,000
North Butte	1.75	7,000,000
Utah Consolidated	0.34	1,360,000
To be allotted	2.70	10,800,000
	100.00	400,000,000

From this table it can be seen that Anaconda Copper Mining Co., the Phelps Dodge Corporation, Utah Copper, Chile Exploration, Calumet & Hecla, and Braden Copper companies are accounting for over half the financial burden.

There has been some misconception of the purpose and effect of this operation. It was not undertaken to dispose of the burdensome accumulation of copper, for such a result would not be achieved by this method, but was merely utilized to enable the copper companies carrying heavy stocks to procure a longer term loan than could have been obtained solely with the aid of the banks.

Copper is an excellent collateral, and the conservative valuation placed upon it in the note issue, 10c. per lb., indicates that more than adequate guarantees cover it.

Surplus stocks are by no means removed as a factor in the market, and they remain practically as potent as before. The greatest benefit accruing from the arrangement is psychological, as it provides a means whereby producers can proceed with their normal business of marketing copper with the assurance that their funds are not tied up in unmarketed metal. Without an accompanying decrease in copper production and its maintenance at a rate commensurate with the present domestic and foreign copper requirements, the effect of the arrangement will be nullified. It is understood that one-third of the monthly shipments of copper by the Copper Export Association will go toward the liquidation of the copper covered by the notes, so that this requirement of itself should predicate cutting down monthly production from 10,000,000 to 15,000,000 lb. from the present rate of about 95,000,000 lb.

Curtailing production appears to be the inescapable requisite to restoring the copper industry to a normal basis. It is an issue which most producers have been loath to meet, and their attitude has been in some measure pardonable, being due to solicitude not only for themselves but to the welfare of their employees. At present smelter production is proceeding at approximately the pre-war rate of 95,000,000 lb. monthly, but a lower rate is desirable if part of the copper export trade is to go toward reducing the surplus. This feature of the funding arrangement practically assures that production will be reduced so that a duplication of the present predicament will not occur.

Copper is still selling at very low prices, but domestic consumers are refraining from entering the market. They have kept out so long that should a buying movement of any magnitude begin it would not be surprising to see the price of copper rise rapidly. It is noticeable that the largest producing interests are not willing to sell their copper at the range between 12 and 13c. delivered, and with the financing of the best part of the copper surplus their burden has been lightened and their position strengthened. Producers and consumers are now at least on a more equitable basis.

The step which the copper producers have taken in funding their surplus stocks illustrates one important advantage accruing to them under the Webb Act, which permits the combination of enterprises engaging in export trade and enables them to quote a uniform export price for their product and to enjoy other benefits of combination that are denied to them in domestic competition. Were there no Webb Law, copper producers would have had to make individual arrangements in order to finance their surplus stocks.

It is to be noted that the disposal of the entire 400,000,000 lb. is stretched over a period of four years, which is at the rate of about 8,330,000 lb. monthly, or comfortably within the allowance of one-third the total monthly exports, which can be expected to run well over 35,000,000 lb.

Although foreign trade has shown no encouraging spurt, every effort is being made to sell copper to Europe at present attractive prices, and advantage is being taken of rail and ocean freight rates to lay down the metal abroad at prices equal to those prevailing on the Atlantic seaboard. Thus copper mined and refined in Montana is being shipped to the Pacific Coast under a rail charge of $7 per ton, and is then transported by boat via Panama Canal directly to Europe for a further water toll of $15. Contrasted with the rail freight of $22 to New York or Atlantic seaboard points, plus the ocean freight rate of $5 to Europe or $11 to England (this rate was reduced from $13 early in February), the saving amounts to from $5 to $11, and explains why it has been possible for the Export Association to make low European quotations — equal to those in the American market.

A great financial load has been successfully lightened by the efforts of the Copper Export Association, aided by the banks, but its result is expected for the present to be more psychological than direct in affecting the price of copper.

Tasmania's Mineral Production

A table showing the quantity and value of mineral products of Tasmania during the year ended Dec. 31, 1919, taken from the "Report of the Secretary of Mines," follows:

Mineral	Quantity	Value
Gold, oz	7,686.4[illegible]	[illegible]
Silver, oz	[illegible]	[illegible]
Lead, tons	[illegible]	[illegible]
Copper, tons	[illegible]	[illegible]
Tin, tons	[illegible]	[illegible]
Coal, tons	[illegible]	[illegible]
Wolfram, tons	[illegible]	[illegible]
Bismuth, tons	1.77	[illegible]
Shale, tons	[illegible]	900
Iron pyrites, tons	[illegible]	4,288
[illegible]	[illegible]	43,181
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Total		[illegible]

MINING STOCKS

Week Ended February 12, 1921

Stock	Exch.	High	Low	Last	Last Div.	
			COPPER			
Adventure	Boston	...	...	*60		
Ahmeek	Boston	51½	50½	50½	Sept. '20, Q	$0.50
Alaska-Br. Col	N. Y. Curb	¾	9/16	11/16		
Allouez	Boston	23½	20	23	Mar. '19	1.00
Anaconda	New York	40	38⅛	39½	Nov. '20, Q	1.00
Arcadian Consol	Boston	3¼	2¼	2⅞		
Ariz. Com'l	Boston	8¼	8¼	8¼	Oct. '18,	.50
Big Ledge	N. Y. Curb	⅜	5/16	⅜		
Bingham Mines	Boston	8½	8½	8½	Sept. '19, Q	.25
Calumet & Arizona	Boston	...	...	49½	Dec. '20, Q	1.00
Calumet & Hecla	Boston	255	250	254	June '20, Q	5 00
Canada Copper	N. Y. Curb	...	...	*13		
Centennial	Boston	8½	8½	8½	Dec. '18, SA	1.00
Cerro de Pasco	New York	29	27⅝	29	Dec. '20, Q	1.00
Chile Copper	New York	12¾	12⅛	12⅜		
Chino	New York	23½	22¼	23⅛	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*31½	*29	*31		
Con. Arizona	N. Y. Curb	...	..	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb		..	2⅛		
Copper Range	Boston	34¼	33	33¾	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*41	*36	*40		
Davis-Daly	Boston	6⅞	6¼	6¾	Mar. '20, Q	.25
East Butte	Boston	9½	9⅜	9½	Dec. '19, A	.50
First National	Boston Curb	*90	*80	*80	Feb. '19, SA	.15
Franklin	Boston	2½	2¼	2½		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol	New York	23¼	22¼	23¼	May '19, Q	1.25
Greene-Cananea	New York	24	23	24	Nov. '20, Q	.50
Hancock	Boston	†3½	†2¼	3¼		
Howe Sound	N. Y. Curb	....	....	3½	Jan. '21, Q	05
Inspiration Consol	New York	37¼	34½	36½	Oct. '20, Q	1 00
Iron Cap	Boston Curb	7	5½	7	Sept. '20, K	.25
Isle Royale	Boston	21	21	21	Sept. '19, SA	50
Kennecott	New York	20	19	19½	Dec. '20, Q	.50
Keweenaw	Boston	1½	1¼	1¼		
Lake Copper	Boston	3⅛	3	3		
La Salle	Boston	2¼	2¼	2¼		
Magma Chief	N. Y. Curb	...	...	*21		
Magma Copper	N. Y. Curb	25½	24	25	Jan. '19, Q	.50
Majestic	Boston Curb	*15	*15	*15		
Mason Valley	Boston	†1¾	†1¼	1¼		
Mass Consolidated	Boston	2¼	2¼	2¼	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	4¼	4	4¼		
Miami Copper	New York	18¾	18½	18½	Feb. '21, Q	.50
Michigan	Boston	†3	†2½	2½		
Mohawk	Boston	47	46	46¼	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5½	5¼	5½		
Nevada Consol	New York	11¾	11¼	11¼	Sept '20, Q	.25
New Baltic	Boston Curb			3		
New Cornelia	Boston	16½	16	16	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb			*5		
North Butte	Boston	12½	11¾	12¼	Oct. '18, Q	.25
North Lake	Boston	*45	*45	*45		
Ohio Copper	N. Y. Curb			3/16		
Old Dominion	Boston	21	20¾	21	Dec. '18, Q	1 00
Osceola	Boston	28½	26	28½	June '20, Q	.50
Phelps Dodge	Open Mar.		†165	....	Jan. '21, Q	2.50
Quincy	Boston	39	39	39	Mar. '20, Q	1.00
Ray Consolidated	New York	14¼	13½	13⅞	Dec. '20, Q	.25
Ray Hercules	Boston Curb	*75	*75	*75		
St. Mary's Min. Ld.	Boston	35	32	34½	June '20, K	2.00
Seneca Copper	Boston			19		
Shannon	Boston	1¼	1	1⅛	Nov '17, Q	.25
Shattuck Arizona	New York	6	6	6	June '20, Q	.25
South Lake	Boston	†1½	†1¼	1		
Superior Copper	Boston	4½	4½	4½	Apr '17,	1.00
Superior & Boston	Boston	1½	1½	1[illegible]		
Tenn. C. & C. cfs.	New York	8½	8	8¼	May '18, I	1 00
Tuolumne	Boston	*55	*55	*55	May '13,	10
United Verde Ex.	Boston Curb	28	26½	28	Nov. '20, Q	50
Utah Consol.	[illegible]	4½	4¼	4½	Sept. '18,	25
Utah Copper	New York	57½	55¼	56	Dec. '20, Q	1 50
Utah M. & T.	[illegible]	2	1½	2¼	Dec. '17,	30
Victoria	[illegible]	1¼	1	1¼		
Winona	[illegible]	*75	65	65		
Wolverine	Boston	12½	12	12		
			NICKEL-COPPER			
Internat. Nickel	New York	15½	15	15	Mar. '19,	50
Internat. Nickel, pf.	[illegible]			81¼	Nov. '20, Q	1 50
			LEAD			
National Lead	[illegible]	7[illegible]	71	71	Dec. '20, Q	1 50
National Lead, pfd	[illegible]	[illegible]	104	104	Dec. '20, Q	1 75
St. Joseph Lead	New York	[illegible]	11¼	11¼	Dec. '20, QX	50
Stewart Mining	Boston			*6	Dec. '15,	05
			ZINC			
Am. Z. L. & S.	New York	[illegible]	8½	8½	May '20,	1 00
Am. Z. L. & S., pfd	New York	[illegible]	28½	28¼	Nov. '20, Q	1 50
Butte C. & Z.	New York	[illegible]	[illegible]	6½	June '18,	50
Butte & Superior	New York	[illegible]	[illegible]	13½	Sept. '17,	1 25
Callahan Zn-Ld	New York	[illegible]	[illegible]	6½	Dec. '20, Q	50
New Jersey Zn.	N. Y. Curb	[illegible]	[illegible]	131	Feb. '21, Q	2 00
Success	N. Y. Curb	[illegible]	*2	*2½	July '16,	03
Yellow Pine	Los Angeles			*59	Sept. '20, Q	03

Stock	Exch.	High	Low	Last	Last Div.	
			GOLD			
Alaska Gold	New York	1½	1⅛	1⅜		
Alaska Juneau	New York	1¾	1½	1⅝		
Carson Hill	N. Y. Curb.	....	....	22¼		
Cresson Consol. G.	N. Y. Curb		....	1¼	June '20, Q	$0 10
Dome Extension	Toronto			*45		
Dome Mines	New York	15¼	12¼	14⅞	Jan. '21, Q	25
Golden Cycle	Colo. Sprgs.	‡		*73	Dec. '20, Q	.02
Goldfield Consol	N. Y. Curb	*11	*8	*9	Dec. '19,	05
Hollinger Consol	Toronto	6.90	6.61	6.65	Jan. '21, M	05
Homestake Mining	New York	50	49⅞	49⅞	Sept. '19,	.50
Kirkland Lake	Toronto	*57	*52	*52		
Lake Shore	Toronto	1 21	1.20	1.21	Jan. '21, K	02
McIntyre-Porcupine	Toronto	1 90	1.86	1.87	Jan. '21, K	.05
Porcupine Crown	Toronto	*21	*20½	*21	July '17,	.03
Portland	Colo. Sprgs.	‡		*60	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*6	*4	*6	May '19,	.05
Silver Pick	N. Y. Curb	*9	*7½	*9		
Teck Hughes	Toronto	*11¼	*10¾	*11¼		
Tom Reed	Los Angeles		....	1.06	Dec. '19,	.02
United Eastern	N. Y. Curb	2½	2 1/16	2	Jan. '21, Q	.15
Vindicator Consol	Colo. Sprgs	†*22	†*17	*18	Jan. '20 Q	.01
West Dome Consol	Toronto	*9	*7	*7		
White Caps Mining	N. Y. Curb	*9½	*8	*9		
Yukon Gold	Boston Curb	†1¼	†*90	*60	June '18,	.02½
			SILVER			
Arizona Silver	Boston Curb	*27	*24	*25	Apr. '20, M	.03
Batopilas Mining	New York	1	⅞	1	Dec. '07, I	.12½
Beaver Consol	Toronto	*39½	*39	*39	May '20, K	03
Coniagas	Toronto	2 05	2.00	2.05	Nov. '20, Q	12½
Crown Reserve	Toronto	†*18	†*16	*18	Jan. '17,	.05
Kerr Lake	Boston	†3⅛	†3	3	Jan. '21, Q	.12½
La Rose	Toronto	*30	*26	*30	Apr. '18,	02
McKinley-Dar.-Sav.	Toronto	*30	*27	*27	Oct. '20, Q	03
Mining Corp. Can.	Toronto	1 10	1.05	1.05	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	8¼	8	8⅛	Jan. '21, QX	50
Ontario Silver	New York	..	.	5	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	⅝	⅝	⅝	Jan. '12,	10
Peterson Lake	Toronto	*9	*9	*9	Jan. '17,	.01¾
Temiskaming	Toronto	†*25	†*24	*24	Jan. '20, K	.04
Trethewey	Toronto	†*18½	†*15½	*17½	Jan. '19,	.05
			GOLD AND SILVER			
Atlanta	N. Y. Curb	*2	*1½	*2		
Barnes-King	Butte	‡....	....	1.11	Aug. '20, Q	.05
Boston & Montana	Boston	...	...	*63		
Cashboy	N. Y. Curb	*8	*6	*7		
El Salvador	N. Y. Curb	7/16	⅜	⅜		
Jim Butler	N. Y. Curb	*18	*16	*17	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*12	*7½	*9½	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	¼		
MacNamara M.& M.	N. Y. Curb	*19	*15	*18	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	10½	9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1⅝	1½	1⅝	Jan. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1 5/16	1¼	1 5/16		
Tonopah-Extension	N. Y. Curb	1⅝	1½	1½	Jan. '21, Q	.05
Tonopah Mining	N. Y. Curb	1½	1⅜	1 3/16	Oct. '20, SA	05
West End Consol	N. Y. Curb	1⅛	1	1 1/16	Dec. '19, SA	.05
			SILVER-LEAD			
Caledonia	N.Y. Curb	*14½	*11	*12	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake			1.15	Dec. '20,	.15
Chief Consolidated	Boston Curb	2¼	2⅛	2¼	Nov. '20, Q	.10
Consol. M. & S.	Toronto	20¼	19¾	20¼	Oct. '20, Q	.62½
Daly Mining	Salt Lake			2.50	July '20, Q	.10
Daly-West	Boston	4	4	4	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	†2¼	†2	2⅛	Dec. '20, K	.25
Electric Point	Spokane	*8	*7	*7	May '20, SA	.03
Federal M. & S.	New York			8	Jan. '09,	1.50
Federal M. & S., pfd.	New York	27	27	27	Dec. '20; Q	1.75
Florence Silver	Spokane	*15	*12	*15	Apr. '19,	.01½
Grand Central	Salt Lake			*37½	June '20, K	.03
Hecla Mining	N. Y. Curb	4¼	4⅛	4 3/16	Dec. '20, QX	.15
Iron Blossom	N. Y. Curb	¼	[illegible]	¼	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake			3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*10	*9	*9½		
Prince Consol	N. Y. Curb	[illegible]	[illegible]	5/16	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*8	*8	*8	Feb. '19,	01
Rex Consol	N. Y. Curb	*7	*5	*7		
South Hecla	Salt Lake	*70	*61	*70	Sept. '19, K	.15
Standard Silver-Ld	N. Y. Curb	[illegible]	[illegible]	[illegible]	Oct. '17,	.05
Tamarack-Custer	Spokane	2.60	2.00	2 50	Jan. '21, K	.04
Tintic Standard	Salt Lake	3.42½	3.25	3.40	June '20, Q	.10
Utah Apex	Boston	2½	2½	2½	Nov. '20, K	25
Wilbert Mining	N. Y. Curb	*3½	*2	*3	Nov. '17,	.01
			QUICKSILVER			
New Idria	Boston			*95	Jan '19,	.25
			VANADIUM			
Vanadium Corp	New York	37½	34½	37	Jan. '21, Q	1 00
			ASBESTOS			
Asbestos Corp	Montreal	175½	175	80½	Jan '21, QX	3 50
Asbestos Corp., pfd.	Montreal			95	Jan. '21, QX	3 75
			MINING, SMELTING AND REFINING			
Amer. Sm. & Ref.	New York	44	41	42	Dec '20, Q	1.00
Amer. Sm. & Ref. pf	New York	82½	82¼	82½	Dec '20, Q	1.75
Am. Sm. pf. A	New York	67	67	67	Jan '21, Q	1.50
U. S. Sm. R. & M.	New York	34½	33½	34	Jan '21, Q	.50
U. S. Sm. R. & M. pf.	New York			43½	Jan. '21, Q	.87½

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

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Health to the Institute!

ALL IN ALL, the Institute may well be congratulated on the success of its annual winter meeting. It was a success technically and socially. The dominant note was that of virility—the air was humming with entertainment and side shows and outside attractions. The technical sessions on metallurgy, on the technology of drill steel, on electrolytic zinc, on petroleum, on non-metallic minerals, and other subjects were live and interesting. The non-metallic committee is a new one, created by the enthusiasm and push of our non-metallic mining specialists in the Bureau of Mines, Oliver Bowles and Raymond Ladoo; and under the chairmanship of Heinrich Ries, it was evident that an important specialty had been added to the Institute's list.

In the petroleum section, among other live topics, there came up the question of the origin of the salt-sulphur-petroleum domes of the Gulf Coast, and although no even remote agreement on the question has been reached, it was evident that all the ancient diverse theories of origin still flourish, and the discussion was thus illuminating and refreshing. Even as to the origin of petroleum, it appeared that not only the veteran Coste but some of the more recently arrived authorities leaned or inclined more or less cautiously toward the volcanic, as contrasted to the pure organic, theory.

Mining geology was not represented in the convention as strongly as usual. An address by Horace V. Winchell on Pachuca and El Oro, in Mexico, was especially notable for the skill in presenting a geologic problem to his hearers in plain and even picturesque language, so that all comprehended and were interested. We understand that the Society of Economic Geologists will meet with the Institute at Wilkes-Barre, in Pennsylvania, next fall, so that more emphasis on this phase of mining may be expected.

The prestige of Herbert Hoover, of course, was felt in the whole organization; and in spite of the very widespread criticism that was abroad as to the Institute having over-extended itself financially and as a publisher, the impression of progress was strong. Doubtless there has been some over-extension, but that is an ordinary incident attached to any strong move: and it is likely that the Institute has seen this detail and made plans to remedy it. In the last two presidents (to speak only of most recent history), Horace Winchell and Herbert Hoover, the Institute has had two forceful and progressive executives, who have helped especially in the great movement of awakening the citizenship-consciousness in the mining engineer and making it effective.

The social side of the meeting was highly developed: nothing was left undone. There is a feeling that this has also been over-extended; and that so much good food in the way of entertainment should not be provided. At the next smoker, for example, the popular desire is to get back to the old habit of circulating around, meeting, and talking. Also, the ladies were more conspicuous than ever before; possibly in this the good movement has been over-extended. Many were so inclined to think; but as long as the technical sessions are not taken in charge by the Women's Auxiliary (and we believe that is the only thing left) we are not in hearty sympathy with the male grouch. We forgot the smoker—where fumigation was appropriate. The solitary male was quite safe there.

As Hoover pointed out in his address at the banquet, the Institute can confidently look forward to a prosperous year. Its newly elected president, Edwin Ludlow, is a man of poise, force, charm, experience, and friends. The membership is greater than ever before, and the income larger. The internal and external organization has been advanced during the year, and will be further advanced under the presidency of Ludlow during the coming year. The citizenship activities of the engineer have been co-ordinated with those of other engineers in the Federated American Engineering Societies, and with Hoover as president of this society the representation of the engineer of mining among other engineers will not be overlooked. A spirit of coordination and co-operation with other organizations, whether in the engineering or in the mining field, prevails more strongly and smoothly than ever before.

Boosting Co-operation

ON THE FRONT COVER of this issue we have reproduced a photograph to which some exception may be taken on the ground that the subject is perhaps a little far-fetched in its relation to mining. We think not, however, and take this occasion to call attention to the fact that there is a real, live association between the work of actual mining and the elements of play, which everyone must obtain in fair measure in order to perform his daily task successfully. The filling in of leisure time with clean amusement, open-air contests wherein a healthy rivalry is introduced, or some other form of attraction which offers a respite from routine occupation, is highly desirable in all industries, many of which have amusements that are characteristic of their particular field.

In northern Michigan and Minnesota, in the iron-mining districts, a great deal of interest is shown each winter in skiing, the season being considerably discounted unless at least one tournament is held in which the contestants can demonstrate their [illegible] in this exciting snow sport. The occasion is made one of general celebration, and the meets are always well attended. Formerly the ski slides consisted merely of steep snow-covered hills, which were taken as nature provided them, but during recent years an innovation in the form of a steel structure, used to heighten the [illegible] of the course, has been introduced. It may be noted that the finances for these affairs are contributed largely by the mining companies.

The encouragement of such activities by company officials may be characterized as "welfare work," but we resent the term, on the ground that the idea is more participative than paternalistic. It is the former spirit that secures complete co-operation between the men and their employer, and the realization by the miners that an interest similar to that shown in their work is being displayed in their recreation produces a fine spirit of loyalty.

This—This Is Hospitality—

"DON'T SHOOT the pianist. He is probably doing his best." This notice, supposed to have been common in the Western saloon at an earlier date, when both the saloon and the West were still distinctive, embodied the spirit of the time and bespoke the charitableness of the miner. Accordingly, only a feeling of warm gratitude can be possible when the member or guest of the Institute considers the entertainment which has been so plenteously provided for him at the stated meetings of the American Institute of Mining and Metallurgical Engineers. The kindly thought, the lavish personal service contributed, the resourceful initiative, can only intensify our love for the genus mining engineer as an all-round man and comrade, and also strengthen our sense of debt to the special committees who have done their durndest to make us happy.

At the same time we have been led to some reflections as to the relation between pugilism and mining engineering. Last summer, when at Hibbing, up on the Mesabi, they provided for us several real fights between professionals; many of us were interested, amused and instructed, just as we were with the Cornish wrestling matches of Houghton. At New York, however, when we were cheered at the smoker by a sham fight, followed by movies representing some dead-and-gone prize fight—was it not Dempsey and some one else?—we did not follow closely—we began to miss anything like a real thrill.

Of course, since Miss Anne Morgan staged a prize fight for sweet charity's sake, and enthusiastically stated thereafter that she had experienced thrills she never had before thrilled, and was going to keep right on, no one can claim that this particular form of contest is not what one looks for in the most refined circles. But it is to be doubted whether mining engineers represent these refined circles. They yawned and gazed—or forgot to gaze—with vast good nature and tolerance; but they did not have the thrills. The thrill presupposes in a certain way a shock—and they were not shocked. One engineer was heard to remark resignedly that if he couldn't hear a symphony he didn't care what they put him up against in the way of an entertainment. Another one remarked that it was all right, but he would not like to bring a guest for fear that the stranger would believe that the entertainment represented the habit and taste of the mining engineering profession.

How could a guest know that the mining engineer and even the prospector is the most balanced man alive, broad in his culture and persistent in his refinement? Let us cite the hell-roaring days of the early placer diggings. We regret that we were not in California in '49 to report the facts, but we were in the Yukon placer diggings in '96, two years before the Klondike rush. Here there was the wild untrammeled life—all men—bearded husky miners of the pick, shovel, and sluice-box, who carried their dust in a moose-skin poke, and weighed out of it on the scales for a drink. We were leaving the country and had some surplus store of blankets, boots and books from which we desired to lighten our load, so we decided to leave them. We were sleeping in the cabin of two revenue officers, the only representatives of the strong arm of the law within a thousand miles; and they offered to auction off our stuff.

The day of the auction we were rather tired, having sat up all night to help the revenue officers stand off the miners from recapturing a keg of whiskey smuggled in from the Canadian side. We beg to apologize, but we were guests. The miners did not fail to attend the auction, however; and bid good gold dust for what was offered. The blankets and boots were disputed for—but the books! They were few and heavy—of the kind that are warranted not to be exhausted in a winter's study—like Darwin's "Origin of Species" and the works of one William Shakespeare. (We kept the Milton ourselves, to read on the way down the river.)

The collection of husky whiskers—even Caribou Bill, we believe—became really excited over these, and the Shakespeare was the culmination of the day. The bidding went by gulches, and when the Hog'em Gulch gang—was it not?—bid in the Shakespeare there was jubilation on their part and disgust remained with the rest of Birch Creek and Forty Mile.

"We shall have a great time this winter" one Hog'emite informed us. "We will meet at one of the cabins, and will get Skookum Aleck to read—he is a fine reader—and the rest of us lie around and smoke and see visions."

We record here a fact; we cannot tell a lie, like Jack London and Rex Beach and the rest of the bunch; so our tale is mild and will not be read, or, if read, will be discredited. But the entertainment committees, striving to find a relaxation program for the well-known kind of he-men with hairy chests which are exemplified by the mining engineer, may have this gentle tale as a contribution to the discussion.

Lightening the Copper Market

THE RECENT COUP of the copper producers in floating a $40,000,000 loan on their surplus copper stocks is one that is worth while examining from many angles. From all of these, let us say from the start, we approve of the move.

Due partly to the overcautious policy of the War Industries Board, which prevented the copper producers from curtailing their production immediately upon the announcing of the armistice; partly to the failure of the great expected buying demand in Europe to materialize, and to other causes, the abnormally great surplus stock of copper metal which accumulated soon after the end of the war has hardly shrunk, in spite of the diversified efforts of the producers to improve the situation.

Drastic cuts in price, long-term financing arrangements with foreign purchasers, the curtailment of production—all seem unable to alter the situation. The lack of gold to buy, and the unfavorable foreign exchange (which has resulted largely from lack of gold and surplus of debt in Europe), have prevented our foreign customers from being able to take even the usual pre-war portion of copper, thus crippling the export trade upon which our great copper-mining industry is built.

Industrial slowing up in this country, due to the normal and necessary deflation, has reduced buying by our own industries. Those who saw in 13c. copper a golden opportunity to lay in a long supply and had the funds to do so, have already bought: but there are many who hesitate to buy anything when it is low, or otherwise than on a rising market. The surplus stocks have become a veritable millstone around the copper producers' necks, an Old Man of the Sea not to be dumped by any known trick.

It was not only an inert burden, but an expensive one to feed. If we reckon say a billion pounds of copper at 15c. a pound, it amounts to the sum of $150,000,000 of stored up labor and capital, paying no interest. To take the place of this locked-up capital, loans must be had from the banks. But the banks in a period like the present have many uses for their money, which is indeed largely employed in financing the Government and in other matters of prime importance; besides, they are wary of loaning largely or for long terms.

By this clever stroke of issuing bonds, the producers virtually get the public to take off their hands 400,000,000 lb. of copper metal, for a period of several years, and to give them, as partial payment, 10c. a pound on it, or $40,000,000. Eventually they will sell the metal, and realize the difference between the 10c. and the market price: but in the meantime for some years it is out of the way and not on the domestic market. The market situation is thereby improved by just so much; the producers get ready money and a relief from the financial stringency; and the banks are glad to transfer their burden to the public. And the private investor, who buys the bonds, is also satisfied; for a bond paying 8 per cent or more, and secured by copper metal on a basis of 10c. a pound, is as good as gold.

To the student of organization in business this new move is also of great interest, touching the problems concerning which we have written in recent editorials. The Copper Export Association is legalized to do business only in foreign countries, as a combination of copper producers, under the Webb Act; the activity of this same group in fixing price conditions or combining in restraint of domestic trade is contrary to the Sherman Anti-Trust Act.

Now, the combined domestic financing of the Copper Export Association is designed to lift the copper stocks mainly from the domestic market, and in so far is a frank attempt to make a combined effort to frustrate the normal workings of the law of supply and demand, and to artificially raise the price of copper metal to the buyer—not perhaps to the ultimate consumer, but to the immediate buyer, at least. Indeed, the immediate effect was a slight rally in the price of the metal. Yet so carefully is the thing done that we have little question as to the legality, or that the legal advisers of the copper producers have so satisfied themselves. And we doubt whether any of our readers will find fault with the expedient which has been adopted to help over a distressing situation: certainly none of our readers who are interested in mining.

As for the ultimate consumer of copper, we have indicated in recent editorials the probability that he is being charged altogether too much, for his own good or that of the copper miners, and that it is the manufacturers of articles containing copper, and other in-between men, who are doing a business profitable and safe for themselves, but expensive to the more essential parties at either end of the chain.

The Heat Treatment of Drill Steel

MORE attention is being paid today to drill steel than formerly, though there is still much that can be done. In most cases this material is no longer looked upon as if its loss or waste were a matter of little moment. Forgotten steel in old working places was once a familiar sight, and it is hardly exaggeration to say that from start to finish steel was often apparently considered as if it were not worth the planning to save. Today in many mines the handling of steel between the face and blacksmith shop is effected with practically maximum efficiency. The underground shop is becoming more common, and machine men as well as shift bosses are coming to realize that steel and its care is one of the most important things they have to study.

Careful use of his steel will do the machine man little good, however, if the matter of heat treatment is neglected in sharpening. In the shop lies the crux of the situation. At the recent A. I. M. E. meeting in New York a representative of a steel company emphasized the importance of selecting a steel of proper quality in the first place and said that in his experience more attention was usually paid to price than to quality. The statement of another speaker, representing a well-known machinery firm, was more to the point. All is not being done by steel manufacturers that can be done, said he, but it is useless for them to attempt to do more when heat treatment is not properly practiced. It is readily seen that a careless or ignorant blacksmith in tempering can completely nullify all efforts made to purchase a steel of superior quality and at the same time defeat those of the management to reduce costs by handling the drill steel properly underground.

Heat treatment, then, is of prime importance, and though strictly a metallurgical subject in its nature it is one which all mine superintendents will do well to study as carefully as local conditions will permit. Research into the causes of the breakage of drill steel was originally undertaken by the U. S. Bureau of Mines, and since then has been taken up vigorously by the Institute committee headed by B. F. Tillson. The subject has been analyzed by Mr. Tillson and his colleagues and is being studied in a systematic manner. The symposium at the recent meeting in New York took up the discussion under certain definite heads. These were: (1) Study of the steels which give the greatest service before failure by breakage; (2) the maximum service which might be expected; (3) the mechanics of failure; (4) the methods and machine development for accelerated tests; (5) the correlation of field tests with accelerated laboratory tests; and (6) the reclamation of depreciated drill steels.

The efforts of this committee have been noteworthy. The subject is one, however, in the study of which all interested technical bodies throughout the country should participate. Van. H. Manning, now the technical director of the American Petroleum Institute, has succeeded in securing the adoption by the drill steel committee of a resolution looking in this direction. This resolution recommended that the A. I. M. E. directors appoint an advisory board on the "investigation of breakage and heat treatment of rock drill steels and other steels or alloys subjected to similar impact stresses" to correlate all co-operative agencies with the Bureau of Mines and the Bureau of Standards. Fourteen national societies and agencies are to be asked to join in this research. With such co-operative research maximum results will be secured with minimum effort.

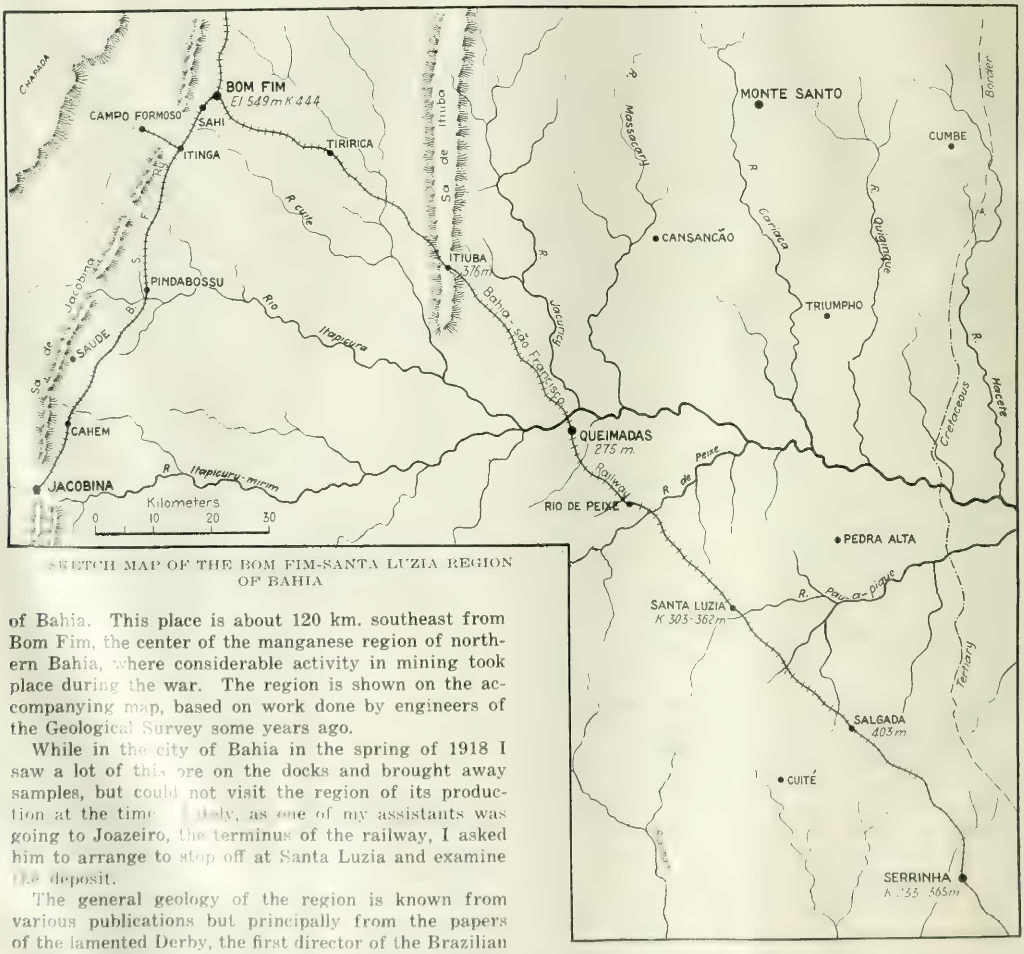
Chromite Deposits of Bahia, Brazil*

The Mineral Is Found in Gneiss in a District Rich Mineralogically and Under Favorable Climatic Conditions—Large Amounts Were Mined During the War, and Some Chromite Still Awaits Shipment

By Horace E. Williams
Geologist, Brazilian Geological Survey

Written for *Engineering and Mining Journal*

SOME years before the war, perhaps in the hunt for manganese or copper, a notable deposit of chromite was discovered near the station of Santa Luzia, on the Bahia-São Francisco Ry., 303 km. by rail and 210 km. in an air line northwest by north from the city of Bahia. This place is about 120 km. southeast from Bom Fim, the center of the manganese region of northern Bahia, where considerable activity in mining took place during the war. The region is shown on the accompanying map, based on work done by engineers of the Geological Survey some years ago.



SKETCH MAP OF THE BOM FIM-SANTA LUZIA REGION OF BAHIA

While in the city of Bahia in the spring of 1918 I saw a lot of this ore on the docks and brought away samples, but could not visit the region of its production at the time. Luckily, as one of my assistants was going to Joazeiro, the terminus of the railway, I asked him to arrange to stop off at Santa Luzia and examine the deposit.

The general geology of the region is known from various publications but principally from the papers of the lamented Derby, the first director of the Brazilian Geological Survey. Especially complete is the paper on the "Economic Geology of the Diamond Bearing Highlands of Bahia," by Dr. John C. Branner and published in the *Engineering and Mining Journal* in May, 1909. Another valuable contribution to the geology of this region is the report of Ralph H. Soper, who traveled extensively over the country for the Brazilian Reclamation Service under the direction of Dr. Arrojado Lisbôa, and which was published in 1914. The first published notice of these chromite deposits which I have seen in English is in a book by Dr. Miller and Dr. Singewald, "Mineral Deposits of South America."

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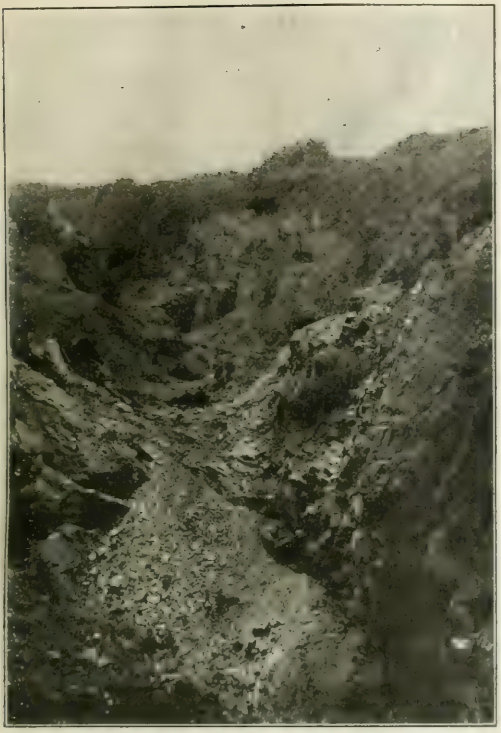
*By permission of the Director of the Brazilian Survey.



OPEN-CUT MINING OF CHROMITE, SANTA LUZIA, BAHIA, BRAZIL

Santa Luzia is situated in an undulating gneiss peneplain, out of which project, somewhat abruptly, frequent rounded knobs of the more resistent granite which forms the prominent landmarks so characteristic of this region. About 110 km. to the west, across this plain, may be seen the great quartzite ridges of the Serra de Jacobina; to the northwest, about 65 km. away, beyond the shallow valley of the Rio Itapicurú, the lower granite range of the Serra de Itiuba appears. This plain drops somewhat to the east in the valley of the Rio Páo-a-pique, beyond which, approximately 40 km. distant, the flat, low table-lands of the horizontally bedded Cretaceous and Tertiary formations close the horizon.

MANY CLIMATIC ATTRACTIONS IN THE DISTRICT

The rainfall in this region is rather light—about 600 mm., though sometimes less, most of which falls from December to March, though considerable rains occur rarely in other months. The streams are wet-weather courses, drying up after a few weeks of sunshine except in the deeper holes. On account of this light rainfall, the vegetation is not luxuriant. The country is generally covered by an atrophied scrub growth of thorny bush with frequent patches of campo. Many varieties of giant cactus thrive, as well as those of more modest proportions.

Agriculture is practiced only in a small way to supply local needs, though the region is generally very fertile and second only to Cuba for the growing of fine tobacco. The principal interest of the inhabitants is in stock raising. The climate is exceptional, a few months' residence being sufficient to effect a cure in all light cases of pulmonary troubles. One of the principal drawbacks is that at the height of the dry season water may be at a premium.

To one traveling in this region in season the many wild fruits found by the roadside are very enticing. Among these, the plum-like umbú and mangaba are most delicious when ripe; but if picked too soon the former is acid and the last named reminds one of the green persimmon. The sap of the mangaba tree is a milky substance which on coagulation with alum yields a fair quality of rubber.

Game is not abundant, what there is consisting principally of deer, ant eaters, and the omnipresent armadillo or tatú. In the mountains is found the mocó, a squirrel-like animal living among the rocks.

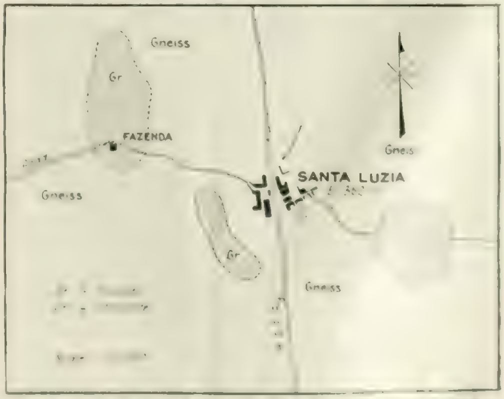
CHROMITE INTERCALATED IN GNEISS

Recently an assistant of the Geological Survey, Dr. Othon H. Leonardos, made a short stop at Santa Luzia to inspect the chromite deposit, and he furnishes the following observations, together with the sketch map and the photograph of the excavations:

"The country rock consists of a fine-grained gneiss, generally light colored and very quartzose. The varying strike of the banding is approximately with the magnetic meridian (about N. 15 deg. W.), with an apparent dip of 55 to 65 deg. W. The gneiss is cut by numerous dikes of pegmatite. A few hundred meters west from the station outcrops of a fine-grained, homogeneous, gray granite are being quarried, the material being shipped to Bahia and elsewhere for paving blocks and other uses, for which it is admirably suited because of its even fracture.

"About 2,000 m. east from the station of Santa Luzia a large deposit of chromite occurs, intercalated in the gneiss. Mining operations have been paralyzed since the close of the war, but it is said that work is to be started up again soon. As may be seen in the photo, mining operations have been by open cut, also by a small inclined gallery over a distance of about 200 m. A large amount of ore was taken out during the war and several thousand tons await shipment. The mineral is very compact, and, mixed with amphibole, occurs in large masses or lenses in the gneiss."

Several other deposits of chromite are known in this



SKETCH MAP OF SANTA LUZIA AND [illegible]ITE DEPOSITS region, some of which may be of importance. One of these is near the village of Campo Formoso, the terminus of a branch line of the railway west of Bom Fim, but of this I have no adequate description, nor have I been able thus far to secure samples of the mineral for analysis.

Under the microscope thin slides taken from chance specimens from Santa Luzia show among the abundant crystals of chromite an inconspicuous groundmass, consisting principally of enstatite, with which were recognized a few grains of perofskite, some minute crystals of rutile, some diallage, what appears to be amphibole, perhaps from the alteration of the pyroxene, a small amount reduced to calcite, and a few small nodules of olivine. In places a little serpentine was seen. Many bright fibrous patches of bastite appear on the weathered surface, reminding one of the saxonite of Shasta County, Cal.

District Contains Other Mineral Deposits

The region shown on the map is very interesting from a mineralogical point of view. Besides manganese and chromite, already mentioned, deposits of graphite and mica have been worked in a small way. A short distance farther north, in a region not shown on the map, are the extensive copper occurrences of Carahybas. The Serviço Geologico is now conducting surveys to determine the feasibility of taking water from the Rio São Francisco above Joazeiro, across the low plains country to the vicinity of these copper deposits, thus making their development possible, it is hoped, in the near future, and at the same time irrigating a wide extent of otherwise unproductive and possibly potentially valuable country.

Considerable quantities of saltpeter are being produced at present from deposits found in the numerous large caves which abound in the limestone formation of the Chapada, shown on the map a short distance northwest from Campo Formoso. This is the edge or rim of the far-famed Chapada Diamanthina of Bahia, and it is needless to say that diamonds are frequently found in the main streams which have their origin in that region.

Graphite Production in Madagascar At a Standstill

The French Ministry of the Colonies has furnished the office of the Commercial Attaché at Paris information on the present production of graphite in Madagascar, according to *Commerce Reports*. It is stated that business conditions were so unfavorable during 1920 that no new producing districts have been opened, no new company for the exploitation of graphite has been formed, and operations at a number of the old deposits have ceased. This is explained by the fact that adverse conditions have recently necessitated selling graphite at a loss. Resumption of operations at the old beds is dependent only upon more favorable conditions, and new deposits will doubtless be discovered as soon as there is an incentive to greater production.

Previous decline in business is shown by the following figures covering exportation in metric tons (metric ton = 2,204 lb.) of graphite from Madagascar: 1917, 27,838; 1918, 15,015; 1919, 4,056.

Madagascar is one of the most important graphite producing countries in the world, and produces an excellent quality of flake graphite used in crucible manufacture.

Sand-Filling in Stopes

By E. D. Gardner*

The Ray Consolidated Mining Co. at Ray, Ariz., under normal conditions mines 4,500 tons of copper ore per day from three 500-ft. shafts. The orebody is an enormous low-grade deposit of the porphyry type. It consists of a flat irregular zone, 50 to 500 ft. thick, of impregnated schist enriched by downward leaching from the upper part. In places the belt is leached from the surface to depths of 400 ft., and the minimum cover at No. 3 mine is about 100 ft. Most of the ore comes from No. 1 and No. 2 shafts and is mined by a caving system.

The part of the orebody worked in No. 3 mine is relatively high grade, very irregular, and, as it extends under the creek bed, obviously could not be mined by the caving method. Any settling of the surface would destroy the ore bins at No. 2 mine and open cracks through which the flood waters from the creek would fill the mine. About seventy-five tons per day are produced from No. 3 mine by a square-set and fill method. A section or panel two sets wide and eight sets long is carried up from one level to the next, or to the top of the ore, and then the space is filled with waste. A series of panels in a staggered line may be worked at the same time. Timbers 10 in. x 10 in. in size are used for the square sets and are doubled with round timbers where required. As a rule, sufficient waste to fill the stopes is obtained from development work in the three mines, but if for any reason the supply is short, capping drawn from a finished stope in No. 2 mine is used.

A raise connects each level of No. 3 mine and extends to the surface at the edge of the railroad track. Waste brought from No. 1 and No. 2 mines in railroad cars is dumped into this raise, and then trammed by hand in one-ton cars along the levels to the top of the panel ready to be filled.

The ore and capping are friable and cave readily. To keep the capping from cracking the filling must completely fill the openings. Undue settling of the filling is prevented by flushing sand in at the top of the stope to fill the interstices in the waste. This is done as soon as a panel is finished. Also, sand may be run in while the panel is being filled. The worked-out stopes are carefully watched, and if the filling settles more sand is used at the top to keep the openings tightly packed.

The sand used, which has about the fineness of ordinary building sand, is tailing from the company's concentrator at Hayden, and is brought to the mine in ore cars on the return trip. The dry sand is dumped from the ore cars into a separate raise and trammed by hand in one-ton mine cars to the top of the stopes. After being emptied from the mine cars the sand is flushed into the stopes by means of a hose. Water for this purpose is piped from the pump column in the shaft; the small amount used readily drains through the filling to the level below, and finds its way back to the sump for the mine pump. The water is clear after leaving the stopes. No bulkheads are used at the bottom of the stopes, as not enough water is used at any one time to create a hazard if held back. The mine is divided into sections by concrete bulkheads for protection against flood waters from the surface.

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*From "Reports of Investigations" Bureau of Mines, January, 1921.

Recreation in the Modern Mining Community

Picturesque Dance-Hall Days Passing—Elaborate Clubhouse of the International Nickel Co. a Model of Its Kind—All the Advantages of Expensive City Clubs at a Cost of $2 per Month

Written for *Engineering and Mining Journal*

THOSE whose only knowledge of mining camps is gained from fiction, or from an occasional night at the movies, are likely to hold perverted ideas as to the character of entertainment or the class of people which can be found in a modern and thriving mining community. The old saloon and dance-hall days are rapidly passing. Our mines, mills, and smelters are coming more and more to be operated by men who are used to decent living conditions. Comparatively young men they are to a large extent, and most of them married. Even the mucker, the filter man, or the crane-chaser may be a college graduate, though wearing dirty overalls. The placid provincial village atmosphere is also absent. Almost every one has traveled widely and is an interesting person to know. Employees of this class, and their wives, demand better conditions than were formerly provided. As a result, the visitor from the city is often surprised to find opportunities for recreation and education comparable with what he can obtain at home.

CLUBHOUSE OF THE INTERNATIONAL NICKEL CO. AT COPPER CLIFF, ONTARIO

Possibly no mining company on the continent has provided a finer recreation club for its employees than the International Nickel Co. at Copper Cliff, Ontario, Canada. The building was erected soon after the outbreak of the war, when building costs were considerably lower than at present, but even then it cost, with furnishings, about $62,000. In the basement are three bowling alleys; a 20 x 40-ft. swimming pool, with a locker room; a gymnasium, complete equipment for which has yet to be installed; a billiard and pool room with four tables; and a refreshment booth. The first floor contains a lounge room, with a high ceiling and fireplace. A pianola and Edison phonograph are provided. A sun parlor opens from this through four double doors, thus making a ballroom floor, 50 ft square, available. A kitchen, tea room, reception room, and reading room provided with the current magazines take up the remainder of the first floor. On the second floor are the servants' quarters and two or three bedrooms for company guests.

A few remarks as to how the club is managed, and concerning its activities, may be of interest and a guidance to those conducting similar organizations. The directors, six in number, who have sole control, are appointed by the International Nickel Co. One member of the board is chairman of the house committee and another of the entertainment committee, these committees being selected from the membership and carrying on the active work of the club. The club members have no voting power.

Employees of the International Nickel Co. are eligible to membership and non-employees to associate membership. Men must be over eighteen years of age and women over sixteen. The names of applicants are posted before election, and if considered desirable are elected by the board of directors, one vote against the candidate serving to exclude him from membership. Any member may be suspended or expelled for just cause.

The following rules as to dues and club activities have been made:

DUES

Members living within six miles of the club shall pay dues of $2 per month. No initiation fee is required.

Members living more than six miles from the club shall pay dues of $1 per month.

Women members shall pay dues of 50c. per month.

Associate members living within six miles of the club shall pay dues of $2 per month and an initiation fee of $10.

Associate members living more than six miles from the club shall pay dues of $1 per month and an initiation fee of $10.

Women associate members shall pay dues of 50c. per month and initiation fee of $5.

School teachers residing in company towns shall not be required to pay initiation fees.

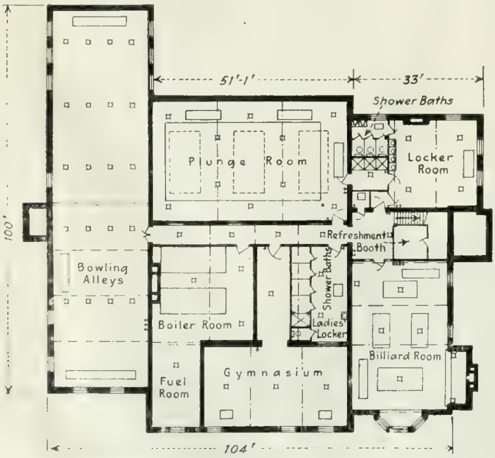
Fees for clergymen shall be $10 per year. No initiation fee is required.

Swimming Pool

Boys and girls whose brothers or fathers are members may use the swimming pool as set out by the house rules. They shall not, however, play any game in the club nor be entitled to other privileges.

Visitors

Visitors may be introduced into the clubrooms by members in good standing, or any woman holding a privilege card, who shall enter their names, place of residence, date of introduction, and their own name in the visitors' register. Members may obtain for visitors cards good for a period of fifteen days. The member introducing a visitor shall be responsible for any indebtedness of the visitor to the club during such time. The same person may not obtain another visitor's card within sixty days unless on request of a member of the board, and this visitor's name may not appear on the register more than once within this period.



BASEMENT PLAN OF THE CLUBHOUSE

Minors are not allowed to be visitors.

Payments

No money shall be paid to employees of the club for the various privileges, but members shall give coupons for the amount of their obligations.

Books of coupons may be obtained by members from the club steward by signing a slip for them, deductions for which will be made from the member's salary or wages in case he is employed by the company, or bills will be mailed otherwise.

Gambling or betting will not be permitted in the club building. No game shall be played in the club building for money, coupons [illegible] stakes.

All entertainments and meetings in the club building must be conducted by the club.

[illegible] Rules

The club will be open for members every day from 9 a.m. to 11 p.m.

Weekly dances will be held Friday evening from 9:15 p.m. to 1 a.m. To help pay for the orchestra, members who attend the dances are expected to deposit with the steward 25c. in coupons.

Dancing will be permitted on Monday evening from 8 p.m. to 11 p.m. No orchestra will be provided. Dancing will also be permitted any [illegible] except Sunday.

Members may bring women guests to the weekly dances.

The billiard room will be open to men only each day except Sunday. Wednesday afternoon and Saturday morning it will be reserved for the use of women.

A charge of 15c. per hour will be made for a pool table and 10c. per hour for a billiard table.

The bowling alleys will be open each day except Sunday for men only, except on Wednesday afternoon and Saturday morning, when they will be reserved for women.

A charge will be made for bowling as follows:

10c. per game for two men;
20c. per game for three or four men;
30c. per game for five or six men.

Pin boys will be paid by the club.

The swimming pool will be open daily for men except at the following hours: Saturday, 9 to 10 a.m.—Members' boys when accompanied by a guardian. Saturday, 10 a.m. to 12 noon—Women and members' girls when accompanied by a guardian. Wednesday, 1 p.m. to 4 p.m—Women. Monday, 7 p.m. to 11 p.m.—Members accompanied by women, and women holding cards.

Towels will be provided at a charge of 5c.

Members are requested to take a shower bath before entering the pool.

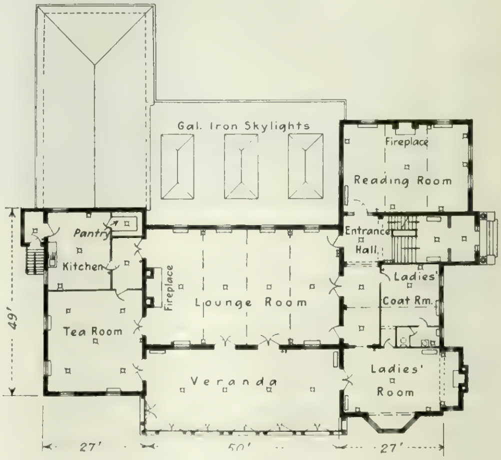
No towels, baseball or football uniforms are to be left in the lockers.

The wearing of trunks or bathing suits in the pool by men is not permitted except at such times as the pool is open for use by women and men.

Lunch will be served each afternoon or evening except Friday, on arrangement with the club steward. Soft drinks, candy, tobacco, etc., may be obtained at any time at the refreshment booth.

Lunch will be served at Friday evening dances from 10 p.m. to 12 midnight.

Charges for lunches will be as shown on menu cards.



PLAN OF THE FIRST FLOOR

At present the club boasts a membership of four hundred. Varied entertainment is provided. The weekly Friday night dances attract a large number, and three or four special dances are also customarily given during the year. Special instructors in the latest dance steps have been engaged from Toronto. Concert and lecture courses are offered and occasional smokers are given. The club rooms afford an ideal spot for the frequent afternoon tea parties given by the women. A card tournament continuing over several evenings is a regular annual feature. Over one hundred members are interested in bowling, and frequent tournaments and matches with outside teams are held. Swimming is popular, mixed bathing being allowed one night a week.

Special instructors have been engaged for this sport at various times.

The membership, it will be noted, is open to all respectable members of the community. The foreign element, however, so far has shown little tendency to apply for admission, seemingly preferring the other entertainment which the town offers. When the club was first organized it was feared that the members would tend to divide into cliques, but happily no trouble has been experienced, and the atmosphere is decidedly democratic.

In addition to this recreation club the company has erected a large building devoted to the Scotch game of curling. The rink is built on the slag dump, which affords an ideal foundation for the ice. The membership is large and enthusiastic. Five clay tennis courts are maintained by the company, members in the tennis club being assessed about $3 per year. This amount would just about pay for two or three hours' play on city courts. Before the war tournaments were held with near-by towns, such as Cobalt, North Bay, and "the Soo." An excellent baseball field and grandstand have been built and two four-club leagues flourish. College players of standing are often secured for the summer. Hockey, lawn bowling, and the "movies" attract their clientele. Even golf has been played amidst the rugged Archæan rocks.

This is only a sample of what one modern mining community can provide in the way of recreation. Many others scattered about the country are not far behind. Often the more remote the place the more elaborate the facilities for enjoying life. Oases are growing in those "abominations of desolation" which formerly characterized most mining camps.

Measuring Icy Torrents

To determine the value of a river as a source of power, or the extent to which it may be utilized for irrigation, navigation, or other purposes, it is first necessary to measure accurately the volume of its flow. For this purpose the U. S. Geological Survey maintains many stream-gaging stations, and its hydrographic engineers are continually traveling from station to station to determine the flow of the rivers when the water is at different heights.

Several methods are employed to find the exact flow of a river. The engineer can sometimes wade across the river, dropping into it his electric current meter every foot or two in water at different depths, and thus determining almost exactly its flow. As the records should be kept throughout the year, many of these measurements can be made only through holes chopped in thick ice.

The hydrographer who is measuring the flow of a stream wears high rubber boots, which may reach up to his shoulders, but though he may keep dry he is naturally likely to get rather cold. For measuring a deeper river a cable is stretched across it and a small trolley car is run across the cable to carry the hydrographer, who at fixed intervals drops his intruments into the water.

In measuring a large river, a cable a mile long may be used, the hydrographer traversing in his car the entire distance and making his sounding every few feet. The results of these observations are later computed to show the number of cubic feet per second flowing in the river measured and are afterward published in reports.

Welfare Films of U. S. Steel Corporation Shown at A. I. M. E. Meeting

THE eight or nine reels shown by the courtesy of U. S. Steel Corporation at the Welfare Session of the annual meeting of the A. I. M. E. in New York City last week were viewed by perhaps a hundred members in the course of Wednesday morning. The pictures emphasized the attention that successful industrial organizations are now devoting to the safety, health, and entertainment of their workers, and also the value of the cinematograph for the instruction and research of "Safety First" work. Aside from a few repetitions, the views shown conveyed a connected story of the worker's daily and weekly life, from the day when, newly hired, he is shown through the plant, until, as a valued employee with years of service still assured, he finds the great company also concerned for the health, safety, contentment, happiness, and education of his boys and girls.

The films showed new men actually learning the uses of the safety devices; how the men are encouraged to meet and discuss and devise additional devices or practices; and how the plant's hospital corps promptly rescues and cares for those who are injured. Here mention should be made of the "Why?" or "Visual Education" reels. These pictures from life, of dangerous combinations or practices, such as a shift of men piling through a freight train moving across their homeward path and the "injured" man who fell from one of the cars; or the careless closing of an unlocked and open safety cut-out switch, with the resultant explosion and the burned eyes inflicted on a fellow worker; the cruel "practical joke" that may lay up one's comrade for weeks—these teach impressively the need for care, thoughtfulness, "thought for the next man" at all times.

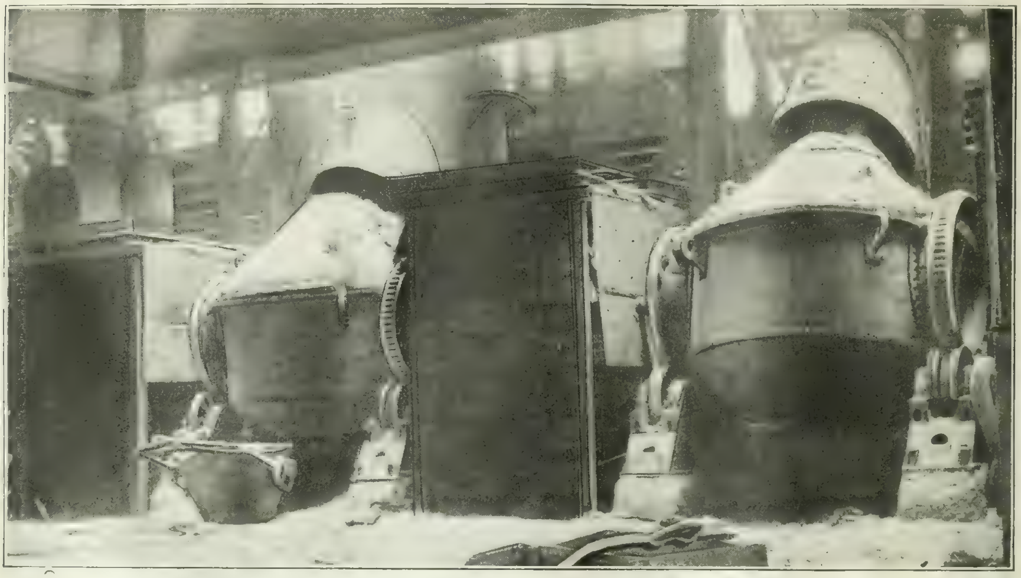
Other reels showed the locker rooms, wash-up and shower rooms, sanitary drinking fountains throughout the shops, rest rooms full of merry round-faced girls, and one of the great shop cafeterias at the rush lunch hour which are today driving out of business the solitary, grimy dinner pail, with its cold sandwich and slab of pie.

A whole series of reels carried the spectators to the neat cottages and attractive Y. M. C. A. at Gary, Ind.; to the multitude of playgrounds, swimming pools, and wading ponds, all full of merry, contented children, women, or men. The field days with their hosts of marshalled children rhythmically performing evolutions or dancing various figures recalled the great school festivals of Central Europe; but the field of negro girls and boys doing the toothbrush drill was certainly American.

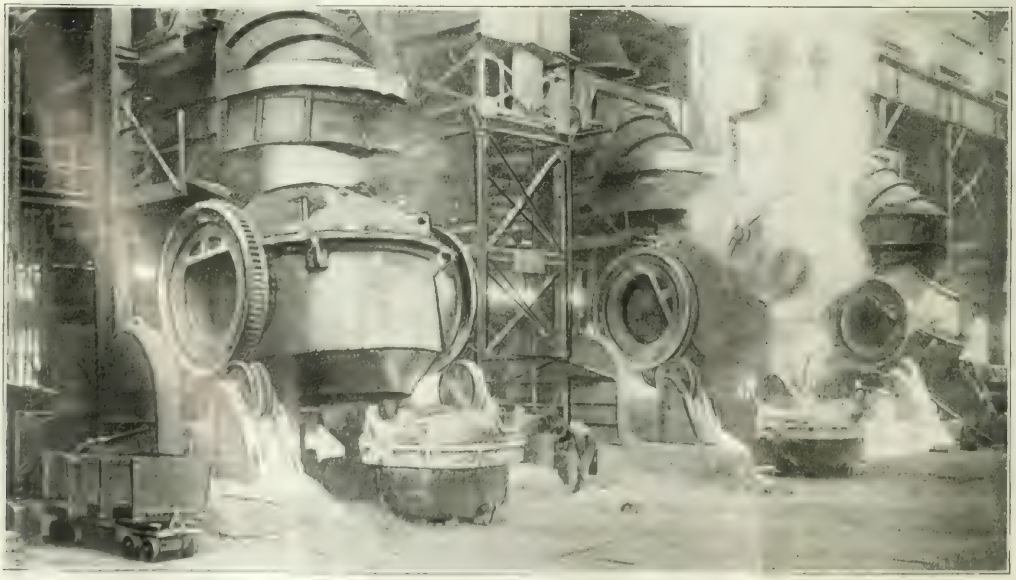
Intelligent care has been devoted to housing and recreation problems at Westfield, Ishkoda, and Mushkoda, Ala., where the right method has been adopted and a great force of negroes won to stea[illegible] surest means. Another reel showed how the strategic location of carefully fenced playgrounds and swimming pools, close to the fascinating, dange[illegible] the railway yard, has almost put an e[illegible] accidents in those localities.

If an occasional snowstorm view [illegible] dancing and running in the broad sunshine under leafing trees, only the hypercritical could [illegible] aware of the fact.

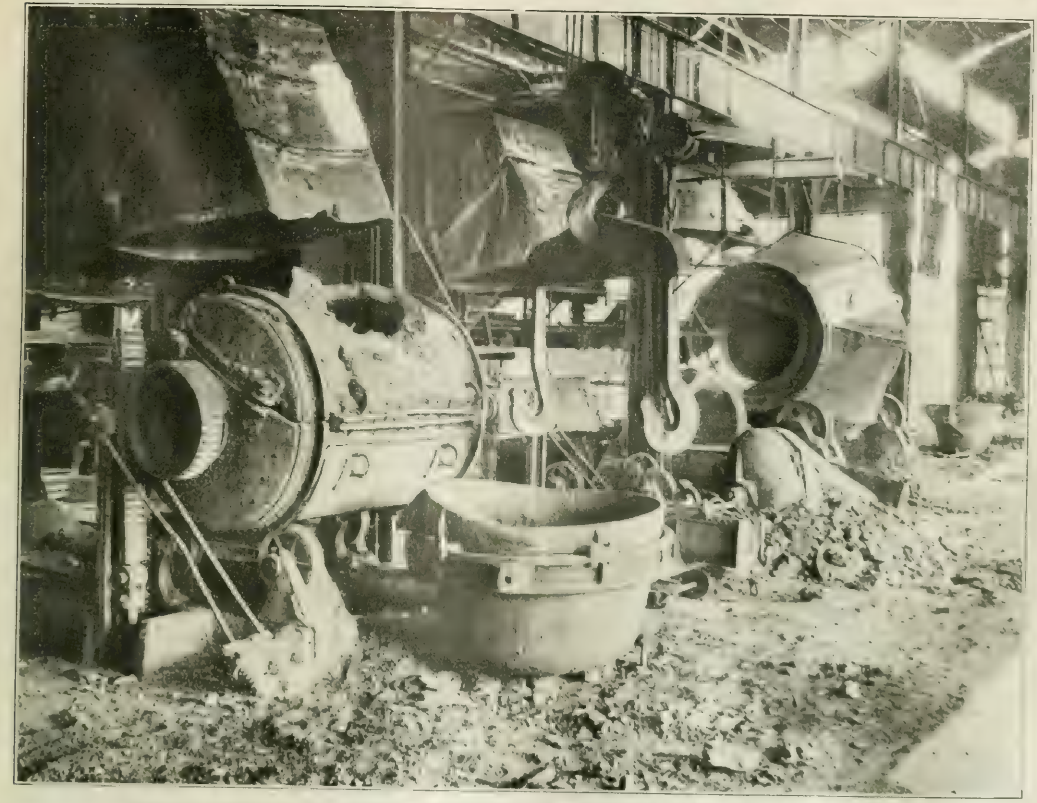
Copper Converters in the Southwest



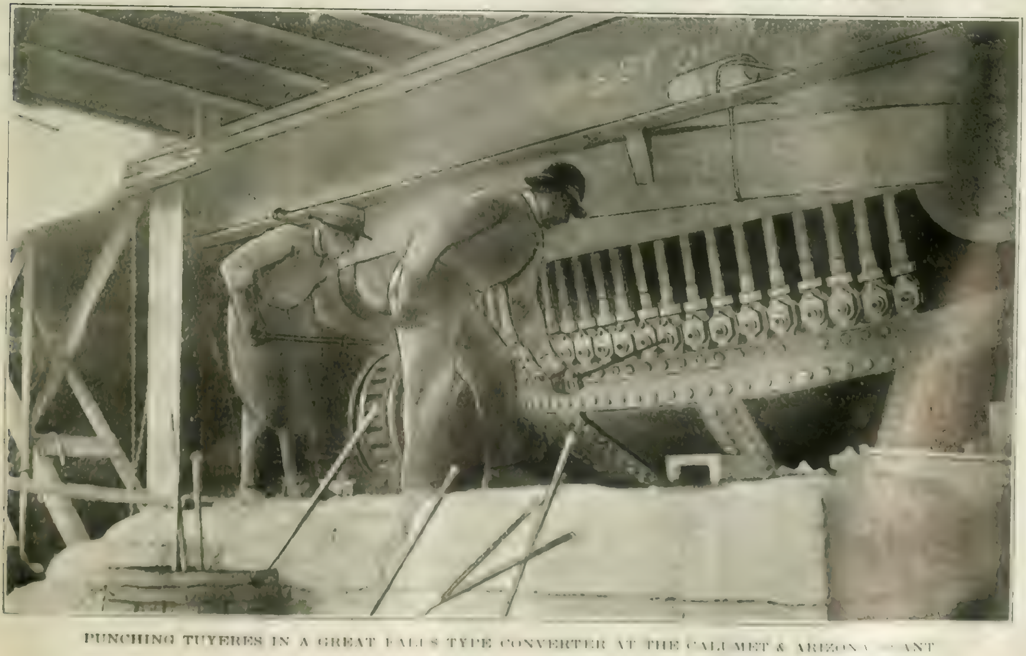
TWO OF THE FOUR GREAT FALLS TYPE CONVERTERS, 12 FT. IN DIAMETER. IN USE AT ARIZONA COPPER CO. SMELTER AT CLIFTON



CONVERTER DEPARTMENT OF THE COPPER QUEEN SMELTER AT DOUGLAS, ARIZ.



BASIC CONVERTER AND CASTING FURNACE AT THE OLD DOMINION SMELTER AT GLOBE



PUNCHING TUYERES IN A GREAT FALLS TYPE CONVERTER AT THE CALUMET & ARIZONA PLANT

The Value of Research in Mining and Metallurgy

Public Interest Held To Be Promoted If the Patent Law Were So Amended as To Permit Government Bureaus To Develop and License Valuable Inventions—Flotation And Dry Concentrating Methods Afford Wide Field of Opportunity for Investigation

BY SAMUEL H. DOLBEAR

Written for *Engineering and Mining Journal*

THE VALUE of intensive empirical research was conclusively demonstrated during the Great War. The work of the Naval Consulting Board, the National Research Council, the Bureau of Mines, and other investigative bodies was not, of course, entirely empirical in character. Nevertheless, the importance of such procedure has been determined definitely. Empirical investigations must, of course, have as their basis a scientific foundation to make them worthy of material consideration, and even then their importance is likely to be limited largely to the human element, and if the investigator does not possess the "inventive faculty," as well as scientific qualifications, the value of much of the work will be lost.

The "inventive faculty" manifests itself usually in one of two ways; sometimes the inventor or investigator may possess ability in both of its phases. The ability to discover (or recognize) new things is more characteristic of the academic type of investigator, whereas the faculty of discovering (or recognizing) new uses for things typifies the investigator of the commercial school.

There has been a good deal of discussion as to the worth of purely academic investigations—that is, research of a purely scientific character in which no commercial utility of the possible results is, at the time, apparent. It cannot be gainsaid that much information so gathered has eventually been of important commercial use, but to me it does not seem wise to encourage strictly academic work at a time when there are so many important problems to be solved and so few men engaged in their solution.

WAR STIMULATED SCIENTIFIC RESEARCH

During the years 1917 and 1918, the number of men engaged in scientific research was greater than at any other time in the world's history. Some of the results are of value for war purposes only. Some can be applied to peace-time pursuits and developments. Perhaps the most important achievement was the training of a large number of men as investigators. Unfortunately, that training was probably incomplete in many instances, because the individual investigator had to be detailed to specific features of a problem and had no opportunity to take up a given question, with its diversity in avenues of approach, to learn to discern the procedure most likely to bring results, to experience the disappointments of having to abandon "pet" theories, and to carry on months of painstaking work, only to learn that it must be discarded and new procedure adopted. The lesson thus impressed is, of course, that it is important to know what not to do. The detailing of problems in this way is often unavoidable, owing to the necessity of investigating many phases concurrently, and sometimes of maintaining secrecy.

The development of new processes applied to mining and metallurgy has been accomplished largely by individual research and experimentation, and many good ideas are developed no further than the issuance of a patent. No central agency exists for measuring the value of an invention. If the inventor is successful in marketing the patent, or the product of the invention, it may come into general use. This is a long and often discouraging task, and if the effort fails, industry may be denied an important improvement in practice. Without doubt, the Patent Office conceals a great number of ideas and improvements in all lines of industrial achievement which would be adopted in practice if they were generally known.

The U. S. Bureau of Mines could render a service of the greatest value by the organization of a special branch of the Bureau to investigate and report upon patents relating to mining and metallurgy. A patent which has expired leaves the public free to use the invention which it describes, and development and demonstration by the Government would constitute a public service, the value of which would not be limited by royalties. On the other hand, progress in the mining industry should not be permitted to lag behind seventeen years merely because an invention is the property of the patent owner, and because a part of the benefit of its use will accrue to the owner. If the public has been instrumental in the development of a patent, the public must derive the benefit of its own participation. Such a participation is a matter of contract with the patent-holder, or of law.

It would be in the public interest if the patent law were amended to permit the Government to develop and license the use of an invention, if the owner has failed to show due diligence within a limited period—say five years or eight and one-half years, which would be half of the life of the patent. Under such a plan the Government could fix and collect the royalty, a part of which to be paid the patent owner, and a part retained in a fund for further development of idle patents. The plan is equally applicable to patents relating to agriculture, chemistry, textiles, and all industries and arts generally.

INVENTION SHOULD BE ENCOURAGED

As it is desirable to increase the number of men engaged in research work, the incentive must be great enough to attract them. The picture, so often drawn, of the poor inventor starving in penury amid his wonders, and the tales of the Morses and Stevensons ridiculed as dreamers of the impossible, are enough to discourage many who possess the necessary qualifications. None of these deterrents, however, compare to the "patent pirate," who uses an invention and depends upon his ability to hire lawyers to mulct the inventor of his just dues. He is not only a dishonest citizen, but a retarder of progress, in that he discourages those who, except for him, would create. The "pirate" is responsible for the statement attributed to Thomas A.

Edison, that "a patent is merely a license to fight a lawsuit."

In one conspicuous case, now in court, the patent owners are being called upon to defend themselves against a charge of *conspiracy in restraint of trade*, even after the Supreme Court has determined that their patent is valid. The patent law specifically provides the owner of a patent with a monopoly for a period of seventeen years, during which time he, and he only, can fix the rate of royalties or other conditions under which the patent may be used by others; and the principle is the same, whether the patent be worth $10 or $10,000,000.

The field for research in mining and metallurgy is an excellent one. Any new method or apparatus which will lessen the cost of production or increase the recovery, thus rendering available ores or products which cannot now be saved, is of the utmost importance. Mining is an operation against a wasting asset, and when the richer deposits have become exhausted, either the price must increase or means must be found to decrease the cost of production.

To attempt to set down the great number of opportunities for improvements in mining and metallurgy would occupy much space. In a general way the development relates to either the means of finding, removing, or treating ore. It is not generally known that considerable work has been done on attempts to locate orebodies, not visible at the surface, by other means than mining exploration and diamond drilling. One patent recently issued claims not only to locate the position of the orebody but to give data regarding its size, by the audio-frequency of a circuit applied at various points in the vicinity of the deposit. So far as I know, no attempt has been made to measure the continuity of an orebody between two points of exposure—as between two diamond drill holes—by placing the ore exposure in circuit and comparing the resistance in the ore to that in the adjacent wall rock.

Development of cheaper explosives is desirable, for it would lead to the development of an apparatus capable of mining ore without explosives, and delivering it to the mill in pulverent condition. The use of conveyors underground is little practiced, though desirable in many operations, both on levels and in stopes where the floor is flatter than the angle of repose.

Eventually, advantage may be taken of the potential horsepower of rock descending through chutes. The use of steel and concrete in place of timber in mines is increasing, although one does not yet hear of concrete square sets. Power shovels have replaced hand shovels in many mines, and it seems probable that eventually these will be made smaller and more flexible for general use.

POTENTIALITIES OF SELENIUM IN METALLURGICAL OPERATIONS

The field of research in metallurgy is greater than in mining. If the volatilization of metals can be made commercial, as suggested by Dr. Cottrell, an almost complete revision of our smelting practice is likely to follow. The use of selenium or other light sensitive substances has not yet been applied to concentration, although it is reported to act successfully in sorting coffee beans, advantage being taken of the difference in color of various beans.

Many ores possess colors by which they can be readily distinguished from accompanying gangue matter; furthermore, crystalline materials usually reflect light; earthy substances do not. Ore sorting might also be accomplished by the selenium method, and perhaps also through the fact that many ores are better conductors of heat and electricity than the gangue.

The principles of flotation are still imperfectly understood. It has been suggested that floatation may ultimately be accomplished without reagents. Possibly a saving in power necessary to accomplish flotation could be effected by causing falling pulp to entrap a part, if not all, of the air necessary to flotation.

A large number of dry concentrating methods have been tried, but none, with the exception of the electrostatic process, has been successful for general application. Their failure is usually due to their inability to function with what might be called "dry slimes"—that portion which corresponds to the slimes of wet concentration.

The scientific accomplishments of inventors have always been a large factor in the world's progress, and the men who possess the necessary talent in this direction should be encouraged to "carry on." The accomplishment in itself may be sufficient reward to some whose philosophy in life is altruism, but most inventors are quite as much disciples of the dollar as men in other walks of life, and monetary reward is an important, if not the most important, incentive. Conspicuous instances in which the inventor has reaped handsome rewards give the necessary impulse, both to the inventor and to the required financial assistance which he is likely to seek.

Adapting the "Blimp" to Mining Operations

The Great War created a demand for airplanes and dirigibles capable of carrying a considerable weight of death-dealing bombs and other war material. With the coming of peace, the progress in aëronautics was speedily turned to account in the establishment of airplane mail routes and the construction of large passenger-carrying planes.

The industrial utility of service through the air has become increasingly apparent in the last few months. Reports are at hand of the establishment of airplane service in British Columbia and the Great Northwest country, to aid in prospecting and development, and the January number of the ***Mining and Oil Bulletin***, published by the Chamber of Mines and Oil, of Los Angeles, Cal., details the enlisting of the "Pony Blimp" to transport men, materials, and mineral products to and from regions difficult of access by the older transportation methods.

Chrome Mining in Quebec

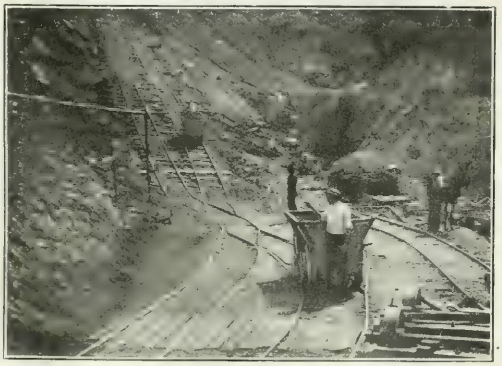
Through a condition which made necessary the condensation of many of the articles published in *Engineering and Mining Journal* of Jan. 22—the Annual Review Number—an important statement was omitted in connection with W. J. Woolsey's article on Quebec. It was stated "The present status of the chrome industry shows an improvement." This should [illegible] read "The present status of the chrome industry shows an improvement over the 1900 period in [illegible] the fact that the present producer and consumer are identical, whereas in the former period the ore was sold in the open market. The future of the industry, however, will depend on the future shipping base for foreign ores."

The Oriskany Iron Ores of Virginia

The Importance of These Replacement Deposits Has Been Much Exaggerated, Although With Decreasing Coke Prices the Desirability of Virginia Iron Ores, Which Are Low Grade and Washable, Will Increase Locally.

By Samuel E. Doak
Written for *Engineering and Mining Journal*

EFFICIENT INDUSTRIAL UTILIZATION of the Oriskany iron-ore deposits of Virginia has been retarded for many years by erroneous conceptions respecting their size and quality. Thirty years ago, they were assumed to be stratified beds, extending for long distances with fairly uniform cross section. Now they are definitely known to be replacement deposits, occurring in minable quantity only where several favoring circumstances are in conjunction.



BOTTOM OF INCLINE AND MOUTH OF TUNNEL AT LOWER LEVEL OF ORISKANY MINE

Despite complete and satisfactory papers, describing the origin and occurrence of these deposits, by R. J. Holden, E. C. Eckel, the late J. E. Johnston, Jr., and others, reports based upon the original assumption of their origin are still in active circulation, and it is always difficult, and frequently impossible, to persuade the owners of properties that their reserves are not comparable to those of the Lake Superior district. It is by no means unusual to receive prospectuses offering investments in these mines in which not only are the deposits described as stratified, but tonnages are claimed that far exceed the total output of the entire Oriskany district to date, notwithstanding that many of the best properties have been worked to exhaustion. Such super-optimism (to phrase it charitably) has hurt the district greatly, and has tended to obscure whatever real value it possesses.

Probable Demand for Virginia Ores

There is still sufficient Oriskany iron ore in Virginia to justify a few words concerning its occurrence, especially as it continues to be the subject of ignorant exploitation. There will probably always be a strong demand for foundry pig iron made in Virginia from local ores, and for this reason these deposits have a greater interest than their extent and richness warrant.

The ore derives its name from the Oriskany sandstone, which it usually underlies, and which it occasionally enriches sufficiently by impregnation and replacement to justify extraction. The principal deposits, however, occur as replacements (and cavity fillings) in the upper beds of the Helderberg (Silurian) limestone, to which the iron in solution has been carried by meteoric waters descending through the highly ferrugineous Romney (Devonian) shales. For the formation of rich deposits of any size it is essential that there should have been free circulation of water through the shales, with easy access for the iron-bearing solutions into pure beds of limestone. Conditions favorable to quantity deposition have evidently been lacking far oftener than not. It is frequently possible to form an estimate of the size of the deposit from the surrounding topography, which is probably essentially the same now as during the period in which the orebodies were formed.

Exploration by Drift and Pits Most Satisfactory

To convert these deposits into pig iron with the greatest economy it is necessary to know approximately what may be expected of them. From the standpoint of quantity it may be said that a deposit of 1,000,000 tons is above normal, and one of 10,000,000 tons has yet to be found. Accurate tonnage estimates are not possible until development work is far advanced. Core drilling has never been successful, for various reasons, and prospecting is best carried on by drifts and pits, with all their limitations. It is rather definitely established by experience, however, that the average depth of a large deposit is about 300 ft. on the dip, with a maximum of 700 ft., and that the average width of the ore is about 20 ft., with a maximum of 100 ft. The length of the body may usually be estimated quite closely after careful surface prospecting.

OLD CHARCOAL FURNACE IN VIRGINIA

This ore is not mixed with as much clay as the other brown ores of the South contain, and it is safe to assume that 15 cu.ft. in place will yield a ton of clean ore. If these figures are kept in mind those interested in the development or utilization of the Virginia ores will be less likely to be deceived respecting the tonnage of a deposit. It is well to remember that the greatest length along the strike is usually reached at or near the surface, and, above all, that the majority of deposits encountered are too small to be of commercial interest, excepting where they are close to either furnace or shipping point.

From the standpoint of quality, it may be said that the ore can usually be mined with sufficient care to average (after washing) 42 per cent Fe and under 22 per cent SiO_2. Two or three mines in the district have produced a higher grade of ore than this over a long period, and there are several that have never attained the grade indicated.

SEPARATION OF QUARTZ FROM ORE PRESENTS PROBLEM

The chief impurities are clay, flint, loose sand, and quartz, the latter in the form of rounded grains intimately intermingled with the ore and iron-stained. The first three can be easily removed, but no economical method of separating the ore from the fourth has yet been evolved. To obtain a fairly complete mechanical freedom for the ore, the run of mine would have to be crushed through 10 mesh. Ordinary gravity methods fail to separate the ore from the quartz in this crushed product, chiefly because the latter is rounded, whereas the ore is comparatively flat. A fair separation can be made electrostatically, but the cost is prohibitive.

The most satisfactory method devised up to the present for preparing this ore for the furnace is to screen it over a grizzly with from 2-in. to 3½-in. openings, hand break and hand pick the oversize (which will usually run from 2 to 6 per cent higher in iron than the fines), and run the undersize through log washers. The oversize is ready for the furnace without further treatment. Hand breaking of the lump is more satisfactory than power crushing, as it necessitates careful inspection and results in better picking. The ore is broken into comparatively small size at the mines, and one man with an eight-pound hammer can break and pick about one and a half tons per hour on the tipple. If wages in Virginia ever reach Northern levels the hand breaking will have to be discarded. The oversize from a 2½-in. grizzly will average about 25 per cent of the total clean ore, provided the customary mining methods of the district are followed.

FINE ORE LOST IN WASHING OPERATIONS

The undersize from the grizzly is put through log washers with fine sand screens (about 16 mesh) at the head end. The clay goes out in the log tailings and the loose sand is removed by the screens. Considerable fine ore is lost with the sand, and occasionally it is advantageous to remove the screens and save all the product from the head end of the logs. The operation is completed by hand picking, unless there is a large amount of flint in the ore, in which event it is sized and jigged. In addition to removing the flint the jigs will take care of any clay that is too coarse to be washed away in the logs.

SELECTIVE MINING OF ORISKANY ORES NOT DIFFICULT

This series of operations will raise the iron content of the ore from 1 to 4 per cent, depending upon its character, but even when chemical analysis fails to show a reasonable enrichment the fine ore must at least be put through the logs. Failure to wash it at all is felt at once in the irregular working of the furnace. Ore that cannot be brought up to the desired quality by the methods outlined must be left in the mine. This can usually be done with little trouble, as the leanest ores are generally along the hanging wall, and probably represent the hanging-wall sandstone which has been impregnated but not completely replaced by the ore. Along the foot wall there is less silica as quartz grains, and more flint and clay.

From the foregoing it will be seen that at best the Oriskany deposits are low-grade iron ores, occurring in comparatively small masses, but despite this they have for several years been the chief source of local ore for the Virginia pig-iron industry, and, as it is probable that they will continue to occupy this position for some time, they should be discussed in the light of the best and most recent information concerning them.

For the last few years the high price of coke has made it cheaper to smelt Lake ores in Virginia than the native ores, but as the price of coke decreases, a point is reached where the reverse is true, and no Virginia furnace can operate continuously and successfully over a long period unless it has its own local ore supply.

ORISKANY IRON-ORE WASHERY IN VIRGINIA

In addition to several known deposits of Oriskany ore with a considerable tonnage blocked out, and to a few promising prospects that have been temporarily stifled by over-exploitation, there are several localities that may contain untouched deposits of some size, but it is the part of wisdom to look with suspicion on any claims for tonnages running into the millions, and at the same time to realize that acceptable profits have been and still can be made on these properties, provided their limitations are thoroughly realized

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Action of Acids on Concrete

Most acids have a deleterious effect on concrete, combining with lime to form corresponding calcium salts, says *L'Industrie Chimique*. Sulphuric, hydrochloric, and nitric acids, among the inorganic, and acetic, formic, lactic, and butyric, of the organic acids, are most marked in effect, especially if the acids be [illegible]. Soda, potash, and ammonia, when pure, do not affect concrete, nor do mineral oils which are derived from the distillation of coal

The Future of Tin

Has Farther To Go To Reach Zero Than Lead, Iron, Copper, or Zinc—"Foolish-Metallurgy Reserves" Are Also Much Greater

BY MARK R. LAMB

Written for *Engineering and Mining Journal*

WITH the prices of all the metals going down, down, down, the safest mine to buy is of the metal which is furthest from the bottom and has the greatest *foolish-metallurgy reserve* (my discovery—copyrighted and patented).

Less than ten years ago, tin was about £100 per long ton. Today it is £170. A year ago it was £400 per long ton. It is much further to zero from 33c. a pound than it is from 4½c. a pound for lead, 2c. for steel, or 13c. a pound for copper.

Whereas copper, lead, steel, or zinc are dependent largely on one flourishing industry for a maintained high price, tin is not. For copper to be high the electrical industry in all countries must be active. At present it is not. For steel, railway extensions and replacements must be under way, and they are not.

For tin, the largest demand is of course for tin plate for conserving food. This demand is regular and does not fluctuate with industry. A surprising quantity of tin is used for wrapping confectionery, as containers for tooth paste, and lately for the new automatically collapsible marmit for mustard. All these demands are regular and not subject to violent changes. So tin, while coming down, comes slower. Furthermore, a much smaller proportionate lowering in the price of this metal reduces output as compared with copper. Already the production in the Federated Malay States has been greatly curtailed, with a consequent increase in the ratio which the Bolivian production bears to the whole.

The mining methods in the Straits are very primitive, and though some dredges are in operation, most of the tin concentrate is produced by the individual placer miners. This method leaves little chance for individual improvement, but *does* constitute an important *foolish-metallurgy reserve.* So soon as dredges definitely replace hand labor, further lower-grade areas can be worked at lower prices. The important producing mines of copper, lead, and iron have no such metallurgy reserves. The tin mines of Mexico have been neglected and not worked for so long that their metallurgy reserves have increased greatly. These mines have never seen a ball mill or a Dorr classifier.

The Bolivian tin mines have a valuable reserve of this kind, but as a result of the work of such men as Söhnlein, Grondijs, and Bliek, backed by capital and intelligent directors, this reserve is being converted into dividends.

The copper industry had profited so exceedingly during the war that the new generation of bankers, ignorant of rather recent history of the metal, were easily interested in the red metal as a basis of credit loans. Of course "the price could not drop below 18c.," but when it did the credits froze, and large copper operators were placed in an uncomfortable position and were unable to meet obligations. They are still in the same position. A few banks tried lead, zinc, and steel with similar results. Tin has not been such an unsatisfactory basis for credit, and recent bank requests to me for detailed reports on tin generally have been interestingly on the increase. It is a pleasant variation to be able to be optimistic regarding a metal.

It is true that the Guggenheims have an important force of men in the Straits and a larger staff in Bolivia. Their shipments of machinery and supplies to Bolivia frequently run into six figures monthly. A short but excellent road and many buildings besides metallurgical equipment will require much time and money for their completion, and the production of tin will be delayed at least for a year and probably for two years, so that the effect on the price of tin need not at this juncture be discounted.

Incidentally, these mines of the Guggenheims will constitute an excellent school for tin engineers. The family will follow its usual procedure and spare no expense in getting the best possible metallurgical results. This will require more than the usual number of engineers, on account of the altitude. The engineering turnover will be more, even, than at Braden or Cerro. It will also require more than the usual accommodations for the staff, as irascibility increases at the rate of 20 per cent per 1,000 ft. above 10,000, and the Caracoles mines reach a maximum of 18,000.

There are no apparent immediate new sources of tin and no means of increasing production except by opening new mines or by developing old ones. Bolivia has not been prospected in the sense that the word is used in the mining states, but it has been pretty well walked over by Indians who know tin and silver, and new mines are harder to find than old ones.

Several important districts have been completely neglected, such as Berenguela, Potosi, and Chorolque, but these *foolish-metallurgy reserves* will be worked in time.

Tin offers the best and safest mining investment today. Competent metallurgical advice is now available, as it was not ten years ago. A good price for the metal is more assured than for any other metal. The present price is 100 per cent above cost of production in the average ore mine in Bolivia, and, finally, the *foolish-metallurgy reserves* are higher than those of any other metal. Mining laws in Bolivia are good and litigation is far less to be feared than in Butte.

Glass Sand Used in the United States

Sand forms from 60 to 75 per cent of all glass manufactured. According to recent figures of the U. S. Geological Survey a little less than 2,000,000 tons of glass sand was used in the United States in 1919. Fortunately, the domestic supply of glass sand of all grades is abundant.

Grinding, polishing, and blast sands are used to make smooth the rough places on metal, glass, stone, and other hard substances. Blast sand is clean, tough, sized sand, composed of either round or angular grains, which is driven by compressed air through a hose for such purposes as cleaning metal castings and dressing stone. In gun shops, locomotive and car shops, and most other places where heavy metal castings are made, the sand blast is used to clean off parts of the mold that adhere to the castings. The size of sand used differs according to the character of the duty and the nature of the operation that it is to perform.

Fire or furnace sand is highly refractory silica sand for lining furnaces and ladles used to contain molten metal, and so has a place in all foundries. About 500,000 tons is used annually in the United States.

BY THE WAY

Pro Bono Metallurgico

i wisht you wuld protest agenst the growing use of whats commonly called tabbles insted of jigs in mills. i am unprejudist because i can oparate any kind of jig. compared to a good jig tabbles is just as useless in a mill as they is in other places since this what they call prohibishun comes in. the tabble makers is getting bolder all the time to. why the other day i heard one of these here wiffly men say that a good ruffian table wuld do all that a jig wuld do an do it better. its a cinch he had never went to australia or he wuld no better. then theres the plato tabble. the gink that makes that is so durned ignorant that he dont no how to spell platteau. that deester overstrom tabble is another one. the overstrom is foreign for over streme meaning the streme flows over the tabble when it shuld be going thru a jig either the hancock or harts i can opperate all kinds. they say they make that there overstrom tabble dimond shaped so it wont have no waste space. i suggest that they cramp that dimond out still flatter sos it will be a strait line and then there wont be no waist space a tall. the other day i seen what someone i suppose jokingly named a card tabble. the gy that invented that was a card alright alright. the mills today are getting so unparticular that they are putting in card tabbles and even butcher tabbles too. i suppose they get these butcher tabbles on acct. of their artistic curved lines but art has no place in a mill i say and a good reliable stanch hancock jig works more business like. i am good with the harts to. why an hell the man that makes what he calls the james tabble (named after his butler) wants to make it for i cant see because he makes jigs to but i suppose he has some fools for cusstomers. the funniest of all is what someone had the effruntery to call a universal tabble which stands up on its toothpick legs and shimmys without anything to make it shimmy but a pully wheel which someone used a broken mold for in casting so one side of it got cast sollid full of mettle. these tabbles as i have intimmated is all fakes and offers a fertile field for your metallurgical idiottorial department compared with jigs. i remain, *b. slopover.*

p.s. i resently invented a new tipe of jig which makes the hancock and harts and richards jigs tho all was good in their time obsolete. *b. s.*

Buried Treasure

Some years ago it was suspected that a murder had been committed near Racine, Mo., in the Tri-State zinc and lead field, and by order of the county attorney an entire tailing dump was moved in the expectation of uncovering a body. This search, which was fruitless, may be simulated at Picher, Okla., according to latest reports. It seems that some months ago two bootleggers, hotly pursued by officers, cached several cases of high-grade whiskey in a pile of tailings at one of the Eagle-Picher Lead Co.'s mines at Picher, with the intention of recovering it the next night. The following day, however, the tailing launder was turned and many tons of tailings piled on the cases. The owners found themselves unable to recover their cache without making more of a fuss than they deemed advisable. Accordingly the whiskey was allowed to remain and is still under the tailings, in spite of many independent searches made in the quiet of the night. No one is willing to go after it openly lest the county prohibition officers should seize it if recovered.

Regarding Apex Suits

"Been readin' lately, m'son," said Cap'n Dick, "some o' these 'ere strong h'arguments bein' passed forth an' back by tha h'experts h'as to w'en a lode is a lode, w'en a lode is nothin' moore'n a h'ordinary vein, an' w'en a lode becomes a 'ole bloody mountain, you, with 'eaven for tha 'angin' an' no foot wall this side o' 'ell's pits. Remin's me o' tha time Jim Trembath wuz h'employed h'as a witness h'on one o' they h'apex suits h'on tha Mother Lode. Jim 'ad worked in that camp for years 'pon years, an' 'ad once 'elped to sink a bit o' a shaf' 'pon a certain vein w'ich one set o' h'experts naow claimed as tha h'apex. But Jim were 'ired by tha h'other side, an' though 'e were'nt no h'expert, 'e nawed well 'nough w'ich side 'e b'longed workin' h'on. So w'en 'e wuz h'asked to describe this 'ere shaf' an' vein, 'e sez, 'She's as pretty a shaf' as h'ever a man put win'las to; straight h'away for two 'undred feet; h'eight by ten sets, with sawed laggin' set snug an' fitty.' 'Describe tha vein,' sez tha lawyer. 'Well, mister,' sez Jim, 'some men might call un a vein. But, min' you, I 'elped put daown h'every bloody foot o' they shaf', an' it h'appeared to me like h'as if we 'ad no bloody vein at h'all 'pon surface. Then she pinched smaller an' smaller h'as she went daown.' "

Isn't Nature Wonderful

A correspondent in describing prospective petroleum developments in the Pouce Coupe district, in the Peace River country, repeats the story of a resident of that region to the effect that along the rugged canyon of the river there is a natural cup in the shale formation from which there gushes, at intervals of about ten minutes, with the regularity of a heartbeat, a small quantity of petroleum. We presume that volcanic fires distill the stuff deep hidden far below, and that storage facilities have been provided by nature or soon will be supplied by the first man that can get a barrel into the district—or make one. Nothing is said of the by-products, but they are doubtless accumulating. When the Mother Lode in California was discovered there was printed a tale of a wonderful gold occurrence over a fumarole, which periodically heated up the formation, causing the casting in a tiny fault of an ingot of pure gold, which was removed for years regularly by the lucky prospector who watched the operation. The gnomes who practiced this ancient metallurgy appear to have gone North.

Giving Subscribers Their Money's Worth

We note that the London *Mining Journal* publishes a theatrical section, by following which mining engineers in the provinces may be kept advised of the latest dramatic successes along the Strand, and thus be able to order their tickets in advance when visiting the home office. Truly, this is Service Plus. The suggestion was broached that we do the same, but the rivalry as to who should become the dramatic editor threatened to disrupt the staff, so the idea had to be abandoned. Or possibly we might better serve our subscribers by running a list of local bootleggers. Lack of space, however, forbids.

HANDY KNOWLEDGE

Dodges Useful in Surveying*

By H. L. THACKWELL

THE following dodges are listed for the benefit of those who may find them useful. The writer has used all of them with one exception, that in No. 3.

1—HOW TO GET ALONG WITHOUT BACK-FLAGMAN

In the West a surveyor is frequently called upon to survey a ranch or homestead, and, upon arriving on the ground, finds that, although plenty of assistance had been promised for the work, only the client and his small boy present themselves. They would act as rodman and axeman respectively. How to get along without a back-flagman is illustrated in Fig. 1.

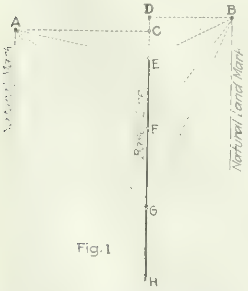

Fig. 1

The point of origin of the survey is at *E* and the survey is to be run in the direction of *EG*. Lay off the base line *EF*. Pick out two conspicuous points in the landscape, *A* and *B*, one on either side of the line to be run, and choose them with respect to their visibility and ease of bisection. Triangulate these points and compute the distances *AC* and *BD*, also *CE* and *DE*. Set up the transit on *E*, foresight on *F*, and set a point *G* on line. Then measure the distance *FG*. In the notebook keep a column or progressive distances from the point of origin *E*. Set up the transit on *G*; since there is no back-flagman recourse can be made to either of the natural monuments *A* and *B*, using that one which happens to be visible. Having the distances *AC* and *DB* and the progressive distances *CG* and *DG* the angle *AGC* and *BGD* can be readily computed.

If the landmark *A* is chosen set the angle *AGC* off on the plates, backsight to *A*, turn the plate in the correct direction so that the vernier reads zero, and the instrument is then in line. Proceed in this manner until the sighting points are invisible or the included angles become too small for accurate use, then triangulate two more points and repeat the process.

2—LAYING OFF TRUE MERIDIAN WITH SOLAR TRANSIT

To lay off a true meridian and to find the time with a solar transit the following method may be used:

Guess at the time as nearly as possible by glancing at the sun. With this inaccurate time calculate the declination and make a solar observation. Read the hour-circle and correct the original declination by the new time. Make another solar observation and read the hour-circle again. If there is any appreciable error between the first and second hour-circle readings, repeat the process until there is no further error. The resulting meridian and time will be as close as if the correct time had been used in the first observation.

3—WHEN DAY OF MONTH IS FORGOTTEN

If the day of the month has been forgotten make an equal altitude observation of the sun and establish a true meridian. Measure the angle from the meridian to the sun, also the sun's altitude. Compute the declination of the sun by the formula

$$\text{Cos. } Q = \frac{\text{sin. dec.}}{\text{cos. lat.} \times \text{cos. alt.}} - \text{tan. lat.} \times \text{tan. alt.}$$

The sign of the first term of the right hand side of the equation is minus when the declination is south; the second term is plus where the latitude is south. If the algebraic sign of the result is plus, Q is the angle between the sun and the North point, but if it is minus it is the angle between the sun and the South point. Correct the resulting declination by the hourly distance to obtain the declination at Greenwich. If the observation has been made correctly an inspection of the ephemeris will disclose a declination similar to the computed one, and the date corresponding to this declination is the date of the observation.

4—TO AVOID HIGH HILL IN LINE OF SURVEY

In the mountain districts the surveyor is often confronted by a high wooded hill in the line of the survey. In such a situation it is frequently advisable to triangulate to the top of the summit, thus avoiding delay in clearing the line. To project the line over on to the other side without occupying the summit station go around the hill and triangulate back to the station. Obtain the bearing of the line by solar observation. The original line can then be located by computing the necessary offset from the triangulated station.

5—TYING IN LARGE OBJECTS

When in a topographic survey it is necessary to tie in objects of large diameter, such as smokestacks, monuments, and similar objects, read an angle first to one edge and then to the other. The mean of the two angles will be the angle bisecting the object.

6—SIGHTING BOX FOR TUNNEL WORK

In aligning a tunnel under ground a capital sight can be made by using an old powder box, as in Fig. 2. Cut a diamond-shaped opening in the box and tack a piece of vellum or tracing cloth over the opening. Take a section of an old level rod about one foot long and nail it across the top of the box. Take a level-rod target and bore a small hole through it near the circumference and on the horizontal line. Slip the target over the rod with the hole downward, then slide it into position over the center of the diamond shaped opening. Hang a plumbline from the hole

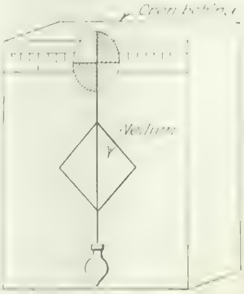

Fig. 2

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*Excerpt from *Engineering News-Record*, Dec. 16, 1920.

in the target and place a light inside the box. In the dark the plumbline will show up vividly against the light background. Clamp the target with the setscrew and move the plumbline into the exact alignment by means of the target micrometer screw. This sight can be used to advantage at night for marking a meridian obtained from a stellar observation.

7—SAVING TIME BY ELIMINATING PLANE TABLE

In making topographic surveys a great saving in time can be made by doing away with the plane table and using the following method:

The party should consist of an instrument man, a recorder, and several stadia rodmen. The transitman sets his instrument over a known point and orients it so that the horizontal angles can be taken by azimuth. The recorder, who is provided with a drawing board mounted on an easel, should be seated close to the transitman. The instrument man reads out the observed angles and stadia distances to the recorder, who immediately plots the points on his drawing board. The plotting is accomplished by the aid of a large semicircular protractor, which is held in position over the station by a needle stuck through its center into the board. The distances and elevations are computed by a stadia slide rule, and the contours are drawn in in the field before moving on to the next station.

As much as 1,200 acres per day of rolling sagebrush land has been mapped with 5-ft. contours by this method. This system has the advantage in speed over that of the plane-table, and the paper can be kept cleaner than would be possible if an alidade were rubbing over its surface. If an accurate angle is required it can be measured directly by the transit plates, whereas the plane-table method would only give approximate angles.

8—PROJECTING ACCURATE LINES

When projecting very accurate lines over rough country, such as tunnel alignment surveys, it is of great importance to have as fine fore and backsights as possible. If there are any extra transits at hand, set them up over the points and sight at the plumbline with the aligning transit. The foresight can be set very accurately by this method, even though the observer can not see the head of the tack in the stake.

9—MEASURING EXCAVATED PRISMS

In measuring up the excavated prisms in small canals much time can be saved by making a template, as in Fig. 3. The template should be constructed of light pine strips, the shape being that of the prism cross section. The center line of the frame should be provided with slots in which can be placed a standard level rod. Readings can be taken on the rod for grade, and by sliding the template down the rod the size and shape of the prism cross section can be accurately checked.

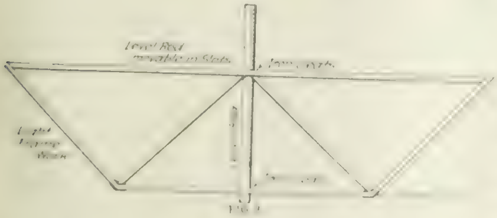

FIG. 3

10—PIPE LINE LOCATION ON HILLSIDE

In making a location survey for a pipe line along a tortuous hillside it often happens that the distance between two P.I.'s is so short that a reverse curve must be used. Make both curves of equal radii, so that the pipe will have the least curvature. The following simple formula will solve the curve, Fig. 4:

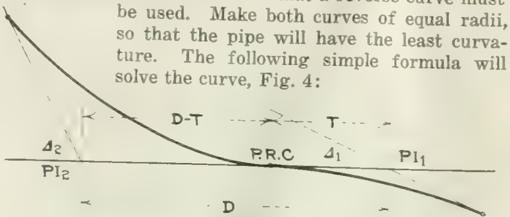

FIG. 4

$$T = \frac{D \cot \frac{1}{2}\Delta_2}{\cot \frac{1}{2}\Delta_1 + \cot \frac{1}{2}\Delta_2} \qquad R = T \cot \tfrac{1}{2}\Delta$$

In locating a flume line around a winding hillside it is economical to build the flume as close to the convex hillside as possible, and in extreme cases even cutting the hillside and building the flume on mudsills. Where the contour is concave build the flume well out so as to give the trestle its maximum height.

The average trestle height should be approximately that which will make the total cost of the line the least. Such a procedure will make the flume of such length that any change in the flume location would increase its total cost. To locate such a line measure the external distance from the P.I.'s of the trial line and by level ascertain the height of the trestle at that point. By reference to previously prepared tables of cost for various trestle heights the economic external distance can be computed.

To Lay Off Degrees With Steel Square

By JAMES I. BURR

Written for Engineering and Mining Journal

To lay off degrees with the steel square: From a table of tangents take the tangent of the angle required, using the first three figures from the left and calling them so many sixty-fourths of an inch. Tables of natural tangents are usually calculated to the radius unit, and are therefore decimal fractions. Multiply each by 1,000, thereby obtaining whole numbers. For example, let it be required to lay off an angle of 10 deg., the natural tangent of which is 0.176327. Multiplying this by 1,000 makes 176.327. Discarding the decimal we have 176, and calling the figures sixty-fourths of an inch we have $\frac{176}{64}$ or $2\frac{3}{4}$ in. The radius 1 treated in like manner makes $\frac{1000}{64}$ or $15\frac{5}{8}$ in. Now take $2\frac{3}{4}$ in. on the tongue of the square and $15\frac{5}{8}$ in. on the blade: the blade gives the angle 10 deg. and consequently the tongue gives 90 deg. less 10 deg., or 80 deg.

Material for Mine Fireproofing

The practical value of cement in mine fireproofing and in sealing off water flow and seepage is well established. Where abundant and cheap, other materials that can be rendered plastic can be utilized to good advantage. Thus, a coating of magnesite cement on mine timbers is reported to be an efficient and cheap protection against fire, particularly under climatic and operating conditions in which timbers and other woodwork become highly inflammable and are expensive to replace. There is in this new application of some of the cheaply mined minerals a promising field for experimentation.

Byproduct Expansion in Non-Metallic Mineral Industries*

By Oliver Bowles
U. S. Geological Survey

IN MANY of the non-metallic mineral industries the waste incidental to producing operations is so great that the expense of handling it is an important item in the production cost, so that the utilization of waste or byproducts is receiving unusual attention at present. The most obvious advantages of such utilization are: (1) Conservation of mineral resources; (2) the removal of waste heaps that in many places obstruct development; (3) manufacture of new and useful products; (4) reduction of production costs through elimination of a large part of the item of waste-disposal expense. In many industries there is keen competition between producers of various products used for the same purpose, so that advantage will accrue to the manufacturer who is able to reduce his production costs.

The recent development of various types of artificial roofing has adversely affected the slate industry; but if by the development of byproducts the cost of slate production could be materially reduced, this industry might be able to compete successfully with substitute products. In the slate industry, the proportion of waste is remarkably high, in some places exceeding 90 per cent of gross production. The North Wales Development Co., Ltd., of Bethesda, Wales, has developed a series of waste slate byproducts that promise to utilize profitably the great volume of waste material in that region. The waste is said to have been used satisfactorily for the manufacture of pottery and tiles, samples of which are on exhibition at the company's office. Waste slate is also pulverized and graded in powdered form from 20 to 200 mesh or finer; the finest powder is air floated and collected with a Sturtevant fan dust collector. This dust is marketed under the trade name of "Myrtox," and is used chiefly as a filler in abrasive soaps, rubber, asphalt, paint, flooring and similar applications. The most important byproduct is brick, whose production is about 10,000 per day.

During 1920, the Bureau of Mines conducted an inquiry with reference to the development of slate byproduct industries in this country. Many samples of slate flour were sent to prospective users for laboratory tests, and reports received so far indicate that it can be used to advantage as a filler in asphalt-road mixtures, molded rubber goods, and other products.

In the granite industry there is considerable waste, particularly in monumental granite areas, where the proportion of waste is almost as high as in slate quarries. As crushed granite is an excellent road material, the enlarged program of highway construction offers a promising outlet. In the St. Cloud granite district of Minnesota, a large crushing plant has been built to utilize for state highway construction the tremendous waste heaps in that locality. It is reported that in Vermont, crushed granite is mixed with lime, molded, and hardened by pressure into bricks, which are similar to sand-lime brick and are said to be excellent for structural purposes. Much of the waste in monumental granite districts could be utilized in the manufacture of building and paving blocks; many granite masses containing defects that render them unfit for monuments would be good material for structural uses or street paving.

In the mica industry, waste is utilized in the manufacture of ground mica. There is, however, the possibility of byproduct development in the mining process. Mica occurs in pegmatites, which consist chiefly of feldspar and quartz; possibly much of this feldspar could be utilized in the ceramic industries. Where the feldspar is intimately associated with the quartz, the two minerals might be pulverized together, forming a material similar to the English "Cornwall stone"; in any event a considerable percentage of quartz is permissible in commercial feldspar. The fact that certain mines in North Carolina formerly worked for feldspar are now worked for mica indicates the feasibility of operating the mines for the twofold purpose of producing mica and feldspar.

Waste marble is used to some extent for riprap, for terrazzo flooring, and for agricultural purposes. The latter use could be greatly extended. Marble waste is also pulverized and sold as marble flour. For certain purposes, this has been successfully substituted for imported whiting. In an attempt to discover profitable uses for small pieces of marble, two companies, independently, have recently experimented with a process of facing concrete blocks with small slabs of marble.

In many limestone centers, there is a great waste of screenings or other unsuitable stone that could be utilized for agricultural purposes. A large part of the price paid by the farmer for agricultural limestone is for the freight charges. A map showing the potential sources of supply of byproduct agricultural limestone and their relation to land areas in need of lime treatment would indicate the most convenient source of supply from which ground limestone could be obtained at a minimum transportation expense. A fluorspar company, in Illinois, recovers calcite from the jig tailings and pulverizes it for agricultural limestone.

In the talc industry, waste could be utilized by manufacturing a greater variety of products at individual plants, for thus material that is unsuitable for one use may be utilized for another. Though nearly all the off-color and impure talc now mined in the United States is wasted, in South Africa and Germany such materials are manufactured into special products, which have found a ready market.

These examples of possible or actual byproduct utilization in the non-metallic mineral field indicate the possibility of a much wider development of such enterprises. Undoubtedly mineral producers are awakening to the fact that, with present high costs of labor and equipment, as small a proportion as possible of the materials produced should be thrown on the dump and abandoned. Producers are beginning to realize the great need of more energetic investigation and experimentation, and the more progressive companies are ready to co-operate heartily with any reputable agency attempting a solution of their byproduct problems.

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*Extracted from the *Transactions* of the American Institute of Mining and Metallurgical Engineers.

THE PETROLEUM INDUSTRY

Petroleum and Asphalt in Venezuela*—II

BY ARTHUR H. REDFIELD

Written for *Engineering and Mining Journal*

THE PARIA DISTRICT comprises the coastal belt of the Gulf of Paria from the northern part of the Orinoco delta to the Peninsula of Paria, an area roughly seventy miles long and thirty miles wide. To this may be added the coastal belt and outlying islands from the Peninsula of Paria as far west as Barcelona, where oil seepages occur in local areas.

The oldest rocks exposed in the Paria district are the pre-Cambrian gneisses and schists which form the backbone of the Peninsula of Paria. In the metamorphosed sediments which accompany these a few Ordovician fossils have been found; but in general the oldest determinable rocks of this district are Cretaceous.

In the Paria district the Lower Cretaceous begins near Cumanacoa with a thin-bedded dark-blue limestone accompanied by a black, thin-bedded quartz-schist. Above this formation is a gray limestone, succeeded by a bluish limestone, similar to the Barbacoas limestone of the Maracaibo district. The oldest beds of this limestone alternate with a dark shale, and, more rarely, with red sandstones. Sandstones are indeed rare in the Lower Cretaceous; their place is taken largely by dark quartz-schists. The clayey rocks are not as abundant as the limestones and quartzose rocks. They lie in some places as hard, dark, schistose rocks in alternation with the limestones and quartz-schists of the Lower Cretaceous, and in places in the form of yellowish beds between the limestones on the contact between the Lower and Upper Cretaceous.

A series of yellow calc-schists follows, alternating with marl, slates, and clay shales. Upon this series rest blue-gray cavernous limestones (compact and uniformly blue in the mountains of Cumaná), identified by thin fossils as Upper Cretaceous, in alternation with white micaceous sandstones which contain no fossils. The sandstones, colored red or reddish-brown where they outcrop at the surface, increase in thickness toward the upper part of the group. Alternating with the most recent beds of the sandstones are red or brown-spotted clay or marl shales, which cleave into parallelopipedal fragments. In the neighborhood of the shales, the limestones cleave more readily.

The post-Cretaceous formations, which occupy the llanos from Araguá, Punceres, and Pilar southward to the Orinoco and eastward to the ocean, as well as in small coastal areas near Cumaná and Araya, have not been differentiated with certainty. These formations, overlying the Cretaceous unconformably, are correlated by Wall with the Newer Parian group of Trinidad, which ranges from the early Tertiary possibly into the Quaternary. A dominantly calcareous series, corresponding to the Tamana and lower series (Eocene to Miocene?) of the Newer Parian, has been recognized in the coastal areas near Cumaná and in the Peninsula of Araya. The llano region, however, of Monagas, eastern Sucre, and the Territory of Delta-Amacuro, is occupied by beds apparently equivalent to the Caroni (Miocene?) and the Moruga (Pliocene-Pleistocene?) series of the Newer Parian. These consist prevailingly of conglomerates with a ferruginous cement, coarse and fine sandstones, shales, and loose sands, with carbonaceous members.

Still less is known of the tectonics of the Paria district than of its stratigraphy. There have been observed in the Cretaceous rocks a number of minor anticlinal and synclinal folds, whose bearing is in conformity with the general strike of the series; namely, about N. 67 deg. E. In the Guanoco area the strike of the strata was assumed by Sievers as N. 75 deg. E. An anticline is known to occur at Guanoco. Nothing further, however, is reported as to the geologic structure of the area.

INDICATIONS OF OIL AND ASPHALT

Bermudez Lake—The most striking evidence of the occurrence of petroliferous formations in eastern Venezuela is the famous Bermudez asphalt lake, situated near the town of Guanoco, three miles above the confluence of the Guanoco and San Juan rivers. The lake is twenty-five miles from the Gulf of Paria and 105 miles due west of the equally renowned Pitch Lake on the island of Trinidad.

The Bermudez Lake is formed by the overflow of several oil springs on a swamp. It is about 1,110 acres in extent, and varies from 1.9 ft. in thinner parts to 20 ft. in thickness near the seeps. The lake is believed to consist of the residues of an asphalt base petroleum, the lighter oils having been distilled away. The flows are composed of alternate layers of asphalt and fine sand. Crusts of slag and burned asphalt point to fires caused by Indians or by the natural ignition of gases emanating from the lake. The lake is overgrown by jungle and covered with water. Blowholes of gas occasionally occur. Water accompanies them, frequently rather warm and highly impregnated with sulphuric acid.

The asphalt of Bermudez Lake shows upon analysis 64.39 per cent of bitumen soluble in carbon disulphide; 30 per cent of water; 2.08 per cent of inorganic matter, and 3.53 per cent of organic matter. After extracting the water the remainder gives [illegible] per cent of bitumen and 2 to 5 per cent of earthy matter, with a loss of 2 per cent. Ultimate analysis of the bitumen reveals 82.88 per cent of carbon, [illegible] per cent of hydrogen, 5.87 per cent of sulphur and [illegible] per cent of nitrogen.

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*Part I of "Petroleum and Asphalt in Venezuela" appeared in Feb. 19 issue of *Engineering and Mining Journal*. Published by permission of the Director, U. S. Geological Survey.

The Bermudez asphalt has a specific gravity of 1.06 to 1.08 at 25.6 deg. C. (78 deg. F.). Its consistency at that temperature ranges from 22 deg. to 26 deg. by the Bowen penetrometer scale. Its luster is resinous. It breaks with a conchoidal fracture, softens at 71 deg. to 77 deg. C. and fuses at from 77 deg. to 82 deg. C.

The Bermudez asphalt lake is owned and exploited by the New York & Bermudez Co., a subsidiary of the General Asphalt Co. of Philadelphia, which is also owner of the Pitch Lake of Trinidad.

In extracting the asphalt a dam of slag and waste is built to exclude water, and the water within the inclosed area pumped out. The asphalt is dug out by hand and loaded into cars. These are hauled by cable to the light railroad, which conveys it eight miles to Guanoco. A refinery with a capacity of fifty metric tons a day expels the water. The refined product is then ready to be exported. The United States takes practically all of the shipments of Bermudez asphalt, except occasional small exports to Trinidad.

The production and exportation of asphalt by the New York & Bermudez Co. is illustrated by the following table:

ASPHALT PRODUCED AND EXPORTED BY THE NEW YORK AND BERMUDEZ CO., 1910-1919

	Production, Metric Tons	Exports, Metric Tons
1910	(*a*)	32,732
1911	(*a*)	48,718
1912	(*a*)	50,050
1913	(*a*)	81,231
1914	(*a*)	57,354
1915	(*a*)	25,364
1916	47,201	44,621
1917	52,991	48,844
1918	46,453	42,850
1919	45,932	42,459

(*a*) No data.

Minor Indications—A second pitch lake occurs in the Pedernales field, at La Brea, on the northwest coast of the island of Capuré. The lake is half a mile in length and 100 to 200 yards across. It is fed by several active oil springs and one asphalt cone. About three-fourths of a mile south of the main deposit are two small cones; additional deposits occur two miles to the northeast. Asphalt deposits are also found on the island of Plata, and at Pedernales.

The Pedernales asphalt deposits were exploited by a German firm for a short time in 1902. The ruins of the German refinery are still visible one mile from Pedernales. Mud volcanoes are reported near Bermudez Lake and in the neighborhood of Maturín.

The Bermudez Co.—The New York & Bermudez Co. (operating under the name of The Bermudez Co.), after a detailed survey by ten geologists, selected, in 1910, under the terms of its concession, nineteen areas of 500 hectares (1,235.5 acres) each near the Bermudez asphalt lake; six areas on the Peninsula of Paria, and four areas on the island of Pedernales.

Development began in 1913. Wells had been drilled on all areas by June of that year. The lands on the Peninsula of Paria were soon decided to be not commercially valuable, and were abandoned. Seven wells, ranging from 200 to 1,100 ft. in depth, were drilled on Pedernales Island. Difficulties with heaving sands, soft mud, and gas pressure necessitated several changes in the method of drilling. Traces of oil were found, but none in commercial quantity. Four areas in the Pedernales field were renounced to the Venezuelan government in March, 1918; nine others were retained for exploration.

Several wells were sunk in the Guanoco area, near Bermudez Lake, ranging in depth from 200 to 4,200 ft. In some a heavy oil of 1.020 specific gravity, almost an asphalt, was found. Such an oil would have to be heated in order to be pumped. No oil of commercial value was obtained. Much geologic investigation was done to find the oil, which was believed to exist here in large quantities. The World War, with the consequent difficulties of obtaining necessary supplies, halted operations during the war period. No new wells were drilled in the Guanoco field during 1919.

All three regions exploited by the New York & Bermudez Co. lie in swamps. Portable tracks have to be laid on trestles. The field camps have been found to be unhealthful; there has been much malarial fever. The headquarters of the company in this region owe their comparative salubrity to their location upon a group of hills.

The Caribbean Petroleum Co.—The Caribbean Petroleum Co. has been drilling in the Chapapotal field, fourteen miles northwest of Maturín, in the State of Monagas, near Chaguaramal, and in the Guanipa field. A road was built in 1917 from the Maturín-Araguá highway to Chapapotal, and a camp established. The field headquarters of the company are at Guanoco. Two wells were drilled in 1918 in the Chapapotal field. The first was abandoned at a depth of 208 ft. after an accident. The second was carried to a depth of 3,231 ft. Asphalt was encountered but no fluid oil in commercial quantity. The exploration work was nearly completed at the end of 1919, with results that do not appear to indicate a commercial value for the deposits.

The Guanipa field lies along the Guanipa River, in the district of Maturín, State of Monagas. During 1917 the area was explored, a camp established, and preparations were made for the development of the field. Two wells were drilled in the Guanipa field in 1918. The first had to be abandoned at a depth of 950 ft., because of an accident to the drill. The second well was drilled without obtaining oil.

BIBLIOGRAPHY

Anon., "The Asphalt Deposits of Venezuela." *Eng. and Min. Journ.*, Vol. 71, p. 303, 1901.

Brett, Homer A., U. S. Consul, Maracaibo, Venezuela. Supp. to *Commerce Reports* (Annual Series), March 20, 1920.

British Controlled Oil Fields, Ltd., Annual Reports.

Bulletin of the Pan-American Union, Vol. 30, p. 502, March, 1910; Vol. 31, p. 777, November, 1910; Vol. 31, p. 1,075, December, 1910; Vol. 33, p. 845, October, 1911; Vol. 34, p. 576, April, 1912; Vol. 34, p. 714, May, 1912; Vol. 37, p. 468, September, 1913; Vol. 38, p. 468, May, 1914; Vol. 39, p. 172, July, 1914; Vol. 41, p. 140, July, 1915; Vol. 41, p. 756, November, 1915; Vol. 43, p. 676, November, 1916; Vol. 46, p. 148, January, 1918; Vol. 47, pp. 583, 624, October, 1918; Vol. 48, p. 336, September, 1919; Vol. 48, pp. 554-561, November, 1919; Vol. 51, p. 425, October, 1920.

Clapp, Fred G., "South America a Big Field for Petroleum Development." Reprint from *New York Commercial.*

—— "Review of Present Knowledge Regarding the Petroleum Resources of South America." Bulletin Am. Inst. Min. Eng., Vol. 130, p. 1,764, October, 1917.

Commerce Reports, Vol. 3, p. 1,235, 1915; Vol. 1, p. 1,239, 1916; Vol. 1, p. 946, 1917; Vol. 3, p. 1,054, 1917; Vol. 4, p. 57, 1917; Vol. 1, p. 162, 1918; Vol. 2, p. 622, 1918; Vol. 2, p, 927, 1918; Vol. 3, p. 740, Aug. 11, 1920.

Cortese, E., "Escursione geologiche al Venezuela." Boll. della Società geol. Italiana, Vol. 20, pp. 447-469, 1901. Abst. Trans. Inst. Min. Eng., Vol. 25, pp. 783, 784. London, 1904.

Henry, Philip W., "Discussion of Ordonez' Paper on 'Oil Fields of Mexico.'" Trans. Am. Inst. Min. Eng., Vol. 50, p. 865, 1914.

Jiménez, Germán, "Apuntes sobre la requeza mineralógica de Venezuela." Proc. 2d Pan-American Sci. Congress, Vol. 8, pp. 234-244. Washington, 1917.

Karsten, H., "Géologie de l'ancienne Colombie bolivarienne." 62 pages and geological map, 4to. Berlin, 1886.

Kite, W. C., "Oil and Asphalt Output of Venezuelan Territory." *Oil and Gas Jour.*, Vol. 18, p. 87, April 23, 1920.

McGoodwin, Preston, U. S. Minister, Caracas, "Venezuela's Petroleum Industry." *Commerce Reports*, Vol. 4, No. 236, pp. 90-93, 1916.

Miller, B. L., and Singewald, J. T., "The Mineral Deposits of South America." Pp. 526-549. New York, 1919.

Miller, J. S., "The Lake Asphalt Industry." *Chem. & Met. Eng.*, Vol. 22, pp. 749-754, April 21, 1920.

Millward, R. H., "Petroleum in the Americas." Bulletin Pan-American Union, Vol. 31, p. 777, November, 1910.

"Mineral Resources of the United States," Pt. 2, p. 393, 1909; p. 436, 1910; p. 472, 1912; p. 1,098, 1913; p. 1,075, 1914; p. 735, 1915; pp. 864-866, 1916; pp. 879, 880, 1917; pp. 1,156, 1,157, 1918.

Ministerio de Fomento, Dirección de Minas: "Datos sobre la industrio petrolera de Venezuela." Boletín, Vol. 1, No. 1, pp. 1-14, October, 1920.

Ministerio de Fomento, Caracas: "Memorias presentadas al Congreso de los Estados Unidos de Venezuela en 1918, 1919, y 1920." Caracas, 1918-1920.

Reid, W. A., "Glances at Petroleum Development in South America." Bulletin Pan-American Union, Vol. 46, p. 49, January, 1918.

Richardson, Clifford, "The Modern Asphalt Pavement," 629 pages, sec. ed., N. Y., 1908, pp. 178-192. A description of the Venezuelan asphalt deposits.

Sievers, W., "Die Cordillere von Merida." Geog. Abhandlungen, Vol. 3, No. 1, pp. 8-16; 16-26; 26-27, 1889.

—— "Zur physikalischen Geographie von Venezuela." Petermann's Mitteilungen, Vol. 42, pp. 125-129; 149-155; 197-201, 1896.

Wall, G. P., "On the Geology of a Part of Venezuela and Trinidad." *Quart. Jour. Geol. Soc.*, Vol. 16, pp. 460-470. London, 1860.

Wall, G. P. and Sawkins, J. G., "Report on the Geology of Trinidad." Part 1, of the West Indian Survey. Published by order of the Lords Commissioners of Her Majesty and Treasury. 211 pp. London, 1860.

British Columbia Oil Lands Not To Be Exploited by Speculators

SPECIAL CORRESPONDENCE

The Dominion government has given notice of the declaration of a reserve on lands in the neighborhood of Fort Norman, Yukon Territory, that may be presumed to carry oil. This will probably have the effect of discouraging the many prospectors and opportunists who were planning to journey to the Canadian northland next summer. However, there is no doubt that there will be a considerable rush to the district, where oil was found by representatives of the Imperial Oil Co., notwithstanding the government's mandate, and arrangements already are being made by transportation companies for the accommodation of those desiring to make the trip.

Premier Oliver, of British Columbia, points with some satisfaction to the action of the federal administration as a vindication of his policy. Recently he said:

"My policy is to hold these lands (the oil-bearing lands of the Peace River District, B. C.) and their wealth for the benefit of the whole province and not to hand them over to speculative exploiters. And the crowning piece of approval of our policy is contained in this evening's papers, where you may read that the Dominion government has followed our lead and declared a reserve on the Fort Norman oil lands. Except that they waited two years while we acted, the Dominion government has done exactly as we did."

Casing Wells in the Salt Creek Field

Recommendations as to the best methods for casing wells being drilled in the Second Wall Creek sand, in the Salt Creek field of Wyoming, and for the drilling of wells in the First Wall Creek sand of the same field, were agreed upon at a meeting recently held at the office of F. B. Tough, Government Supervisor of Oil and Gas Operations, Denver, Col.

In drilling wells in the proved area of the Salt Creek field there was a chance of encountering production in the shale crevices at depths ranging from 200 to 1,200 ft., and for this reason, as well as for mechanical convenience, it was necessary to cement a conductor casing at about 80 feet below the surface, using about ten to twenty sacks of cement. In view of the shallow depth and small amount of water, if any, to be shut off by this string, it is not customary to allow more than twenty-four hours for the cement to set. Of course for such a short time the cement should be placed in as thick a mixture as possible. The casing is to be screw pipe in good serviceable condition. Commonly, this string is 10 in., but not necessarily so.

A smaller string of pipe is then carried through the First Wall Creek sand and approximately forty feet into the firm shale below, at which point it is cemented with sufficient neat cement mixture to extend well above the First Wall Creek sand. The quantity of cement required for this operation varies with respect to the size of casing, the size of hole in which it is set, whether or not caving strata has been penetrated, and other operating factors. An exact computation of the amount of cement to be used is often impossible and an estimate must suffice. This estimate should allow a good margin of safety, so as to be sure that the cement is forced well above the First Wall Creek sand. To facilitate these estimates the U. S. Bureau of Mines has prepared a table showing the number of linear feet filled by one sack of cement when set in the annular space outside various sizes of casing in various sizes of hole. For cementing 8¼-in. casing forty feet below the First Wall Creek sand, fifty sacks of cement are frequenty used.

It was generally conceded that, owing to the chances of encountering shale-oil production, a string of 80 ft. of screw pipe in good serviceable condition should be cemented, in the case of first sand wells as well as those drilled for the second sand. Considerable discussion ensued as to the best method for preventing loss of oil and gas into the shale below the 80-ft. casing point and above the First Wall Creek cap rock on which another string of pipe was to be seated. This discussion arose in view of the fact that in numerous operations the string of casings set or supposed to have been set on or near the cap rock of the first sand failed to prevent the passage of oil and gas into the overlying shale, and in some instances through it to the surface at points two or three hundred feet distant from the nearest well.

As no new wells are now being drilled to produce from the First Wall Creek, the question of properly seating the inner string for first-sand wells was left open for further consideration, and those interested were requested to communicate their views to the Government Supervisor of Oil and Gas Operations.

Book Reviews

Geology of Petroleum. By William Harvey Emmons. Cloth; 6 x 9; pp. 624, 254 maps and illustrations. McGraw-Hill Book Co., New York. Price, $6.

This comprehensive treatise on the world's petroleum is one which will be gladly welcomed by the student and the practical geologist. The thoroughness of the author is evident to any one who reads its pages; and the reader will welcome the detailed yet balanced presentation of a great array of carefully selected facts.

The first chapter is introductory to the general subject, and touches briefly on occurrence, uses, and geographic and geologic distribution. The second chapter treats of surface indications of petroleum, such as oil seeps, bituminous material, gas, mud volcanoes and dikes, and oil shales. A brief chapter expounds the subject of openings in rocks; another, the character of rocks containing such openings (reservoir rocks); following is a chapter dealing with the origin of petroleum and natural gas from organic matter, and another discussing the principles of petroleum accumulation in quantity. The structural features of oil and gas reservoirs are specifically considered.

The second part of the book is devoted to examining in appropriate detail the oil fields of the world, giving their structural and chemical peculiarities, and their geologic occurrence.

In North America, the various oil fields, from the Appalachian to the Pacific Coast, are summarized in different chapters; and the work then reviews the fields of Europe, Asia, Oceania, the Caribbean Islands, and South America, in the order named. The book is well illustrated, and full of interesting data. It will not fail of appreciation.

As a review is supposed to criticise, if need be, a question might be raised as to the arrangement of chapters, which appears a little haphazard. In the geographical section, for example, it might be thought that the Caribbean Islands, and then South America, might follow Mexico, instead of having Europe, Asia and Oceania interjected. Similarly, in the first part of the book (which might well be so designated, to separate it from the descriptive latter part) we might suggest that the present chapters could well be rearranged as follows: I, VI, VII, XIV, IV, XII, IX, III, V, X, XI, II, VIII, XIII—which would arrange the chapter heads as follows: (A) Introduction, Properties of Oil and Gas, Origin, Petroliferous Provinces, Association of Petroleum and Salt Water, Metamorphism of Petroleum; (B) Accumulation of Petroleum, Openings in Rocks, Reservoir Rocks, Structural Features of Reservoirs, Deformation of Petroliferous Strata; (C) Surface Indications of Petroleum, Maps and Logs, Gas Pressure, and Oil Recovery.

In the chapter on petroliferous provinces, the writer properly points out that the conception is analogous to that of petrographic provinces and metallogenic provinces. It is: therefore why the -graphic, -genic, and -ferous for one conception? The endings all have different meanings: and the natural thought is that a committee of three geologists, rock-, ore-, and oil-, might well make a pilgrimage to the shrine of some philologist, who might purge them of their careless handling of the Greek and Latin.

J. E. S.

Stones and Quarries. By J. Allen Howe. Cloth; 4½ x 7; pp. 137; 36 illus. Isaac Pitman & Sons, New York. Price, $1.

This recent addition to Pitman's "Common Commodities and Industries" series includes in its introductory part a brief history of stone working, a description of the common rock-forming minerals, and the classification of rocks. Chapters are devoted to the origin, occurrence, and varieties of limestone, sandstone, slate, marble, granite, and other igneous rocks. The final chapters deal with the application of stone to various uses, and the method and equipment employed in quarrying and preparing stone for market. When so small a book is devoted to so broad a subject, it must of necessity constitute an outline only, but the author has covered the field as fully as seems possible in the space at his disposal. As a subject having many ramifications is treated with brevity, it is regrettable that a more complete bibliography was not added, thus directing the reader to sources of more detailed information. The book is of English publication.

O. B.

Technical Papers

Western Australia—The annual report of the Department of Mines of Western Australia for 1919 is now available on application to the Department at Perth.

Geological Survey — The annual report of the director of the U. S. Geological Survey for the year ended June 30, 1920, is now available, and may be had on application to the Survey at Washington.

Idaho — The Twenty-second Annual Report on the Mining Industry of Idaho for the year 1920 has been issued. It is a pamphlet of twenty-four pages and may be obtained on request to Robert N. Bell, State Mine Inspector, Boise, Idaho.

South African Limestone—Geological Survey Memoir No. 11 is entitled "The Limestone Resources of the Union." Vol. II is at hand, describing the limestones of Natal, Cape, and Orange Free State provinces. Price, 5s. from the Geological Survey, Pretoria, South Africa.

Stenches as Mine Warnings—The U. S. Bureau of Mines has issued Technical Paper 267, supplementing No. 244, giving further information on the properties of chemicals used as stenches. It may be obtained for 5c. on application to the Superintendent of Documents, Washington, D. C.

Cyaniding—U. S. Bureau of Mines *Reports of Investigations* No. 2,205 (obtainable on request to the Bureau at Washington) gives the results of the cyanide treatment of amalgamation tailings. The cost of erection and operation of a small plant is detailed and a flow sheet is presented for the solution of the given problem.

Mine Safety Orders—A bulletin of mine safety orders, effective Jan. 1, 1921, in the mines of California, has been issued by the Industrial Accident Commission of California. The safety orders were revised at a public hearing on Aug. 17, 1920. They are worthy of study by mining engineers. The booklet can be obtained from the commission at 525 Market St., San Francisco, Cal.

Manganese Ores—Part I of U. S. Geological Survey Bulletin No. 710 (248 pages, free from the Survey, Washington, D. C.) "Contributions to Economic Geology," is principally devoted to deposits of manganese ores in New Mexico, Costa Rica, Panama, Arizona, California and Nevada. Thirty-six pages are given to zinc-lead and antimony ores in the Pine Creek district of Idaho.

Cementation in Mining—In the *Proceedings* of the South Wales Institute of Engineers issued Jan. 21, 1921 (price 10s. from the Institute, Park Place, Cardiff, Wales) fifty-six pages are devoted to a paper by H. F. Ball, entitled "The Application of Cementation to Mining." The paper is well illustrated and describes in a complete manner the use of cement as a means of sealing off water in mining operations in fissured ground.

Properties of Crude Oils—The U. S. Bureau of Mines in its *Reports of Investigations*, Serial No. 2,202, gives data showing the properties of typical crude petroleum samples from New York, Pennsylvania, West Virginia, Kentucky, Ohio, Indiana, and Illinois. For purposes of comparison, figures for a few samples from several other states are included. The report covers forty-seven mimeographed pages and may be obtained upon request.

Iron and Steel—The U. S. Geological Survey has issued Bulletin No. 703, "The Iron and Associated Industries of Lorraine, the Sarre District, Luxemburg and Belgium," by Alfred H. Brooks and Morris F. LaCroix. The publication makes a complete survey of pre-war conditions in the iron and steel industry in France, Germany, and Belgium. A preliminary summary of the subjects, prepared by Mr. Brooks, appeared in *Engineering and Mining Journal* of May 8, 1920

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Industry's Need for Research Is Expounded Before Engineers Of National Council

Benefits to the Makers of Explosives, Nickel, Copper, and Steel, Emphasized at Meeting in New York City.

Some benefits to industry resulting from research scientifically conducted were interestingly stated by Dr. Charles L. Reese, chemical director, E. I. du Pont de Nemours & Co., and Mr. A. J. Wadhams, general superintendent, International Nickel Co., in addresses before the division of engineering of the National Research Council, on Friday, Feb. 4, at the Engineers' Club, New York City.

Dr. Reese emphasized the value to industries of organized research in particular. Some research projects are not immediately productive of financially profitable returns, others yield great savings or large profits immediately. If research be properly organized, or conducted on a co-operative basis by one great industry or a group of industries, a winning average, from the accountant's method of keeping score, is much more likely to be made. But organization and co-operation must be so conducted that the individual research worker feels no restraint.

Mr. Wadhams told of the hurdles research had to take successfully to become established in old industrial plants. Three groups particularly required "converting," the directors, the shop superintendents, and the foremen. Success depends largely upon the human qualities of the research personnel and their ability sincerely to recognize the value of the knowledge gained by the practical man in his experience, as well as laboratory knowledge.

The fruits of research gathered by the two corporations represented by the speakers are indisputably shown in the prosperity and the great contributions both companies were able to make to the winning of the war. Their aid began with the Allies long before America participated. The du Pont company furnished inconceivably large quantities of explosives to the Allies and to the United States, and despite mounting wages and rising cost of living was able actually to reduce the prices of "powder." The International Nickel company supplied practically all the nickel used by the Allies and our army.

Research in the du Pont laboratories made the manufacture of explosives safe and further reduced the chances of loss of life or personal injury by substituting machines for hand labor in hazardous operations. It cut the time required for making "powder" from months to days. It led to the production in huge quantities of sulphuric acid and of materials used in the dye industry but also essential in the manufacture of explosives. Research made possible the elimination of the great lead-lined tanks and pipes formerly believed to be necessary in acid plants; It substituted the cheap and quickly available iron and steel, saving the labor of thousands of lead burners, a very special type of skilled labor.

The story of nickel was no less interesting. Within the memory of middle-aged men, the standing of nickel among metals was hardly above that of a nuisance to the producer of copper, especially from certain ores. Its chief use was for the humbler coins of the world. Only after years of research and many disappointments were discovered economical and successful methods for separating nickel from copper, and then no one knew quite what to do with all the nickel.

In the early 80's it was discovered that steel alloyed with nickel was useful in refrigerating apparatus. About that time a cholera epidemic occurred in our Southern States, and it was believed at that time that the cholera germ could not survive at low temperatures. Congress passed a bill providing for the construction of a nickel-steel ship in which a refrigerating apparatus could be installed so that the cholera victims could be kept aboard this ship under low temperatures. The attempts to carry out this contract led gradually to the large use of nickel for alloying with steel for many purposes.

Galen H. Clevenger, consulting metallurgist to the U. S. Smelting & Refining Co., Boston, presided at the meeting of the division of engineering, which was attended by twenty-two members and guests. The division's work is directed toward stimulation of research in the industries, bringing about co-operation in the acquisition of new scientific knowledge, and its dissemination among the engineers and managers of our industries. The division is supported by the National Research Council and by Engineering Foundation.

United Engineering Society Elects Officers

At the annual meeting of the Board of Trustees of United Engineering Society Jan 27, the following persons were elected officers of the Society for the ensuing year: President, J. Vipond Davies; first vice-president, Calvert Townley; second vice-president, W. L. Saunders; secretary, Alfred D. Flinn; treasurer, Joseph Struthers; assistant treasurer, George H. Pegram.

San Francisco Section, A. I. M. E., Discusses Institute Finances

Suggests Five Members of Committee To Examine and Report on Present and Future Expenses

The San Francisco section of the A. I. M. E. met on Feb. 7. At the meeting the secretary read the reply from the secretary of the Institute to the following resolution passed by the San Francisco section on Jan. 11:

> The San Francisco section is not entirely in accord with the action of the finance committee of the Institute in debiting the members' accounts with a charge of $10, leaving the payment or non-payment of same to the discretion of each member, with no alternative to pay a lesser amount. The section desires to be advised regarding the necessity for this action, which appears to be establishing a dangerous precedent.
>
> With no desire to criticise the action of the committee in adopting such course, the section respectfully suggests that a committee be appointed to examine (and report on) the finances of the Institute and to submit a report with recommendations; whereby the future expenses of the Institute shall not exceed its income. The section suggests that the committee consist of seven members, three of whom shall be thoroughly conversant with editorial and publication work.

Secretary Stoughton's reply of Jan. 31, stated that at a directors' meeting held in New York City on Jan. 28, 1921, the following resolution was passed:

> Appreciating the deep concern in the welfare of the Institute which has been characteristic of the San Francisco section, and sensible of the continued support which the Institute can always expect from our Pacific Coast members, the board of directors would ask the San Francisco section to suggest the personnel of the committee which it has spoken of in its recent communication, in order that the investigation proposed may be conducted in a manner and by persons entirely acceptable to our San Francisco members.
>
> RESOLVED: That the officers of the Institute be instructed to furnish the San Francisco section full information to carry out the proposed investigation.

The members of the San Francisco section were of the opinion that the subject was of interest to the Institute membership as a whole, and on motion suggested five members for the committee, the remaining two to be selected by the board of directors of the Institute. The members named were W. R. Ingalls, E. W. Parker, C. R. Corning, R. M. Raymond, and A. S. Dwight.

At the conclusion of the business meeting C. M. Eye presented a paper on the mineral resources of the Philippines. He reviewed the history of mining and discussed gold, silver, copper, iron, salt, oil, and coal. E. H. Clausen followed with a brief discussion of the geology of the gold deposits and gold mining conditions.

The American Engineering Council has recommended to President Harding that an engineer be appointed Assistant Secretary of War.

MEN YOU SHOULD KNOW ABOUT

E. W. Shaw is investigating reported showings of oil near Summerville, S. C., for the U. S. Geological Survey.

F. L. Ransoone, of the U. S. Geological Survey, is studying the geology of Boulder Canyon, Nevada.

Dr. Louis D. Ricketts and **Col. John C. Greenway**, were in New York City during the past week.

T. H. Jenks, mining engineer, has returned to Los Angeles, Cal., from a visit to Colorado.

Edwin J. Collins, consulting mining engineer of Duluth, Minn., was in New York City early in February.

A. L. Flagg of Phoenix, Ariz., recently spent several days examining mining properties in Yavapai county, Ariz.

C. H. Fry, mining engineer of San Francisco, Cal., has returned from examining mines in Tuolumne County, Cal.

D. S. Dean spent several days recently inspecting the Gogebic Range properties of the Keweenaw Association.

W. G. Swart, vice-president and general manager of the Mesabi Iron Co., has gone east on a business trip of several weeks.

R. B. Phillips, mining engineer, has been elected assistant recording secretary of the Bisbee, Ariz., chapter of American Association of Engineers.

Walter Harvey Weed recently made an extensive examination of the properties of the United Arizona Copper Mining & Smelting Co., near Mayer, Ariz.

Cornelius F. Kelley, who has been inspecting Arizona and California properties of Anaconda Copper Mining Co., has left Butte, Mont., to return to New York City.

Mark Elliott, general superintendent of the Interstate Iron Co., has returned from Pittsburgh, Pa., where he attended to business matters relative to his company.

M. G. Gulley, of the U. S. Geological Survey, has gone to California to investigate the reported showings of petroleum in wells drilled in the Imperial valley.

J. W. Sherwin, general manager for the West End Consolidated Mining Co., with headquarters in Oakland, Cal., was in Tonopah, Nev., recently to inspect the West End mine.

Charles S. Witherell, metallurgical engineer, recently on the metallurgical staff of Guggenheim Bros., has entered private practice. His office is at 150 Nassau St., New York City.

W. T. Lee, of the U. S. Geological Survey, addressed the Pick and Hammer Club of Washington, D. C., on Jan. 22 on the application of aerial photography to the study of geology as practised by himself.

Willis Lawrence, mining engineer and general superintendent of the Mammoth mines, Mesa, Ariz., has returned there from a three weeks' examination trip into Sinaloa, Mexico.

Dr. A. O. Hayes, formerly on the staff of the Geological Survey of Canada, is giving lectures on the minerals and ore deposits of the Maritime Provinces of Canada, at Queen's University, Kingston, Ont.

C. E. Julihn, superintendent of the Lake Superior experiment station of the U. S. Bureau of Mines, was in Washington last week conferring with officials of that bureau in regard to plans for the coming fiscal year.

H. Foster Bain, the acting director of the U. S. Bureau of Mines, has been selected as chairman of the interdepartmental committee on standardization of petroleum specifications. He also represents the Interior Department on the committee. At present Mr. Bain is paying an official visit to several of the mid-West stations of the Bureau.

H. D. Pallister recently resigned as superintendent for the mines of the McKinney Steel Co., at Wolfpit, Pike Co., Ky., to become professor of mining in the School of Mines of the University of Alabama. Prof. Pallister enters on his new duties Mar. 1, next, and his address will be University, Ala.

Lawrence Wilkerson Wallace, consulting mechanical engineer, serving a third term as president of Society of Industrial Engineers and vice-chairman of F. A. E. S. Committee on Elimination of Waste, was unanimously elected secretary of Federated American Engineering Societies, at Syracuse, N. Y., on Feb. 14.

Mathew Van Sicklen has been appointed assistant chief mining engineer of the U. S. Bureau of Mines, to succeed **C. L. Colburn**, who has been made safety engineer in charge of the cooperative work between the U. S. Bureau of Mines and the National Safety Council. Mr. Van Sicklen was graduated from the Columbia School of Mines in 1906. He has had an extended mining engineering experience in this country and in South America.

E. A. Hayes, of California, who has been nominated by the President to be one of the directors of the War Finance Corporation, has been prominently identified with the mining industry in the West. His nomination, like all others being made by the outgoing administration, probably will not be confirmed by the Senate. In the case of technical appointments or men specially qualified for positions, it is anticipated that renominations will be made by the incoming President.

Mining engineers recently visiting New York City included **George C. MacKenzie**, of Montreal, Que.; **Fedor F. Foss**, of Washington, D. C.; **Edward B. Corbet**, of San Francisco, Cal.; and **M. R. Wolfard**, of Cambridge, Mass.

SOCIETY MEETINGS

The Institute of Metals meets in London, on March 9 and 10.

The Institute of Mining and Metallurgy holds its annual meeting in London, on March 17.

The Canadian Institute of Mining and Metallurgy holds its annual meeting Mar. 2 to 4, at Montreal instead of at Ottawa.

The Northwestern Mining Convention holds its twenty-sixth annual session at the Spokane Hotel, Spokane, Wash., Feb. 28 to Mar. 5.

The American Association of Petroleum Geologists holds its fifth annual meeting on March 17 to 19, at Tulsa, Okla. Prominent geologists from all parts of the United States expect to be present, and the program promises to be interesting. Wallace E. Pratt, Houston, Texas, is president, and Charles E. Decker, Norman, Okla., is secretary-treasurer.

The Engineering Section of National Safety Council will hold its mid-winter meeting at Philadelphia, Pa., on Feb. 28. The meeting is held jointly with the local Philadelphia council and with the local section of **The American Society of Mechanical Engineers.** The program includes important papers on signals and signaling, dust explosions, crane overhoist limit stops, boiler accessories and safety in operation electrical fatalities, and air-compressor lubrication.

OBITUARY

Charles T. Krusse, the Michigan representative of the Jones & Laughlin mining interests, and who had been connected with the company for thirty-four years, died Feb. 14, at his home in Ishpeming, Mich.

Georges Humbert, an inspector general of mines, and member of the Academie des Sciences, was buried at Paris, on Jan. 25. Mr. Humbert was also professor of analytical chemistry in l'Ecole Polytechnique and in le College de France.

F. Close, metallurgical engineer, who had been staying in Switzerland recently, suffering from an attack of septic pneumonia contracted during the epidemic of 1918, died there on Jan. 25, last. Mr. Close was known in connection with the early stages of flotation processes in the United States. He went there about 1910, representing Elmore Bros., in the interest of their vacuum flotation process, but later returned to England and was for some time associated with those developing the Murex process.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

Butte Operators Confer With Union Representatives

Con Kelley, Spokesman, Tells Delegates Oppressive Working Rates Must Come Down

At a series of conferences in Butte last week between mine operators and representatives of the unions, Con F. Kelley, president of the Anaconda Copper Mining Co., acting as spokesman for the operators, announced that the companies were disinclined at this time to continue to enter into long term contracts with the unions, thus departing from the custom which has prevailed for years with organized labor. In no uncertain language, Mr. Kelley informed the delegates that unless oppressive working rates which resulted in inefficiency and high costs were changed, the Anaconda company would break with the unions and break for good. The unions also were assailed for their financial support of an alleged Soviet newspaper whose avowed object was destruction of the Anaconda company and the American Federation of Labor. The attitude of the companies suggests that the Butte district is near the threshold of the "open shop."

Of the proceeds of the copper sold during the last four months of the past year at from 13c. to 14c., stated Mr. Kelley, labor received 10c. with 2½c. paid to railroads and refineries. Anaconda had had to secure funds with which to purchase mine supplies, he continued, and copper costs had mounted to 16.7 cents.

It is said that the delegates will report back to the unions for action. The conference is regarded as the most important in Butte in years.

Colorado Industrial Commission Probes Into Wage Reduction

At the hearing of the Colorado Industrial Commission in Denver on Feb. 15 for the purpose of inquiring into the wage reduction that the mining companies of the state had announced would become effective on that date, representatives of forty-eight companies appeared. Among these the chief witnesses were George E. Collins, Bulkeley Wells and Jesse F. McDonald. Not a representative of the miners appeared to protest against the reduction, which in the case of the minimum wage was from $4.50 to $4 per day. It is presumed that the wage reduction will be allowed.

WEEKLY RÉSUMÉ

Important conferences took place at Butte last week between the operators and union representatives of the district, the latter being told that oppressive working rates must be changed unless the unions wished to break with the companies for good. At Helena, in the same state, a hearing was held on two pending mine taxation measures proposing a 1½-per cent levy on the net revenue of copper companies. Vancouver, B. C., was recently the scene of the annual meeting of the British Columbia section of the Canadian Institute of Mining & Metallurgy. Final decision is expected soon as to whether the proposed Arizona & Sonora Ry., whose route from Ajo to Rocky Point on the Sonora coast is being surveyed, will be constructed or not. At the hearing in Denver on Feb. 15 on reduction of miners' wages no representative of the miners appeared. Conditions throughout the country remain unchanged from last week. Word has come that the Dwight-Lloyd sintering plant of the Broken Hill Associated Smelters at Port Pirie, Australia, was destroyed by fire in January. In London, the market situation is reported to be worsening. In Mexico, the Torreon smelter has been blown in. The A. S. & R. plant at Monterey has shut down.

At Washington the requests for protective tariffs on all sorts of things are piling up. The American Mining Congress has put in its plea for a duty on certain minerals and mineral products. The loudest demand has come from producers of ferromanganese, though these same interests are opposed to a tariff on manganese ore. Secretary John Barton [illegible] has [illegible] against liberalizing the War Minerals Relief Act. The National Safety Council and the [illegible] of Mines have [illegible] to safety work.

Dwight-Lloyd Plant Destroyed

The Dwight-Lloyd sintering plant of the Broken Hill Associated Smelters Pty., Ltd., Port Pirie, South Australia, was totally destroyed by fire on Jan. 25, according to word just received by mail. The fire spread to the ore bins, conveyors, rock roaster section and iron stone crusher, which were all seriously damaged. An early resumption of work at Port Pirie had been hoped for but cannot now take place until the Dwight-Lloyd plant has been replaced. This will doubtless hinder a full resumption of work at Broken Hill.

State Mine Taxation Hearing Held at Helena, Mont.

Operators Oppose Measures Designed to Levy 1½ Per Cent Tax on Net Copper Revenue

A public legislative hearing on two administrative measures designed to levy a tax of 1½ per cent on the net revenue of metal was held at Helena, Mont., on Feb. 11, and brought forth the statement from representatives of the mining companies operating in the Butte district that copper was being produced at a loss of 5c. to 6c. per lb. by the companies. Statistics were furnished to show the heavy burdens the mining companies already were laboring under, and to impose additional taxation, it was stated, simply was inviting a complete shutdown of the industry in Montana. Colonel Charles Muffly, president of the Montana Mining Association, declared that at present not a silver mine in the state is paying dividends and that 95 per cent of the properties are closed because of low metal prices and high production costs.

L. O. Evans, chief of counsel for the Anaconda Copper Mining Company, said that the main trouble is that people fail to appreciate the theory of mine taxation, explaining the utter impossibility of valuing a mine because of the fact that no one can tell the value or the amount of ore underground. He stated that the Butte mines cannot keep their ore reserves open for more than a year or two in advance.

Mr. Evans declared that the Anaconda company for the years 1917, 1918 and 1919 had paid 20.15 per cent of the total general taxes of Montana, and that under the present net proceeds tax they are being taxed 100c. on the dollar. In the six years from 1912 to 1917 it has paid in wages $132,264,695 and in taxes $5,679,000, while many millions more have been spent for supplies, the total expenditures for the half dozen years totaling $251,000,[illegible]. An additional $17,279,000 for [illegible] was distributed.

"We had only one [illegible] year in the copper industry," continued Mr. Evans, "and then when we [illegible] a fair profit the Govern[illegible] the metal down fr[illegible] which later was increa[illegible] to 15 or 16c. a p[illegible]."

"The only other [illegible] which the license tax prop[illegible] measure now under consideration has ever been tried is Utah, in 1917 and 1918, but the

EIGHT CARLOADS OF MACHINERY MADE BY YUBA MANUFACTURING CO. FOR GUIANA DEVELOPMENT CO.'S 7-CU.FT. DREDGE ON ITS WAY FROM MARYSVILLE, CAL., TO STEAMER FOR SHIPMENT TO SOUTH AMERICA

revenue was only 3 per cent of the net proceeds, while under the old system the tax was $3\frac{1}{3}$ per cent of the net proceeds. The act was repealed," said Mr. Evans in conclusion.

Guiana Development Co.'s Dredge Shipped Promptly

About six months ago the Guiana Development Co., 120 Broadway, New York, ordered a 7-cu.ft. dredge from the Yuba Manufacturing Co., of California, for its operations in Dutch Guiana. The Yuba company has been successful in making prompt shipment and recently began loading the dredge parts at San Francisco into a chartered steamer that will take the machinery, together with purchased electrical equipment and hull lumber, direct to South America. The accompanying photograph shows eight carloads of the dredge machinery on its way from Marysville, Cal., to the steamer.

Last October, Perry Tiffany, president of the Liberty Company, and George A. Laird, general manager of the Guiana Development Co., sailed for South America with a party of ten engineers and operators to begin active work of installing dredging equipment on the Maroni River between French and Dutch Guiana. In the past, attempts made to install equipment in the upper waters of the Maroni have been unsuccessful, owing to the obstacles in the way of transportation. The present company, however, is equipped for all emergencies.

At the annual meeting of the Montana chapter of the American Institute of Mining and Metallurgical Engineers Fred W. Bacorn, of Butte, was elected chairman. About 100 engineers from throughout the state attended the session. L. V. Bender, of Anaconda, was chosen vice-chairman and E. B. Young, of Butte, was re-elected treasurer.

Cariboo Miners' Association Seeks Changes in Placer Mines Act

By Donald D. Fraser

The miners of Cariboo, B. C., have recently formed an association, the object of which is to promote the general welfare of the Cariboo mining district. The organization now has branches in Stanley, Barkerville, Quesnel and Harper's Camp and over 100 members. The first effort of the association has been to draw up a set of resolutions bearing on the Placer Mines Act, which has been sent to Victoria with the request that the legislation recommended be enacted during the present sitting of the House.

The most important resolution calls for the abolishment of the free miner's license as a condition of title. More than one mining proposition in the province in the past has been turned down by capital because of this, on the ground that the title was not good. At present if a lessee does not take out his free miner's license when due he loses all title to any mining ground he may hold. The tax is only $5, but the amount which is contingent on one certificate is often very large. As a remedy, the association recommends that a certificate of work be issued by the gold commissioner when he has received one rental payment plus a declaration showing that the required assessment work has been done. The certificate would then be conclusive evidence of the validity of the lease to which it pertains.

It is furthermore recommended that the rentals for leases be payable on one day, Nov. 30. Delinquent leases are recommended for tax sale instead of cancellation, giving the owner the privilege of buying them back up to the time of the sale. This measure would tend to bring more revenue into the public treasury and also gives the owner a chance to reclaim if he so desires.

Fate of Arizona & Sonora Road Still Undecided

Proposed 100-Mile Railway Would Link Ajo with Rocky Point on Sonora Coast—Survey Now Under Way

The proposed route of the Arizona & Sonora railway is being surveyed at the present time. The line runs from Ajo, Ariz., to Rocky Point, Sonora, on the Gulf of California. Whether or not the road will be built has not been decided as yet. Dr. Louis D. Ricketts and Col. John C. Greenway, prime movers in the project, are in New York on business said to bear on this matter.

Most of preliminary survey has been completed and the location work in Mexico is being finished. The line will be a little less than 100 miles long and the heaviest grade, it is reported, will be only 0.5 per cent, with only a little rock work in the hills. There are tangents over 20 miles long on the desert. Rocky Point, it is said, should make a splendid ocean terminal, with over 35 ft. of water at the shore line.

The line, if built, will be owned by Arizona copper interests, including the El Paso Southwestern Ry. Much is said to depend on the attitude of the latter. About 50 miles of the line will be in Mexico and 50 miles in the United States. The Mexican government has stipulated that a Mexican engineer shall accompany the party.

Protest Against Increasing Ontario's Taxes

The proposed legislation to increase the taxes on mining, now before the Ontario Legislature, is meeting with very strong opposition throughout Northern Ontario. A meeting of the Temiskaming Associated Boards of Trade was held at Cobalt on Feb. 16, at which resolutions were adopted protesting against any increase.

British Columbia Section of Canadian Institute Meets at Vancouver

Discussions of Metallurgical Subjects Feature Sessions—H. N. Thompson Attempts To Reconcile Producers and Smeltermen—Activity of Various Districts of Province Described —E. E. Campbell Succeeded as Chairman by Col. J. Leckie

BY ROBERT DUNN

Metallurgical problems with which operators of the silver-lead-zinc properties of the Kootenays are faced; the difficulties confronting the coal mining companies of Vancouver Island; and a general summary of mining conditions of British Columbia were outstanding features of the program of the annual meeting of the British Columbia division of the Canadian Institute of Mining & Metallurgy held in Vancouver City, B. C., Feb. 9 to 12. There was a large registration of delegates and from Wednesday morning, when Mayor R. H. Gale extended his welcome, until Friday afternoon, when the end of the business sessions was reached, the meetings were well attended.

Following the luncheon to the visitors, business was opened on Feb. 9 by William Fleet Robertson, provincial mineralogist, who recounted his impressions of the condition of the mining industry in 1920, taking for a basis the preliminary review and estimate of the Department of Mines, issued recently.

Among the Government mining engineers who spoke was J. D. Galloway, of the northeastern district. There was a large tract of territory, particularly north of the Grand Trunk Pacific Railway, that had been traversed by but few prospectors, said Mr. Galloway. Lack of capital explained the slow development of the mineralized sections of this area. Most of the known mineral deposits came within the classification of medium-grade ores, but high-grade ores had been found. While in his district in 1920 there had been no activity in copper mining placer gold mining had held its own, the production being about the same as in 1919. Attention now was being paid to the possibilities of dredging the placer grounds and a number of leases were being tested by Keystone drill with this object in mind. Several dredges were to be installed and, at Quesnel, operations were being started by the Cariboo Platinum Extracting Co., a concern interesting itself in the recovery of the platinum and gold values from the sands of the Fraser River and several of its tributaries; and also in the testing of the alluvial sands of other parts of the province.

P. B. Freeland, the engineer in charge of a considerable part of the older and better known mineral zone of what is generally described as the Boundary, was able to speak optimistically of the prospects within his "bailiwick," notwithstanding that here are situated the Copper Mountain mine and the new concentrator of the Canada Copper Corporation, recently closed down; the Hedley Gold Mining Co.'s mines, now idle; Phoenix, until a few months ago a thriving mining camp operated by the Granby Consolidated, now a deserted town; to say nothing of the inactive smelter, of the same company, situated at Grand Forks.

A. G. Langley, of the Kootenays, referred specially to the development and the activity of the Consolidated's Sullivan mine. A talk by William M. Brewer, of Vancouver Island and the lower British Columbia mainland, on coal mining and the Britannia mine, together with the statement that the Lucky Four claims, situated in the Cheam Range, promised to become one of the large mines of the West; a description of the Dolly Varden mine operations by P. W. Racey; and an appeal by J. D. MacKenzie, of the faculty of the University of British Columbia, on behalf of returned men who are completing their technical training, concluded the session.

"Mining Camp Village Planning and Improving" was the subject of a public lecture, under Institute auspices, delivered by T. B. Adams, of the Commission of Conservation, Ottawa, on Wednesday evening.

With S. S. Fowler in the chair the session Friday morning was opened with a discussion of "Metallurgy in British Columbia." Horace Freeman outlined the problem of dealing with the complex ores of the Kootenays, containing lead, zinc, silver, copper and iron, in varying proportions. The trouble was caused by the zinc, he said, and the zinc content of British Columbia lead mines usually increased with depth. Zinc sulphides also were found in some high-grade native silver deposits. In lead smelting and in silver cyaniding this zinc hitherto had proved a serious obstacle to successful economic treatment. In the first case there were produced infusible slags and in the second a part of the silver could not be dissolved in the cyanide solution.

After referring to the practices of the past and the present Mr. Freeman said that what British Columbia lead-silver-zinc miners wanted was a simple concentration of the lead, silver, and zinc in one body, shipment of this, and treatment by a process capable of yielding the three different elements in a very few steps. The Honorary Advisory Council for Scientific and Industrial Research had made a grant for research having as its goal the solution of this problem. The work was in progress but the funds available were lamentably inadequate. Loans had been made by the provincial government through its industrial department upon which there was little prospect of return.

Mr. Langley endorsed Mr. Freeman's estimate of the importance of the work and was pleased to note that the latter was engaged in such research. In the Kootenays there were thousands of tons of ore on dumps, containing, say, 80 oz. silver, a considerable percentage of lead, and 25 per cent zinc. The smelters refused it. If shipped to smelters south of the line there were freight rates which, in conjunction with penalties, made it scarcely worth while. To know more of the art of separating the zinc economically was of vital importance to British Columbia, according to Mr. Langley.

Oscar Lachmund detailed a proposal for establishing sampling plants in different mining centers. These would be financed by the government. Ores would be purchased, sampled, mixed, and a material thus obtained that would be acceptable at the smelters.

E. E. Campbell, late of the Granby Consolidated Mining, Smelting & Power Co., expressed himself as interested in the remarks of Mr. Freeman but observed that, in his experience, many things were done in practice that were not strictly scientific. While, no doubt, the general principles were never departed from, the best results were not always obtained by strict adherence to chapter and verse. In Anyox, for instance, it had been necessary to adapt practice to conditions; to adopt a "cut and fit" policy. This had been done in connection with the product of the Hidden Creek mines with success and experiments were now being carried on by means of a small mill, the results of which, it seemed assured, would be beneficial.

Prof. H. N. Thompson, of the University of British Columbia, essayed to clear away some of the misunderstanding between smeltermen and mining men because of the penalties levied by the former aganist the ores of the latter. If the problems of the smeltermen were better appreciated there would be less ill feeling, he said. There appeared still to be a [illegible] among some mining men that their returns should be based on the full market value of the mineral content of their product. He [illegible] some of the difficulties th[illegible] are "up against" when presented with ores containing combinations of copper, lead, silver, zinc and iron. No metallurgical picnic this, he assured his hearers, and very graphically he depicted the effect of reactions on the furnaces in zinc smelting, and in lead smelting, when the metal, the recovery of which was sought at the moment, was associated with too great a quantity of the other or when some slight miscalculation had been made in the course of treatment. The argument was not all on one side he told his miner friends. However he looked forward to the happy time when the lion and the lamb would lie down together in amity, being careful to refrain from specifying which properly should be termed the "lion" and which the "lamb."

It happened that the Associated Boards of Trade of British Columbia were meeting at the same time and place as the Mining Institute which explains the novelty of the joint luncheon of Thursday. The "tit bit" of this was an address by Thomas Graham, general superintendent of the Canadian Collieries, Ltd., on "The Coal Industry of Vancouver Island." The people of Vancouver Island are agitating for cheaper coal but by the time Mr. Graham finished the impression was that it would be fortunate indeed if retail prices did not take still another jump.

J. D. MacKenzie presided over the session of Friday morning which was featured by an admirable paper on "The Relations of Geology to Mining in British Columbia," by Dr. S. J. Schofield. "The Relation of the Institute to Government" introduced by H. Mortimer Lamb in the afternoon was generally discussed. It was felt that the sphere of influence of the organization could well be enlarged by closer co-operation with the provincial government in the consideration and the framing of legislation dealing with the mining industry.

The meeting ended with a dinner at which formal notice was given of the retirement from the chairmanship of E. E. Campbell, owing to his approaching departure, and the accession to the vacant office of Col. J. Leckie, who is held in high esteem both because of his standing as a mining man and his military experience and honors. Col. Leckie's informative lecture on "Campaigning in Northern Russia" closed the proceedings.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Payne Against Liberalizing War Minerals Act

Says Best Way, If Further Relief Is Advisable, Is to Compensate All Producing in War Period

Liberalization of the War Minerals Relief Act so as to include those who were induced to produce by published statements of the Government's needs would be unwise, in the opinion of John Barton Payne, Secretary of the Interior. "If Congress in its wisdom," says Secretary Payne, "shall decide the claimants receiving a published request are entitled to compensation, it would be better, in my judgment, simply to provide that all persons producing manganese, pyrites, chrome and tungsten, from the declaration of war to the armistice, shall be entitled to compensation for their net losses. If the measure be thus enacted the determinations of loss will be matters of valuation and accounting."

This expression from Secretary Payne is contained in a letter written to Representative Rhodes, chairman of the House Committee on Mines and Mining, in regard to the bills which have been introduced proposing a more liberal construction of the "request or demand" feature of the law. Any such legislation, Secretary Payne says, "would necessarily permit reopening all claims which have been adjusted, for the reason that in these the beginning of allowable loss has been set by determination of a definite date of Government request or demand." Continuing he says:

"If the law be amended to allow awards for losses following published request there can be no refusal to reopen all claims whether heretofore rejected or allowed in part, since if a claimant asserts that at an earlier time than now established he was encouraged by public request to undertake the operation which resulted in loss there can be no possible means of determining the correctness of such claims other than his own statement."

"Such legislation," Secretary Payne says, "necessarily will involve the reorganizing of a force of engineers and accountants of the size originally employed by the War Minerals Relief Commission and the continuance of the commission for an indefinite time. The awards necessarily will be much larger than in the past and an additional appropriation will be required, not only for relief but for expenses."

The Senate has authorized the publication as a public document of the report of the commission.

Awards were recommended by the War Minerals Relief Commission during the week ended Feb. 12 as follows (the name of the claimant, the mineral, the amount recommended, and its percentage relationship to the amount claimed are shown): William A. Blanton, chrome, $400, 32 per cent; L. B. Stokes, chrome, $553.62, 32 per cent; Tungsten Reef Mines Co., tungsten, $15,446.61, 71 per cent. In addition the claim of the Vindicator Consolidated Gold Mining Co., which previously had been disallowed, was reopened and an award of $13,089.04 was recommended. The recommendation is 34 per cent of the amount claimed.

Safety Council To Co-operate with Bureau of Mines

In an effort to arouse greater interest in safety in mining and to co-ordinate and develop the safety work being conducted by the National Safety Council and the U. S. Bureau of Mines a co-operative agreement has been entered into by those organizations.

Mining Congress Asks Tariff on Certain Minerals

Ferromanganese Manufacturers Want Duty on Their Product But Wish Ore Admitted Free

The American Mining Congress has asked the Committee on Ways and Means to remove a number of minerals and mineral products from the free list and allow them the benefits of a protective tariff. The minerals are: Fluorspar, graphite, chromite, ferrochrome, manganese, ferromanganese, magnesite, pyrites, tungsten and ferrotungsten. In meeting the objections which have been raised to these duties, Herbert W. Smith, who appeared for the Mining Congress, said that in view of the losses sustained by the producers of war minerals during the recent emergency that private enterprise never again would go into the war-time development of these resources. If it is done at all the work will have be done by the Government, which would mean great loss of time before production could be obtained. He used this as a reason why it is impracticable to leave war minerals in the ground as potential reserves. He said the safe way to be prepared in this particular would be to enable these industries to develop under reasonable tariff provisions.

Very determined opposition was forthcoming against the proposal to put a duty on manganese ore and on iron pyrites. The manufacturing chemists contend that sulphuric acid is such a basic necessity to the chemical industries that an extensive and highly ramified activity should not be hampered by a duty on its principal raw material, when no important pyrites industry has been developed in the United States, where all indications point to very high costs of production and transportation from American sources to the points of consumption.

The producers of ferromanganese pointed out to the committee that there is about $15,000,000 invested in their plants and that there is a deliberate attempt on the part of an English pool to wipe out the American industry. This should be met, it was argued, by placing a duty of 2c. a pound on ferrotungsten and by allowing the American manufacturers to obtain their raw materials at the lowest available cost. Some sympathy was shown for the domestic production of manganese ore but it was stated that the lower grade of the domestic ore, the transportation cost involved, and the irregular grades of these ores, as well as the fact that it requires more fuel to smelt it, are difficulties which militate against its use. In case any duty should be described for manganese ore, it was pointed out that a higher duty would have to be asked on imports of ferromanganese. It was stated that the ferromanganese industry would require a duty on ferromanganese at least the double of any duty that might be prescribed on ore. If the suggested duty were 3c. per lb. on the manganese content of ore it would require 6c. per lb. on ferromanganese.

Due to the importance of manganese as an essential in making steel the chairman of the committee asked one of the witnesses if the domestic production of the ore should not be encouraged. While the representatives of the ferromanganese industry repeatedly stated that they did not oppose a reasonable duty on the ore it was very evident that they were not enthusiastic about that phase of the situation. At one point in his testimony E. G. Lavino, of Philadelphia, said: "The domestic ore is in remote localities and there is not much of it. I think it would be better to conserve it for emergencies. Otherwise it will be worked out in a couple of years and economically it is not good business." On being questioned Mr. Lavino stated that he referred to the Batesville, Ark., district in stating that the supply would be mined in two years. He said that the domestic producers had the advantage of very high prices during the war, were given priority in the matter of transportation and had many other advantages but with it all brought out only a small production. His firm contracted for 100,000 tons at that time, it is stated, but only 1,000 tons were furnished on these contracts. The chairman of the committee suggested to the witness that he wanted protection for his product but was opposed to protection for the ores. This led Mr. Lavino to say: "I am in sympathy with any reasonable protection of any industry in the United States but we do not feel in view of our experience that there is a sufficient quantity of manganese ore in the United States to begin to supply the need. Moreover the quality is not good."

On the other hand Charles W. Potts, representing the Northern Minnesota Ore Co., presented an exhaustive statement to show that there is enough manganese ore in the United States on which to found an industry. He asked that a duty of 35c. per unit of metallic manganese be placed on crude ores and concentrates. He said that the experience during the war had demonstrated that the former objections to the building up of the domestic manganese industry are now invalid. Among other things he said:

"That domestic sources cannot be depended upon to supply domestic needs is now an absurd argument; for the production of American mines in 1918 disclosed the fact that the ore is available, and that it is so plentiful that in a very few months domestic production increased to a tonnage equal to prewar requirements and the industry was just getting started when the war closed."

Operators of salt mines and wells in the United States are asking that their product be removed from the free list and a duty of 25c. per 100 lb. be imposed. The producers of graphite have asked a duty of 1c. per lb. on ore under 50 per cent graphitic content; 2c. per lb. on ore with more than 50 per cent graphite; 3c. per lb. on lump graphite; 6c. per lb. on flake graphite; 20 per cent ad valorem plus 5c. per lb. on the graphitic content of graphite bricks.

The removal of graphite from the free list was opposed vigorously by the manufacturers of crucibles. By insisting upon a high tariff, it was declared, the miners of graphite are jeopardizing their own interests, since the crucible industry offers practically their only market.

Manufacturers of safety fuses have asked for a duty of $1 per 1,000 ft. on imported fuses. The present duty is 15 per cent ad valorem. In like manner the manufacturers of blasting caps requested a duty of $2.25 per 1,000 caps. The present tariff is $1 per 1,000. The rate asked is the same as that carried in the Payne law. A duty of 50c. a unit on potash has been requested by the United States Potash Producers Association. The representative of the Association stated that with such a duty a domestic industry would be able to meet outside competition within five years. A duty of 50c. a unit, it was argued, would mean only an increase of $1 a ton in the average fertilizer. The United States is now producing one-half of its normal requirement of potash, it was stated.

Salt Lake Experiment Station
Reports for January

The Salt Lake City station of the U. S. Bureau of Mines for the month of January reports the continuance of work with various volatilization processes. Experiments have proven that it is possible by this process to extract 94 per cent of the silver and 80 per cent of the lead in the complex ores of Good Springs, Nev. Ores from the Utah Apex at Bingham have been successfully treated by the Bradford process. Microscopic work was also carried on, studies being made of ores from the Deadwood Lead & Zinc Mining Co., of sponge iron from California, platinum ore from Idaho, etc. Experiments have been continued with oil shales, the oil retort recently installed being made use of for this purpose.

Zinc Standardizing Plans Made

The American Engineering Standards Committee upon which the Department of the Interior is represented, has designated the American Zinc Institute and the American Society for Testing Materials as sponsors for the projected standardization of zinc. This action was taken following a suggestion from the Belgian Standardization Association. The American Society for Testing Materials and the American Zinc Institute have accepted this joint sponsorship and are undertaking the formation of a committee under the rules of the American Engineering Standards Committee. After reviewing the entire field it has seemed that a representative committee competent to consider this broad project can be formed. It is to be composed of fifteen members. Five are to be producers of zinc representing the mining, smelting and rolling industries. Five members are to be consumers of zinc representing the three major users of metal, that is manufacturers of brass, galvanizing industry and sheet zinc industry. Five members are to represent general interests comprising independent consulting engineers and representatives of appropriate Government departments.

The American Zinc Institute is arranging for the selection of five producers of zinc and the American Society for Testing Materials has undertaken to arrange for the selection of the other representatives. The Bureau of Mines has designated Dr. Chas. H. Fulton as its representative. The Bureau of Mines is particularly interested in methods of analysis and settlement of contract for ore.

The American Society for Testing Materials through the activities of its committee on non-ferrous metals and alloys has adopted standard specifications and methods of analysis for spelter. It is thought that these standards are entirely acceptable, so far as they go, to the industry and it is expected that those standards will serve as a starting point for the activities of the sectional committee. Considerable standardization in the zinc field already has been accomplished. The problem now is to extend the work already done to cover more recent developments such as [illegible] for rolling sheet zinc. There is in addition the important question of [illegible], sampling and determining moisture of ores.

Government's Silver Purchases Over 37,000,000 Oz.

Purchases of silver under the Pittman Act at the close of business on Feb. 19 totaled [illegible] fine ounces.

NEWS BY MINING DISTRICTS

Special London Letter

Market Situation Worsening—The Position of Santa Gertrudis—Large Gold Field in Congo Reported

By W. A. Doman

London, Feb. 8—If anything the malaise in the world of mining, as in other branches of industry, is being aggravated rather than moderated. The fall in the prices of metals has been so continuous that mining companies, whether precious or base metal, are "feeling the draught." For December the figure at which it was estimated the Transvaal gold would be disposed of was £5 19s. 0d. per fine oz., a very high level, and when the subsequent course of the metal is considered a doubt arises in the mind as to whether the estimate was actually realized. If it were, there is a tremendous drop as regards the sales for January, the figure taken being 14/— down at £5 5s. 0d. Profits consequently have suffered. It is rather unfortunate that the present moment should have been chosen for another labor agitation on the Rand. The miners are demanding more pay and shorter hours and the companies see their revenue dwindling. It seems almost like a nail in the coffin of Kaffirs. There is just one ray of hope and that in a speculative sense, for this market at the moment. Share prices have been low partly because of a large block of "enemy" holdings being on offer by the respective officials of the Home and Union governments. These two gentlemen could not agree as to the course to be taken, and as quotations continue to fall away and no one is benefitting the Custodian of Enemy Property in South Africa has come by invitation to London, to work out a scheme in conjunction with the Public Trustee. They have had differences as to which of them is the real holder of certain shares.

Investors in silver mining companies have become very nervous of late owing to the low level to which the metal has fallen. Not only do they see their profits disappearing, but their capital is also endangered. One of the most popular companies is the Santa Gertrudis, and, as I reported recently, the company raised additional capital in the shape of notes. These were distinctly attractive at the time, but they have since gone to a heavy discount. Fears have been expressed that as a result of the slump in silver and of other causes the company will not be able to pay its way. The board has consequently taken steps to alleviate anxiety by explaining the position. Mr. J. A. Agnew, a member of the technical committee, in the course of an interview states that, even with silver at its present price, a very good profit can be made by Santa Gertrudis, while treating from 30,000 to 40,000 tons of ore monthly. The position is really aggravated by other troubles, for the company has suffered from a lack of filtration capacity. Now that this has been removed, the rate of output is checked by a limitation of power. The consumption has to be cut down by 25 per cent and this fact prevents the management from taking advantage of additions to the mill, the expenditure upon which has almost ceased. Mr. Agnew states that while a material improvement in the position is postponed by the shortage of power the views of the directors as to the future of the mine are unchanged. Of course the fall in silver has checked the expansion of the National Mining Corporation and the Mexican Corporation.

I learn that, according to private advices from the Congo, a gold field is being traced out of a size to dwarf the Witwaterstrand.

AUSTRALIA

Queensland

Hampden-Cloncurry Smelters To Stay Shut Down, Likewise Those of Mt. Cuthbert—Chillagoe State Smelters Also Forced Down—Mt. Quamby Gold Strike Less Alluring

Brisbane, Jan. 10—The falling prices of metals, especially of copper, is having a very serious effect on the mining industry of Queensland. The production of copper in the Cloncurry district is said to cost, under existing conditions, somewhere about £80 per ton, and with the London price down to about £71 or £72, it was not difficult to predict that something must happen. It is now definitely announced that the smelters of the Hampden-Cloncurry company, which closed down at the usual time for the Christmas holidays, are not to be blown in again until prices improve, although development work in the company's group of mines is to continue as usual. The chairman of the company recently stated that costs have gone up to such a level that the workers' efficiency has become so unsatisfactory, and that the price of the metal has dropped to so low a point that the owners of Australian copper mines cannot now earn profits. The smelters of the Mount Cuthbert company, which had only a short campaign last year, are also to remain idle for an indefinite period after the holiday recess, but development work in some of its mines is to go on.

The Chillagoe State smelters have had to follow suit and close down. The reason given was that, owing to the low market prevailing, producers would not sell their ores.

The Government has up to the present been able to work only one mine (the Einasleigh copper mine) in connection with the Chillagoe smelters, which several times ran short of ore, but during the session lately closed parliamentary authority was obtained to operate other mines and to spend a larger sum annually on the development of State mines and in operating the smelters than was previously available. The State Battery at Wolfram remains closed, and must so remain while the prices of the rare metals continue as low as they are, for the simple reason that there is nothing for the battery to work on.

The Mount Morgan company, as a large producer of copper, is, of course, being much affected by the ruling low market, although it is assisted to some extent by its gold output and the help which it gets from the Gold Producer's Association. Up to the beginning of 1920 the company paid dividends pretty regularly, and has distributed in all nearly £9,400,000, but the last payment to shareholders was made in April, 1920, and the general manager recently stated that the copper production is now being conducted at a loss, and that the vanishing point as far as dividends are concerned appears to have been reached. There is, however, fortunately no intention to close down the big mine for the present, and operations will be continued in the hope of an early improvement in prices and possibly a reduction in the cost of production. When the last mails left there was a slight upward movement in metal quotations.

The gold discovery at Mount Quamby, in the Cloncurry district, which was to prove another Rand, has had much of the romance knocked out of it by the matter-of-fact, cold-blooded geologist whom the Government sent out to examine the property. This geologist, L. C. Ball, confirms the reports of the existence of immense quantities of conglomerates, but he says the rock has been demonstrated to be gold-bearing only in the southernmost part and that much prospecting must be done before any pronouncement can be made as to the remainder. The deepest working is 12 ft. down. Much of the conglomerate tested has been found to be barren, some gave low values, and one sample went 1½ oz. to the ton. The average of twenty-four samples from the surface workings, which are scattered over a length of 700 ft. with a maximum width of 100 ft., was just about half an ounce to the ton. There is, therefore, no doubt that the conglomerate is auriferous, but much work has to be done before it is proved that it can be exploited profitably.

MEXICO

Coahuila

Torreon—Feb. 12—The Torreon smelter is being blown in after an idleness of several months. The plant will be operating in full blast before the end of this month, giving employment to several hundred men.

CANADA

British Columbia

Queen Mine, Near Salmo, Bonded to C. H. Cassill—McAllister Shareholders Meet

Salmo—Wisconsin interests, which have held the Queen mine, on Sheep Creek, for a number of years, have bonded the property to C. H. Cassill, of Spokane, president of the First State Bank of Ovanda, Mont. The consideration involved is $150,000, with a $20,000 payment due in July, 1921, $10,000 six months thereafter and three payments of $40,000 covering a period of a year and a half. The property, consisting of fifteen claims, is credited with a gold production of $1.529.000 within the last 20 years. Mr. Cassill intends to incorporate a company under the laws of British Columbia with a capitalization of 1,000,000 shares of a par value of 25c. per share to take over the Queen group and amalgamate with this ground a number of other claims in the vicinity, and which he has held for a long time.

Three Forks—The McAllister M. & M. Co. shareholders met in Spokane on or about Feb. 10 to authorize the closing of a deal whereby W. A. Grimes and associates take up the bond held on the McAllister group, prior to maturity, which would not be until a year from next May. The McAllister company will be dissolved and it is likely that the syndicate acquiring the property will seek incorporation. The property is on the North Fork of Carpenter Creek, and produces a high-grade dry ore. A wagon road will be completed to the mine this year. The consideration involved in the present deal is $35,000.

Sydney Inlet—The Tidewater Copper Co. has temporarily stopped production. A certain amount of underground development and diamond-drill work will be undertaken to better define the orebody. Dan Drumheller, superintendent, reports that the mill which was recently remodeled was doing excellent work at the time of the shutdown. A good operating profit was reported for December, in spite of the unsatisfactory market.

Ontario

McIntyre Planning To Increase Milling Capacity

Porcupine—The McIntyre is planning to increase its milling capacity to between 900 and 1,000 tons per day. The extent and gold content of the No. 5 ore body now being worked at the lowest level are rated to show an increase at depth.

A syndicate including local and American interests is negotiating for the acquisition of the Porphyry Hill property in Deloro Township about half a mile south of the Dome mines.

The Gold Reef is planning the resumption of operations at an early date, including the sinking of a shaft to the 300 level, to open up a strong vein indicated by diamond drilling

NORTH CAROLINA

New Talc-Grinding Plant Built—Reopening Old Spoon Mine

Troy—Operations are under way in the new Hemp talc district, which has been developed in an old gold-mining region. The most active work is that of the Standard Mineral Company, Inc., 858 Woolworth Building, New York City. This company is building a 35-ton talc-grinding mill and expects to be ready to ship ground talc soon. A crayon mill, with capacity of 100 gross daily, will start at the same time. Bins are being erected at the mine, and an Ingersoll-Rand compressor, drills and channeling machine are being installed.

R. I. Dickens is opening the old Spoon gold mine, northeast of Ashboro, for New York owners and is sinking a shaft and crosscutting. Donald Cameron has completed his Marathon mill plant at the Porter mine and will soon begin grinding.

A. J. Overton is installing a rock crusher and a haulage system at his thirty-stamp mill recently built. This mill is now in operation.

Waynesville — The Cons. Natural Abrasives Mining Co. has been organized with a capital stock of $2,000,000. This is a consolidation of rhodolite, corundum and garnet properties said to cover 7,000 acres in Jackson, Macon and Clay counties, N. C., and Tower County, Ga. It is intended to raise funds to remodel the present plant and add equipment sufficient to permit the production of 150,000 tons of finished product per year.

ARKANSAS

Manganese Mining Practically Closed Down—No Ore Sold for This Year

Batesville—Little of note has happened recently in the Batesville manganese district. Ore contracts expired Dec. 31, and there was a spurt of shipping the last week of the year, getting rid of accumulations and getting the yards and bins cleaned up. No ore has been sold for this year as yet, and the probabilities are that it will be March at least before any new contracts are made. The prices to be paid will no doubt be low. The industry is practically closed down. The Northern Minnesota Ore Co. is working a few men contract mining on high-grade ore only, as is R. S. Hanford at the Davis Hill property and Snapp land and Pottorf property north of Pfeiffer. A. G. Gray also has a few men working on his land near Pfeiffer. Otherwise no ore is being mined whatever.

Little development work is being undertaken. E. C. McCombs, representing the Independence Mining Co., is using the interval of no production to repair and enlarge and overhaul its washing plant at the Polk Southard property, north of Cushman, and will install a crusher to put the ore in better size for sampling. The Northern Minnesota Ore Co. expects to do some test pitting this spring or in the near future. The National Manganese Ore Co., of Indianapolis, Ind., going ahead with the projected 30-ft. dam on Lafferty Creek just below the town of Anderson and putting up washing plant, and other equipment.

The consolidation of the Eureka Manganese & Mining Co. and the Southern Hill Manganese Co. was effected Jan. 20 by the organization of a new company capitalized at $250,000 and to be known as the United States Manganese Co. The new company takes in the Eureka mine and mill of the Eureka company, which was owned by W. H. Beatty, W. H. Denison, and N. A. Adler, and the Southern Hill property, which was mined during the war by C. H. Lord, of Chicago; and associates. The new company also takes over 543 acres of mineral land, formerly belonging to the Gregory estate, some of which is expected to be valuable. The principal stockholders war by C. E. Lord, of Chicago, and McFatrich, of Chicago, M. A. Losee, of Chicago, and W. H. Beatty, of Cushman. Dr. Roe is president, Dr. McFatrich, vice-president, and W. H. Beatty, secretary and manager. The company started operations at once with a view to getting the Eureka mine in shape for economical operation. In the absence of a market, the company expects to be able, financially and physically, to stockpile the product.

MICHIGAN

The Copper Country

Arcadian Consolidated Re-elects Directors—C. & H. Electrolytic Down Temporarily

Houghton — The Arcadian Consolidated Mining Co. held its annual meeting in Houghton on Feb. 8. Directors were re-elected as follows: R. H. Shields, president, W. B. Anderson, L. W. Killmar, J. W. Shields, S. T. Everett, J. C. Shields, H. W. Fesing, J. G. Stone and F. W. Miller. The only work being done at present is the sinking of the New Baltic shaft, which will be down 940 ft. by March 1. It will then be connected with the New Arcadian shaft, which is about 3,500 ft. away. A thousand feet of drifting has been done from the New Arcadian shaft toward the New Baltic.

Chief Engineer H. W. Fesing in his report states that the showing of copper on the 250, 400, 500 and 600 levels is very good. On the last the vein is 26 ft. wide, with mineralization across the entire lode. He goes on to say: "Should the vein between these two shafts disclose such copper values as the openings in the various levels of both shafts would indicate, then there can be no doubt that possibilities exist here for the development of an immense tonnage of commercial rock. Even in the block of ground [illegible] the 900 level, between the two shafts, and allowing for the usual [illegible] in rock selection, no less than [illegible] tons of merchantable [illegible] should be supplied."

The Quincy Mining Co. continue to

operate but one of its stamp mills. Production is about 3,000 tons per day or about 60 per cent normal.

The Copper Range Co. has been increasing its mine forces slightly at its three operating mines in the last few weeks. The total output of ore is now about 65,000 tons per month. Of this the Champion produces about 60 per cent, the Baltic about 25 per cent, and the Trimountain 15 per cent.

Calumet & Hecla has suspended operations at its electrolytic plant for about two weeks. This action was caused by the decreased supply of copper mineral with the required silver content.

Dwight E. Woodbridge, mining engineer of Duluth, Minn., gave an interesting talk on the Hudson Bay country to a group of Copper Country business and professional men on Feb. 9. He touched on the history of the Hudson's Bay Co. and the peculiar habits and customs of the Eskimos. But the greater part of his address was devoted to the great iron deposits in that country, especially on a group of islands in Hudson Bay. He was of the opinion that if future detailed examination bears out the results of the preliminary examination, these great iron ore deposits will come into direct competition with the ores of Michigan and Wisconsin.

Menominee Range

B. C. Neeley Buys Iron Ore Tract Including Vivian Mine

Iron Mountain—Benjamin C. Neeley, of Crystal Falls, Mich., has purchased 640 acres of mineral lands in Breitung township, Dickinson County, the description being the west half of Section 33 and the west half of Section 34. The Vivian mine, operated many years ago, is located on these lands, and was worked by Pickands-Mather interests. There is a very large tonnage of low-grade ore on the property and the recent purchaser is to begin diamond-drilling with the idea of finding high-grade. Neeley has been a successful operator in the Iron County district of the Menominee Range for many years.

At the Ernst mine the shaft is being deepened from the 9th to the 10th level. When this is done the mining force will be increased. The Ernst is doing diamond drilling.

The Bates mine shaft is being concreted.

Marquette Range

Rolling Mill Mine Closed Down Pending Better Market

Negaunee—The Rolling Mill mine, operated by the Clement K. Quinn company, has been closed pending a better ore market. Men will be retained to conduct diamond drilling explorations and to repair shaft [illegible]. About 100 men are out of [illegible] result of the shut-down.

The Mary Charlotte mine, operated by the Breitung interests, closed down on Feb. 17. About 100 men were laid off. Large stocks of ore and [illegible] are said to be the reasons.

MINNESOTA

Mesabi Range

Republic Iron & Steel Closes Mines on Mesabi Range—Air Tank Explodes at Hill-Crest

Nashwauk — Although the Hawkins mine, which is being stripped, has closed down for repairs, the mining industry in the near vicinity is still moving. The La Rue mine is operating with full crews, also the Crosby mine, and it is anticipated that the York mine will reopen in another month as there is certain preparatory work to be accomplished before the shipping season. Stripping operations continue at the properties of the Butler Bros.

Gilbert—The Republic Iron & Steel Co. closed all mines of the company on the Mesabi Range on Feb. 12. The three mines in Michigan will be operated at only 50 per cent of normal. The mines affected on the Mesabi Range are the Petit and Schley at Gilbert, the Union at Virginia, the Kinney at Kinney, and the Bray at Nashwauk.

Ely—The North Chandler mine, of the Chandler Mining Co., has reduced its working schedule to four days a week. About 100 men will be employed.

The Zenith mine is still working six days a week with a reduction of the number employed which is approximately 150 men.

Ironton—The 6 x 10-ft. compressed air tank at the Hill-Crest mine exploded and caused considerable damage to the engine room besides breaking one of the arms of the engineer with other minor injuries. Part of one of the walls of the engine room was destroyed and the equipment badly damaged.

ARIZONA

Calumet & Arizona Finds New Body of High-Grade Carbonate Ore

Bisbee—In drifting on the 770 level the Calumet & Arizona company has cut a body of high-grade azurite and malachite ore. The immediate purpose of driving this drift was to develop some low-grade siliceous ore found in churn drilling. The new discovery was unexpected and from appearances is the top of an orebody. It is located on the Ormond claim and the ore is typical of the high-grade specimen ore mined in the early days of Bisbee.

A geological examination of its property is being made for the Higgins Development Co. in Bisbee by F. H. Farrell, of Los Angeles.

Tombstone—Rushin & Hobbs, leasing on the Silver Cloud mine, eleven miles northeast of Tombstone, have shipped three cars of silver ore from the dumps. Some development work is being done in the mine.

Courtland—F. J. Gibbons is leasing on the property of the Great Western Copper Co. No shipments are being made. Ore is being stockpiled until the copper market is more favorable. A few others are also leasing in a small way but not shipping.

MONTANA

Butte-Jardine Trying Out Champion Mill—Western Smelting Co.'s Furnace Almost Complete

Champion District—Tuning-up operations at the 200-ton Champion mill of the Butte-Jardine are under way with the concentrates showing a recovery around 95 per cent. The Champion dumps all will be milled, the silver values running up to 15 oz.

Cooke City—The 300-ton copper blast furnace of the Western Smelting & Power Co. is about 90 per cent complete. At the mine, on Henderson mountain, a crosscut tunnel is being driven to open at depth orebodies the existence of which has been shown by tunnels higher up on the mountain. A hydroelectric plant of the company has been in operation for the past five years.

COLORADO

Modoc Company's New Hoist Running

The new 250-hp. hoist at the Modoc mine is in operation, and is lifting two double-deck cages from the 15th level. The hoist is designed to lift 3-ton skips from the 22nd level. The equipment was built by the Wellman-Seaver-Morgan Co. of Cleveland, Ohio. The installation cost approximately $50,000.

UTAH

Tintic Standard Strikes Rich Ore on 1,100 Level

Eureka—The Tintic Standard has opened exceptionally rich ore in a drift from the No. 2 shaft on the 1,100 level. The drift has shown shipping ore for 500 ft. and the exceptionally rich silver ore has come in in the last 100 ft. It is felt that this level will equal the 1,250 and 1,200 levels in productivity. Milling ore has also been developed on the 1,100. The new mill is treating 175 tons daily, and the first cleanup, when the precentage of recovery can be determined, will be made in a few weeks.

NEVADA

Mining Engineers Object to New Licensing Bill

Mining engineers throughout the state of Nevada are making vigorous objections to the passage of Senate Bill No. 21, an Engineers' License Bill affecting all classes of engineers. This measure was prepared and introduced in the state Senate through the efforts of a small group of civil engineers in Carson City and its existence was a surprise to the engineering profession in the state of Nevada. Mining engineers as a whole opposed the bill on account of its loose construction and ambiguity. There are divers opinions regarding this type of legislation through this state, and it is generally felt that before a bill of this kind is introduced it should be scrutinized closely by representatives of all concerned. It is not likely that the bill will pass.

THE MARKET REPORT

Daily Prices of Metals

Feb.	Copper, N. Y. net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L	Zinc St. L.
17	12.65	28.75	32.50	4.35@4.40	4.25	4.95
18	12.65	29.00	32.75	4.25@4.40	4.15	4.90
19	12.55	29.50	32.75	4.25	4.10	4.90
21	12.50	28.50	32.25	4.10	4.00	4.85@4.90
22	.	...	....		....	..
23	12.25	28.25	32.00	4.00	4.00	4.80@4.90

*These prices correspond to the following quotations for copper, "delivered": 12.90, 12.90, 12.80, 12.75, 12.50c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Feb.	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
17	73¼	71¼	76	168	172	20	20⅝	24¾	25¾
18	73¼	71½	76	173½	176½	20	20½	25½	26¼
19									
21	72¼	70½	75	170	173½	19¼	20¼	25½	26¼
22	71¼	[illegible]	74	170	173	19	19¾	25¼	25¾
23	70¾	70	74	169	172½	[illegible]	[illegible]	25¾	[illegible]

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Feb	Sterling Exchange	Silver New York, Domestic Origin	Silver New York Foreign Origin	Silver London	Feb	Sterling Exchange	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
17	388¼	99½	60	34¼	21	[illegible]	99½	57¼	33
18	387½	99½	58¾	33¾	22				33¼
19	[illegible]	99½	57¾	33¼	23	[illegible]	99½	57¼	33¼

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, Feb. 23, 1921

Absence of any demand, and pressure to sell, caused a fresh crop of price reductions in the local market during the last week. Declines in copper and lead have also occurred in London. Dealers are very pessimistic, and can see no immediate hope of a betterment as long as some interests seem disposed to market their current output regardless of price. However, business in some lines shows some prospect of improving, and in several instances corporation directors have shown a disposition to lay in moderate stocks of metals at current low prices when financial conditions allow

Copper

Consumers generally show no interest in the market, and are not even willing to make a bid. Copper for prompt shipment was freely offered by at least two interests at 12⅝c. delivered, on Monday, and this afternoon sales were made at 12.50c. The larger producers claim to be maintaining their price at 13c., without, however, moving any metal. It is to their interest of course to do this, inasmuch as any marked decline just at this time might interfere somewhat with the marketing of the $40,000,000 bond issue recently placed. Premiums of ¼c. per month are generally being asked by all would-be sellers on metal for forward delivery. Export demand has turned very weak.

Lead

The American Smelting & Refining Co. reduced its official price of lead, New York and St. Louis, from 4.60c. to 4.50c. on Friday the 18th, and the next day made a further reduction to 4.40c. This is still considerably above the market, and another revision is likely.

The outside market has declined violently, owing to the cutting of prices by two interests, one in St. Louis and the other here in New York. In one case the price reduction was inspired by considerable stocks, which had to be marketed to raise cash, and in the other by the fact that declines in London and the pressure of Spanish lead make importing look attractive. Some promising business has been booked on the decline, and close followers of the market are advising buying at current prices. Inquiries for small lots have not been as numerous as a few weeks ago, but were in evidence to some extent, particularly on Monday. The business of lead consumers is fairly good in some lines, particularly in the paint, storage-battery, and cable industries. The two producers of chemical lead have so far shown no disposition to sell under 4.50c. St. Louis, but how long they will persist in their policy is unknown. Apparently no business is being booked at that price.

Lead for forward delivery is approximately the same price as for prompt, but there is somewhat more disinclination to sell on the part of producers. Possibly about five points premium for each month in the future would about represent their ideas.

Zinc

The market has continued very listless, with few sales recorded. The further decline is attributed largely to the continuation of tight money conditions in the West, for when the question of ready cash is paramount, the price received for zinc or any other metal is a secondary consideration to procuring funds. European zinc is still being imported, and helps to prevent the market from recovering, although not much of it has been sold. American [illegible] are said to constitute part of the imports, but are admitted duty-free only after satisfactory proof that it is primarily zinc of American origin, and not a bonded product, and such conditions are difficult to meet. High-grade zinc continues at 7.25c. New York and ordinary grades are reported offered in St. Louis at 4.80c. today.

Tin

London was somewhat stronger last week, owing to reports of greatly curtailed Bolivian production. Such of these reports as we have seen would appear to be greatly exaggerated, and it is unlikely that more than a one-third cut in production is in effect or contemplated. Even at present prices, Bolivan producers are probably making money. Chinese tin is being more actively offered in the local market than for some time.

Straits tin for future delivery: Feb. 17th, 33@33.25c.; 18th, 33.50@34c.; 19th, 33.25@33.75c.; 21st, 32.50@33c.; 23d, 33@33.25c.

Arrivals of tin, in long tons: Feb. 15th, Australia, 5; China, 10; 18th, London, 205; 19th, London, 25.

Gold

Gold in London: Feb. 17th, 104s. 11d.; 18th, 105s. 6d.; 21st, 106s.; 22d, 105s. 6d.; 23d, 105s. 8d.

Foreign Exchange

The probability that Great Britain would be in the market for American dollars with which to pay interest on loans made by this country during the war had an adverse effect on sterling exchange in the closing days of last week, but sterling was stronger again Monday and today. A large amount of buying by speculative interests has accompanied the recent rise, so that there is a pronounced long account now to be considered.

On Monday, Feb. 21st, francs were 7.265c.; lire, 3.655c.; and marks, 1.64c. New York funds in Montreal, 15⅛ per cent premium.

Silver

The silver market has continued weak, on account of further selling by China and the Indian bazaars; and London fell today to 32¾d., which is the lowest quotation since Nov. 4, 1916. The New York market has also declined, but with the lower prices a scarcity of silver and an inclination on the part of sellers to hold their product are becoming apparent.

Mexican Dollars—Feb. 17th, 45⅝; 18th, 44½; 19th, 44⅛; 21st, 43¾; 23d, 43¾.

Other Metals

Aluminum—List prices of 28@28.5c. are nominal. Outside market 24@25c.

Antimony—Chinese and Japanese brands, 5¼c.; market quiet. W.C.C. brand, 6¼c. per lb. Cookson's "C" grade, spot, 9⅝c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony[1] (200 mesh), 6½@7c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 7c.

Bismuth—$2.35@$2 [illegible], 500-lb. lots.

Cadmium—Nominal, $1.40 per lb., in 1,000-lb. lots.

Cobalt—Metal, $4.50 per lb.; black oxide, $3@$3.10 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $325 per oz.

Magnesium—Crude, 99 per cent, $1.25@$1.35 per lb., f.o.b. Philadelphia.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 38@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $70@$80 per troy oz.

Palladium—$65 per oz.

Platinum—$70 per oz. Strong.

Quicksilver—Nominally $50 per 75-lb. flask. San Francisco wires $47.75.

[1]**Rhodium**—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 50@55c. per long ton unit, f.o.b. Atlantic ports.

Manganese Ore—40c. per unit, seaport; chemical ore (MnO_2) $60 per gross ton, lump; $65@$70 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

[1]**Tantalum Ore**—Guaranteed minimum 60 per cent tantalic acid, 40c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¼@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Feb. 19—Zinc blende, per ton, high, $26.90; basis 60 per cent zinc, premium, no offers; Prime Western, $22.50@$20; fines and slimes, no offers; calamine, basis 40 per cent, offer $15, no sales; average settling price, all grades of zinc, $25.24.

Lead, high, $48.45; basis 80 per cent lead, $45@$40; average settling price, all grades of lead, $46.15 per ton.

Shipments for the week: Blende, 5,943 tons, lead, 1,185 tons. Value, all ores the week, $204,710.

Less than 900 tons of zinc was sold this week, over half of which is reported on $22.50 basis, with the rest reported bought on $20 basis. A large mercantile establishment claims the purchase of 1,000 tons on $22.50 basis for speculation, but as this must be resold to smelters, it is not reported as purchased ore until more may be known of the transaction, no producer having acknowledged the sale.

Lead ore declined $5 at the close, with little animation on $40 basis.

Platteville, Wis., Feb. 19—No market for lead or zinc ore. Shipments for the week: Blende, 614; lead, 30 tons. Shipments for the year: Blende, 5,796; lead, 510 tons. Shipped during week to separating plants, 185 tons blende.

Non-Metallic Minerals

Asbestos—Crude, No. 1, $2,000@$3,000; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, $23; ground (white), $45; ground (off color) $30@$32 per net ton, less than carload lots, f.o.b. New York. Crude, first grade, $10 per ton, f.o.b. cars, Missouri; floated, $28 per ton in bbls.; $26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis.

Chalk—English, extra light, 5@5½c.; light, 5@6c.; dense, 4½@5c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$10; washed, $10@$12; powdered, $15@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $15@$20, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $15@$25, f.o.b. American ports; powdered, $35@$45, f.o.b. New York.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar—Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $25 per ton, f.o.b. Illinois mines, and $25, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, $60; lump, $17.50, f.o.b. Heathden, N. M. In Canada

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

85 per cent calcium fluoride sells for $20 per ton, f.o.b. Madoc; output limited. Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines.

Fuller's Earth—$16 per ton, carload lots, f.o.b. mines.

Graphite—Ceylon lump, first quality, 8@9c. per lb.; chip, 7c.; dust, 5½c. No. 1 flake, 7½c.; high-grade amorphous crude, 3c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Dolomite, 1@2 man size, $1.60@$1.65; 2@8 in., $1.55@$1.65 per net ton, f.o.b. Plymouth Meeting, Pa.; fluxing, $1.65@$1.75 per net ton, f.o.b. Howellville, Pa.

Magnesite, Calcined — High - grade caustic calcined, lump form, $35@$40 per ton, carload lots, f.o.b. California points. In Chicago district, $57.70; Atlantic seaboard, $61@$63.

Dead - Burned — $38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); all f.o.b. New York.

[1]**Monazite**—Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—According to a Tennessee producer, there is little demand for phosphate rock. Owing to the decreased price of farm products farmers claim they are not going to use fertilizers this year, so manufacturers are holding off purchasing phosphate rock, as they had accumulated fairly good stocks during the fall months. Quotations: Per long ton, Florida ports: 77 per cent tricalcium phosphate, $13; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $8.35; 68 per cent, $7.85; 68@66 per cent, $7.60. Finely ground Tennessee rock sells for $8.50 per net ton for 13 per cent phosphorus content, agricultural application; for acid-making, 14 per cent, $9; both prices f.o.b. Centerville, Tenn.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 16c., c.i.f. Atlantic seaport; furnace size, 16½c.; Spanish lump, 14@16c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1½ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$45, talcum powder grade. Southern talc, powdered, carload lots, $10@$14 per ton; less than carload, $25, f.o.b. cars; freight to New York $5.25 per ton, carload lots; less than carload lots, $9.25. Imported, $40@$50; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 10@11c. per lb.; sulphide, powdered, 14@15½c. per lb. in carload lots.

Sodium Nitrate—$3 per cwt. ex vessel, Atlantic ports. Market quiet.

Sodium Sulphate—For 95 per cent material, $20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; $32 per ton, New York.

Potassium Sulphate—Domestic, $220@$230 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 16@17c. per lb. of chromium contained; 4 to 6 per cent carbon, 16@17c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $100, f.o.b. furnaces; resale, $90, delivered; English, $100, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $40@$45, f.o.b. furnace.

[1]**Ferromolybdenum**—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $55@$60; 50 per cent, $80@$85; 75 per cent, $145@$150.

Ferrotungsten—Domestic, 70 to 80 per cent W, 55@60c. per lb. of contained tungsten, f.o.b. works. Foreign, 60c.

Ferro-uranium—35 to 50 per cent U, $7 per lb. of U contained, f.o.b. works.

Ferrovanadium—Basis 30 to 40 per cent, $5 per lb. of V contained, plus 75c.@$2 differentials and according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York list price, 21¾c. per lb.; wire, 15⅝.

Lead Sheets—Full lead sheets, 8¼c.; cut lead sheets, 8⅝c. in quantity, mill lots.

Nickel Silver—33½c. per lb. for 18 per cent nickel.

Yellow Metal—Dimension sheets, 19½c.; sheathing, 17½c.; rods, ⅜ to 3 in., 16⅝c.

Zinc Sheets—$11 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $80 per net ton, shipping point; arches, keys, wedges, $85; splits, soaps, $100.

Fire Brick—First quality, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $45@$50.

Magnesite Brick—9-in. straights, $90@$100 per net ton; 9-in. arches, wedges and keys, $105; soaps and splits, $120.

Silica Brick—9-in., per 1,000: $45@$55 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, Feb. 22, 1921

The break in steel prices on the part of the independent producers has made practically no progress since last report, the reason being that there is no disposition on the part of buyers to take hold, so that little opportunity for competition is afforded. Minimum prices quoted thus far, by comparison with Industrial Board or Steel Corporation prices, are as follows: Bars, 2c., against 2.35c.; shapes, 2.20c., against 2.45c.; plates, 2.25c., against 2.65c.; hoops, 2.85c., against 3.05c.; blue annealed sheets, 3.20c., against 3.55c.; black sheets, 4.10c., against 4.35c.; galvanized sheets, 5.35c., against 5.70c. Standard steel pipe has not been shaded, remaining steady at 57½ per cent basing discount, and tin plate is also steady at $7.

It is a question whether the failure of buyers to take hold was a surprise to independents. The chief object in cutting prices is assumed to have been to force the Steel Corporation's hand, causing it to reduce prices and therefore wages, and thus bring about a redistribution of demand.

Pig Iron—The first sales of basic iron this year have just been made, and at the new low price of $25, Valley, a 1,000-ton lot being included. Bessemer is quotable at $27, Valley, and foundry remains nominal at $28.

Semi-Finished Steel—There is no inquiry for billets or sheet bars in the open market and quotations remain purely nominal at $45 and $47. The Steel Corporation has [illegible] from its $47 price on sheet bars, [illegible] steel only to regular contract customers.

Charcoal and Coke

Charcoal—Willow, [illegible] per lb. in bbls.; hardwood, 5½c. per lb., in 250-lb. bbls. Barrel charge is 35c. additional.

Connellsville [illegible] foundry, $6@$6.50.

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Weak Support to Silver Market in the Far East

American Producer Unaffected by Present Conditions—Over One-Seventh Pittman Act Purchases Completed—Indian and Chinese Trade Depression Not Helpful to Foreign Silver Market — Movements of Silver in 1920 Comparatively Light

THE SILVER PRODUCER in the United States is practically the only metal-mine operator who, under present conditions in the metal markets, can profitably work his property. With the fixed price of $1 per oz. for silver established by the Pittman Act, he can look forward for upward of three years' operations at a high price for silver and in the face of continually declining commodity and production costs. He is in a fortunate position compared with his fellow operators in low-priced copper, lead, and zinc.

Unfortunately, most of the silver produced in the United States is byproduct metal obtained from the refining of copper and lead, so that a relatively small number of mining companies are directly engaged in producing silver exclusively. However, the fixed price of silver has been of great importance in aiding the copper and lead producers to make "both ends meet." Were it not for the high precious-metal content of Idaho lead ore and Montana copper ores, the production of lead and copper from these two states would undoubtedly be much smaller.

PITTMAN ACT WORKING SMOOTHLY

Over 36,000,000 oz. of silver had been purchased by the Treasury under the Pittman Act by the middle of February, or more than one-seventh the total required purchases of 207,000,000 oz. Talk of repeal has been quieted in this country as a better understanding of the working and principles of the Pittman Act has been realized. It is well that this should be so, for the mistaken impression that the Government was losing heavily on these purchases seemed widespread. Criticism at present directed against the act has come mainly from abroad, where it has been pointed out that there are good reasons why high silver prices are inimical to the best interests of the United States. One reason advanced was that high silver prices prevent importation of Eastern commodities or increase their cost, to which one may make rejoinder by pointing out that high priced silver is beneficial to our export trade to the East, as it enables Asiatic peoples to make large purchases from the West.

BRITISH ARE PAYING SILVER PRODUCER

It should not be forgotten, in discounting arguments for the nullification of the Pittman Act, that the American silver producer is being virtually paid by British funds, as it was Great Britain's demands for silver during the war for use in settling India's trade that led to heavy purchases from the U. S. Government at $1 per ounce. This British money is now literally being passed along to the American producer in replacing the silver in the Treasury.

The silver market at present seems without any firm foundation. Currency requirements are small; in fact, nations appear anxious to be rid of their silver currency. Mexico is an exception, as silver pesos are being coined to replace exported Mexican coins. China and India are in the throes of severe trade depression. India, which ordinarily has a favorable trade balance, necessitating heavy shipments of silver to the East, had an adverse trade balance in 1920 of about 307,000,000 rupees, compared with a favorable balance of 1,208,000,000 rupees in 1919. Under such circumstances there is little wonder that India, the greatest silver consuming country in the world, has recently been *selling* silver instead of buying. Chinese trade is in a similiar position, but no accurate figures are available regarding trade conditions in China.

INDIA'S INACTIVITY IN THE SILVER MARKET

One cannot help but conclude that India's tremendous absorption of silver during the war—it will be remembered that in the year 1918-1919 India consumed more than the entire world's production—has found an insecure resting place, and has not been satisfactorily digested. Furthermore, this points to the advisability of continuing the course mapped out by the Pittman Act in buying up again the great stock of silver the United States released in a few months during the war, and thus removing a demoralizing market agency.

India is still having trouble with her rupee currency system, which was recently reorganized to change the rupee from a basis of fifteen to the sovereign to ten to the sovereign. Although this step was taken to restore the token character of the rupee, and ostensibly to link the rupee to gold and not the pound sterling, the rupee has fluctuated in response to the price of silver and seems to have disregarded its relation to the price of gold. This has been due primarily to the unwillingness of the Indian government to convert or freely exchange rupees for gold, thus making the rupee an inconvertible token coin.

Although the rupee now has a face value of 2s., or 0.487c., it is quoted around 27c. in the exchange market. Considering that rupee exchange has fluctuated greatly in the course of twelve months, it is not surprising that Indian trade is in an unsatisfactory condition.

SMALL EXPORT BALANCE OF SILVER IN 1920

During the calendar year 1920 exports of silver—as might be expected from the effect of the Pittman Act—dropped off. Whereas in 1919 India was the greatest purchaser from this country, in 1920 India's imports were relatively small. Exports to China in 1920 were much larger than to any other country, and illustrate how important China has recently been as a sustaining factor in the market. The following table gives a comparative record of silver movements to and from the United States in 1919 and 1920:

EXPORTS OF SILVER

To	1919	1920
China	$77,583,367	$61,347,610
British India	109,180,718	642,408
Hongkong...	10,245,351	24,872,571
Canada	7,854,378	7,061,755
England...	15,635,386	4,924,788
Japan......	3,946,453	4,673,784
Others	14,575,398	10,093,308
Totals	$239,021,051	$113,616,224

IMPORTS OF SILVER

From		
Mexico	$63,303,437	$53,197,337
Peru	8,862,537	11,990,677
Central American States..	5,200,481	7,198,851
Canada	7,171,469	3,788,435
Chile	1,927,324	3,744,351
Others	2,944,770	8,140,390
Totals	$89,410,018	$88,060,041

Compared with an excess of silver exports over imports in 1919 amounting to $149,611,000, the balance in 1920 was only $25,556,000.

The last month for which detailed silver movements are available—December, 1920—shows an excess of exports amounting to $1,455,278, despite the diversion of the entire United States production to the Treasury. However, repurchases first began in May, and from the last day of April to the first of the year 1921 an excess of $3,853,161 in silver had been imported, presumably for the benefit of consumers in the United States, who naturally prefer to satisfy their requirements by purchasing lower-priced foreign silver. It can be expected that for several years imports of silver will exceed exports.

COMPANY REPORTS

United Verde Extension Mining Co. Records Operating Loss

Copper: Arizona

A report of operations of United Verde Extension Mining Co. for the year ended Dec. 31, 1920, states that ore mined during the year amounted to 164,307 dry tons, averaging 12.84 per cent copper, 0.023 oz. gold, and 2.22 oz. silver, and that smelted during the year amounted to 161,617 dry tons, which yielded 41,942,700 lb. copper, 5.530 oz. gold, and 359.370 oz. silver.

The amount of ore developed and remaining in the mine above the 1,500 level is estimated at 1,148,800 tons, averaging 11.81 per cent copper, 0.023 oz. gold, and 2.22 oz. silver.

The operation of one furnace at the smelter during the year was continuous and the output was 41,942,700 lb. Costs per lb. were as follows:

Mining	$0.0343
Smelting	0.0214
Freight on ore	0.0010
Freight on bullion and refining	0.0274
Other expenses	0.0011
Total	$0.0852

These costs do not include (1) depreciation, (2) reserve to return capital (depletion), (3) taxes.

General conditions are satisfactory, with the exception of the additional cost of coal and coke at the mine and the increase in railroad freight rates, which must be reduced before the mining industry of the state becomes healthy.

The state and county taxes paid during 1920 amounted to $367,257.70, a burden which must be reduced in order that the demand for lower cost may be met.

Earnings for the year ended Dec. 31, 1920, follow:

Gross revenue from metals produced		$7,591,814 72
Other revenue		202,843 37
		$7,794,658 09
Deductions:		
Mine and smelter operating, freight and selling expenses, etc	$3,407,829 77	
Other expenses, including taxes paid and accrued	570,808 43	3,978,638 20
Earnings from operations		$3,816,019.89
Less:		
Amounts written off to reserves for depletion and depreciation		4,635,228.70
Net loss to surplus		$819,208.81

Dividends amounting to $2,100,000 were paid on the $525,000 capital stock outstanding.

Surplus account on Jan. 1, 1920, stood at $5,904,067.54; on Dec. 31, 1920, at $2,984,858.73.

Mount Lyell Mining & Railway Co.

Copper: Tasmania

A report of the Mount Lyell Mining & Railway Co., Ltd., for the year ended Sept. 30, 1920, indicates that 107,879 tons of ore was shipped from the Mount Lyell mine, containing 0.38 per cent copper, 0.99 oz. silver, and 0.038 oz. of gold per ton. The North Mount Lyell mine shipped 50,905 tons of ore, assaying 7.56 per cent copper, 1.36 oz. silver, and 0.11 oz. gold per ton, to the smelters, and 22,876 tons of ore, assaying 3.92 per cent copper, 0.58 oz. silver, and 0.008 oz. gold per ton to the flotation plant. The Lyell Comstock mine shipped 11,459 tons, assaying 2.15 per cent copper, 0.14 oz. silver, and 0.034 oz. gold, to the flotation plant. A comparative production table follows:

MOUNT LYELL PRODUCTION YEARS ENDING SEPT. 30

	1920	1919	1918
Copper, tons	4,536	5,314	5,705
Silver, oz	168,109	266,864	320,344
Gold oz	5,164	5,538	7,042

Costs per ton of ore amounted to £1 1s. 2d. for mining; £1 2s. 2d. for concentrating and smelting, and 2s. 7d. for converting copper.

The working account shows a profit of £152,162 7s. 3d. After deducting prospecting, development, and depreciation charges amounting to £57,059 19s., the net profit from all sources amounted to £76,007 11s. 8d. The company's liquid assets at Sept. 30, 1920, show a surplus of £533,861 19s. 9d.

The working account follows:

DEBITS

	£	s.	d.
Mining charges	180,494	5	11
Mine preparatory works overburden	4,110	18	5
Mount Lyell mine underground development	19,685	7	10
Ore concentration	32,948	0	4
Smelting expenses	154,535	16	7
Converter expenses (bessemerizing)	17,480	3	9
Railway traffic expenses, maintenance, management and repairs	34,896	15	4
Freight and charges on copper	55,990	1	4
Balance to profit and loss	152,162	7	3
Total	£652,303	16	9

CREDITS

	£	s.	d.
Blister copper and chemical works	622,045	4	2
Less ore purchase	3,064	0	7
	£618,981	3	7
Railway traffic revenue	33,322	13	2
Total	£652,303	16	9

A dividend of 2s. per share was paid Dec. 19, 1919, and a dividend of 1s. per share on June 28, 1920. Surplus balance on Sept. 30, 1919, was £411,003 5s. 2d., and £217,624 0s. 2d. on Sept. 30, 1920.

The company is capitalized at 1,300,000 shares of £1 each, of which 1,289,195 shares have been issued.

St. Mary's Mineral Land Co.

Copper: Michigan

A report on the affairs of the St. Mary's Mineral Land Co. for the year ended Dec. 31, 1920, follows:

RECEIPTS

Cash on hand Dec. 31, 1919		$95,953 79
Payments for wood and timber	$64,969.00	
Payments for surface	5,350.00	
Depletion of Champion Copper Co. ore reserves	300,000.00	
Distributions	1,280 00	
Dividends	312.00	
Notes collected	31,750 00	
Ground rent	4,519.50	
Interest	16,208.10	
Sundry other receipts	714 64	425,103 24
Total		$521,057 03

EXPENDITURES

Mayflower-Old Colony Copper Co. assessment	$3 00	
Naumkeag Copper Co. assessment	4,170 00	
Houghton Copper Co. advances	1,400 00	
Charter, capital stock, and land taxes	49,545 45	
Salaries and expenses at Portland, Boston and Houghton	26,784 32	
Treasury certificates of indebtedness	50,000 00	
1920 distribution No. 1	320,000 00	$451,902 77
Cash on hand Dec. 31, 1920		$69,154 26

No demand developed for mineral lands, which was perhaps not unnatural in view of the unsatisfactory price at which copper was selling for most of the year. No dividends were paid by the Champion Copper Co., but one capital distribution of $600,000 was made by that company for moneys set aside as representing depletion of their ore reserves. From the company's share of this distribution and similar distributions previously received, $2 a share on this company's stock was sent to stockholders as a distribution of capital on June 15 last.

MINING STOCKS

Week Ended February 19, 1921

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Adventure	Boston	....	....	*60		
Ahmeek	Boston	52	51	51	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	11/16	9/16	9/16		
Allouez	Boston	23	22	22½	Mar. '19	1.00
Anaconda	New York	39⅞	38⅝	38¾	Nov. '20, Q	1.00
Arcadian Consol	Boston	3	2¾	2¼		
Ariz. Com'l	Boston	8½	8⅜	8½	Oct. '18,	.50
Big Ledge	N. Y. Curb	⅜	5/16	⅜		
Bingham Mines	Boston	8½	8½	8½	Sept. '19, Q	.25
Calumet & Arizona	Boston	....	....	49½	Dec. '20, Q	1.00
Calumet & Hecla	Boston	254	249	251	June '20, Q	5.00
Canada Copper	N. Y. Curb			*13		
Centennial	Boston	9½	9½	9½	Dec. '18, SA	1.00
Cerro de Pasco	New York	29½	28¼	28¼	Dec. '20, Q	1.00
Chile Copper	New York	12½	11¾	12⅛		
Chino	New York	23¼	22½	22½	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*37½	*31½	*35½		
Con. Arizona	N. Y. Curb			1/16	Dec. '18, Q	.05
Con. Copper M	N. Y. Curb	....	....	2½		
Copper Range	Boston	35½	33¼	35	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*40	*36	*37		
Davis-Daly	Boston	7	6¼	6¼	Mar. '20, Q	.25
East Butte	Boston	9½	9¼	9¼	Dec. '19, A	.50
First National	Boston Curb	*100	*85	*90	Feb. '19, SA	.15
Franklin	Boston	2½	2⅜	2⅜		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol	New York	23	22⅝	22⅝	May '19, Q	1.25
Greene-Cananea	New York	23	22¼	23	Nov. '20, Q	.50
Hancock	Boston	3⅛	2½	2¾		
Howe Sound	N. Y. Curb	3⅛	3	3	Jan. '21, Q	.05
Inspiration Consol	New York	36¾	34¾	35⅜	Oct. '20, Q	1.00
Iron Cap	Boston Curb	7	7	7	Sept. '20, K	.25
Isle Royale	Boston	20½	20	20	Sept. '19, SA	.50
Kennecott	New York	19¼	18¼	18½	Dec. '20, Q	.50
Keweenaw	Boston	...	...	1½		
Lake Copper	Boston	3¼	3	3¼		
La Salle	Boston	2¼	2¼	2¼		
Magma Chief	N. Y. Curb			*21		
Magma Copper	N. Y. Curb	25	24½	24½	Jan. '19, Q	.50
Majestic	Boston Curb	*9	*9	*9		
Mason Valley	Boston	...	...	1¼		
Mass Consolidated	Boston	2½	2½	2½	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	4¼	3⅞	4¼		
Miami Copper	New York	18¾	18⅜	18½	Feb. '21, Q	.50
Michigan	Boston	3	3	3		
Mohawk	Boston	48¼	46	48¼	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5½	5¼	5¼		
Nevada Consol	New York	12	11¼	11¼	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	16⅜	16	16	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....	....	*5		
North Butte	Boston	12⅜	12	12⅛	Oct. '18, Q	.25
North Lake	Boston	....	..	*45		
Ohio Copper	N. Y. Curb	....	....	3/16		
Old Dominion	Boston	21	20	20	Dec. '18, Q	1.00
Osceola	Boston	28½	27½	27½	June '20, Q	.50
Phelps Dodge	Open Mar.	....	†165	....	Jan. '21, Q	2.50
Quincy	Boston	40	40	40	Mar. '20, Q	1.00
Ray Consolidated	New York	14¼	13⅛	13⅛	Dec. '20, Q	.25
Ray Hercules	Boston Curb	*75	*75	*75		
St. Mary's Min. Ld.	Boston	36	34	35	June '20, K	2.00
Seneca Copper	Boston	....	....	19		
Shannon	Boston	1¼	1	1¼	Nov. '17, Q	.25
Shattuck Arizona	New York	6⅞	6⅞	6⅞	June '20, Q	.25
South Lake	Boston		....	1		
Superior Copper	Boston	4 1/16	4	4	Apr. '17,	1.00
Superior & Boston	Boston	2¼	1¾	2¼		
Tenn. C. & C. cfs.	New York	8⅜	8⅛	8⅛	May '18, I	1.00
Toulumne	Boston	*65	*55	*57	May '13,	.10
United Verde Ex.	Boston Curb	29	27½	28	Feb. '21, Q	.50
Utah Consol.	Boston	5	4½	4½	Sept. '18,	.25
Utah Copper	New York	56	51¾	52½	Dec. '20, Q	1.50
Utah M. & T.	Boston	2¼	1 13/16	2⅛	Dec. '17,	.30
Victoria	[illegible]	2¼	2¼	2¼		
Winona	[illegible]		...	*75		
Wolverine	[illegible]	13¼	13	13¼		
NICKEL-COPPER						
Internat. Nickel	[illegible]	16	15½	15½	Mar. '19,	.50
Internat. Nickel, pf.	[illegible]	....	..	80½	Feb. '21, Q	1.50
LEAD						
National Lead	New York	72	71¼	71¼	Dec. '20, Q	1.50
National Lead, pfd.	New York	[illegible]	103	103	Dec. '20, Q	1.75
St. Joseph Lead	New York		...	11¾	Dec. '20, QX	.50
Stewart Mining	Boston		...	*6	Dec. '15,	.05
ZINC						
Am. Z. L. & S.	New York	[illegible]	8	8¼	May '20,	1.00
Am. Z. L. & S., pfd	New York	[illegible]	28	28¼	Nov. '20, Q	1.50
Butte C. & Z.	New York	[illegible]	[illegible]	5¾	June '18,	.50
Butte & Superior	New York	[illegible]	13	13	Sept. '20,	1.25
Callahan Zn-Ld	New York	[illegible]	[illegible]	6	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb		.	141	Feb. '21, Q	2.00
[illegible]	N. Y. Curb		.	3	July '16,	.03
Yellow Pine	Los Angeles			*59	Sept. '20, Q	.03
GOLD						
Alaska Gold	New York	1⅜	1⅛	1⅛		
Alaska Juneau	New York	1¾	1⅝	1⅝		
Carson Hill	N. Y. Curb.	....	....	22¾		
Cresson Consol. G.	N. Y. Curb	....	....	1⅛	June '20, Q	$0.10
Dome Extension	Toronto	....	....	*45		
Dome Mines	New York	16½	14¼	14⅛	Jan. '21, Q	.25
Golden Cycle	Colo. Sprgs.	‡	.	*73	Dec. '20, Q	.02
Goldfield Consol	N. Y. Curb	*10	*8	*9	Dec. '19,	.05
Hollinger Consol	Toronto	6.95	6.51	6.51	Jan. '21, M	.05
Homestake Mining	New York	50	50	50	Sept. '19,	.50
Kirkland Lake	Toronto	*56	*51	*51		
Lake Shore	Toronto	1.22	1.19	1.20	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	2.02	1.96	1.96	Jan. '21, K	.05
Porcupine Crown	Toronto	*23½	*20	*22¼	July '17,	.03
Portland	Colo. Sprgs.	‡	.	*60	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*7	*5	*6	May '19,	.05
Silver Pick	N. Y. Curb	*9½	*7	*7½		
Teck Hughes	Toronto	*10	*10	*10		
Tom Reed	Los Angeles	1.40	1.10	1.30	Dec. '19,	.02
United Eastern	N. Y. Curb	2 9/16	2½	2½	Jan. '21, Q	.15
Vindicator Consol	Colo. Sprgs	†...	.	*18	Jan. '20 Q	.01
West Dome Consol	Toronto	*8½	*7½	*8¼		
White Caps Mining	N. Y. Curb	*9	*7½	*7½		
Yukon Gold	N. Y. Curb	*100	*100	*100	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*25	*22	*22	Apr. '20, M	.03
Batopilas Mining	New York	1	⅞	⅞	Dec. '07, I	.12½
Beaver Consol	Toronto	*41	*38	*38	May '20, K	.03
Coniagas	Toronto	....	....	2.05	Nov. '20, Q	.12½
Crown Reserve	Toronto	*17	*17	*17	Jan. '17,	.05
Kerr Lake	Boston	3	3	3	Jan. '21, Q	.12½
La Rose	Toronto	*34	*30	*30	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*30	*30	*30	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.25	1.18	1.18	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	8⅛	8	8⅛	Jan. '21, QX	.50
Ontario Silver	New York	4¼	4¼	4¼	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	11/16	[illegible]	⅝	Jan. '12,	.10
Peterson Lake	Toronto	*8¼	*7½	*7¾	Jan. '17,	.01¼
Temiskaming	Toronto	*27	*26	*27	Jan. '20, K	.04
Trethewey	Toronto	*18½	*16¼	*16¾	Jan. '19,	.05
GOLD AND SILVER						
Atlanta	N. Y. Curb	*2	*1½	*2		
Barnes-King	Butte	‡....	....	1.11	Aug. '20, Q	.05
Boston & Montana	Boston	....	...	*63		
Cashboy	N. Y. Curb	*8	*6	*6½		
El Salvador	N. Y. Curb	7/16	5/16	5/16		
Jim Butler	N. Y. Curb	*17	*15	*16	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*11	*8	*10½	June '16,	.05
Louisiana Con.	N. Y. Curb	..	.	¼		
MacNamara M. & M.	N. Y. Curb	*18	*17	*18	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1 5/16	1¼	1 5/16	Jan. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1 3/16	1⅛	1 3/16		
Tonopah-Extension	N. Y. Curb	1½	1¼	1 7/16	Jan. '21, Q	.05
Tonopah Mining	N. Y. Curb	1½	1¼	1⅜	Oct. '20, SA	.05
West End Consol	N. Y. Curb	1 1/16	1	1 1/32	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N.Y. Curb	*12	*10	*11	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	1.17½	1.17½	1.17½	Dec. '20,	.15
Chief Consolidated	Boston Curb	2¾	2⅝	2⅝	Feb. '21, Q	.05
Consol. M. & S.	Montreal	20¼	19¾	19¾	Oct. '20, Q	.62½
Daly Mining	Salt Lake	.	....	2.50	July '20, Q	.10
Daly-West	Boston	. .	.	4	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb			2⅛	Dec. '20, K	.25
Electric Point	Spokane	*5	*5	*5	May '20, SA	.03
Federal M. & S.	New York	.	...	8	Jan. '09,	1.50
Federal M. & S., pfd.	New York	27	26½	26⅞	Dec. '20, Q	1.75
Florence Silver	Spokane	*17	*16	*16	Apr. '19,	.01½
Grand Central	Salt Lake		.	*37½	June '20, K	.03
Hecla Mining	N. Y. Curb	4½	4¼	4⅜	Dec. '20, QX	.15
Iron Blossom	N. Y. Curb	*20	*20	*20	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	...	....	3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	....	....	*9½		
Prince Consol	N. Y. Curb	⅜	¼	⅜	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*8	*7½	*7½	Feb. '19,	.01
Rex Consol	N. Y. Curb	*9	*7	*8		
South Hecla	Salt Lake	*67	*66	*66	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	3/16	3/16	3/16	Oct. '17,	.05
Tamarack-Custer	Spokane	2.04	2.00	2.00	Jan. '21, K	.04
Tintic Standard	Salt Lake	3.40	3.27½	3.27½	June '20, Q	.10
Utah Apex	Boston	2½	2½	2½	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*3½	*2½	*3	Nov. '17,	.01
QUICKSILVER						
New Idria	Boston	....	....	*95	Jan. '19,	.25
VANADIUM						
Vanadium Corp.	New York	37¾	35¾	36½	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	.	...	80½	Jan. '21, QX	3.50
Asbestos Corp., pfd.	Montreal	94	92	92	Jan. '21, QX	3.75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	44⅛	41¼	42⅞	Dec. '20, Q	1.00
Amer. Sm. & Ref. pf.	New York	82¼	82¼	82¼	Dec. '20, Q	1.75
Am. Sm. pf. A	New York	67	67	67	Jan. '21, Q	1.50
U. S. Sm. R. & M.	New York	34¼	33½	33½	Jan. '21, Q	.50
U. S. Sm. R. & M. pfd.	New York	43¼	42¾	43¼	Jan. '21, Q	.87½

* Cents per share. † Bid or asked. ‡ Quotation missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

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The Swinging Pendulum

"WHEN the devil was ill, the devil a monk would be." But when the old boy recovered he forgot his good resolves. With this as text the labor agitator has ammunition enough to work up a sermon of strong appeal to the workingman, even though his analogy and deductions be entirely wrong. To support his argument he need only quote from the report of the Institute's subcommittee on industrial relations, presented at the recent meeting. "Today," says this report, "it is estimated that the average reduction in wages of the non-unionized classes is about 24 per cent from the early high point of 1920, and the downward trend is in full progress. The labor unions have not yet fallen in line, but they cannot long hold off the inevitable. The efficiency is increasing day by day. *Already the hastily undertaken welfare schemes are being dropped, and despite the hollow protestations of many to give a 'square deal,' old and trusted employees are being laid off.* The law of supply and demand remains inexorable. The pendulum has swung back; employers are again masters of the situation."

Words are winged. This blanket indictment is unfortunate. The facts should have been given. If the sentence in italics (our own italics) be untrue, it better had never been written. If it be true, then there is something rotten in the mining industry, for this is practically a charge of hypocrisy against the operators who have "hastily undertaken welfare schemes." Obviously, the great mining corporations who have long devoted much time and money to industrial relations work are not included, but one may rest assured that the soap (or dynamite) box orator will not make this distinction.

To what extent, then, have welfare schemes been dropped and old and trusted employees laid off? Most operators, large and small, have been forced to curtail or suspend. The small company compelled to close is hardly likely to continue its welfare work, nor will the workman object, for, his pay check stopped, he is looking elsewhere. The larger producer, in most cases in a more or less permanent camp, is continuing his welfare program, for he knows that present conditions are but temporary and that it will pay in the long run.

We doubt that old and trusted employees are wantonly being laid off. Good business dictates otherwise. News from all districts during the last few months indicates that operators are seeking to effect curtailment and at the same time keep their organizations together. But when business crises come, even the trusted employee may have to go, for what other course is open, the millennium being not yet arrived? He will usually be the last to go, however.

The pendulum has indeed swung back, and the employers are once more the "masters" of the situation, as the committee says. It is well that all bear in mind, however, that the pendulum's swing continues, that the struggle between capital and labor is not over, and that the lamb and the lion, or rather the lion and the tiger, are not yet ready to mix on equal terms. More than once agitators have said that welfare schemes had been forced on operators, that they denoted fear on the latter's part rather than sincere good will, and were evidence of what the unions had done for labor. The company today that drops its welfare program because it feels that now it once again is master, helps to convince the workingman that the agitators spoke correctly, and the cause of organized labor is thus strengthened.

We are going through the reconstruction period heralded and looked forward to during the war. Mining companies now have an excellent opportunity to establish good relations with their men on a firmer basis than ever before. Wielding the big stick will give only a temporary advantage, and be repented of later. Recently, at Butte, operators and union representatives met, and the latter were told that oppressive working rates must come down or the companies would break with the unions for good. Experience has shown that labor at Butte needs curbing, and the attitude of the operators seems justified. But the latter will do well to remember that the pendulum will again swing back, as it has in the past, and that folly now will mean extra trouble then.

Mining Versus Engineering

THE LIFE of a mining engineer is divided among his business or professional duties (his work), his personal or domestic relations, his relaxation and social relations, his duties and functions as a citizen, and his group ties and duties. By the last we mean his co-operation and team work as a unit of those groups of men with which he is naturally most affiliated. The all-round man makes a proper balancing of his time, money, work, and loyalty among all of these. No longer can he live on such a simple daily schedule as "eight hours for work, eight hours for play, eight hours for sleep." His schedule, considered week by week, or month by month, or year by year, will become more and more complicated as he ascends in the scale of life.

For the moment, we wish to dwell on the group ties and duties. Take yourself as a typical mining engineer, and submit your affiliations to logical analysis. That is something which is done all too rarely. As your title indicates, your profession is a combination of two callings—mining and engineering. You practice engineering as applied to mining. Right here two distinct affiliations are discovered. Are you more engaged and interested in the calling of mining or in that of engineering? Some of our readers, after consideration, will indicate the latter; but by far the great majority will decide for the former.

There are several organized [illegible] groups which claim your affiliation and participation. To put it briefly and epigrammatically, [illegible]

Institute of Mining and Metallurgical Engineers, which represents the engineering of mining; the *American Mining Congress*, which represents the politics of mining; the *Mining and Metallurgical Society of America*, which represents the policies of mining. We believe these definitions will be, and indeed have been, practically recognized and accepted by the societies in question. Also there is the *Society of Economic Geologists*, which represents the geology of mining. From a consideration of these four national mining societies, it is relatively easy for each to determine what phases of mining thus represented merit his interest and support, and in what degree. Of these four societies, the first and in a way the fourth are engineering societies; they represent the technology of mining. The second and third do not concern themselves with engineering problems properly speaking, and so are not essentially engineering societies, although the third is composed exclusively, and the second to a very considerable degree, of engineers.

So much for the mining groups. Of the engineering groups there are a number, especially the Four Founder Societies, comprising, besides the mining engineers, the civil engineers, the mechanical engineers, and the electrical engineers. Also, there are the chemical engineers, represented by the American Chemical Society. All these are tied together in interest, not so much by occupation as by class: they represent the application of various sciences to various industries, and are affiliated by reason of these facts, although the industries in which they labor are very diverse. Recently two successful attempts have been made to co-ordinate and combine the engineers into central organizations working more efficiently, the American Association of Engineers, which has many thousands of members, and whose object is primarily the economic welfare of the engineer members, and so has something of the aspect of a union; and the Federated American Engineering Societies, which aims to make effective the judgment and influence of the engineer as a citizen.

Your representation as a member of the engineer group is, therefore, well organized and co-ordinated. Your representation as a member of the mining group is also well provided for by the societies mentioned, but the central co-ordinated organization of this group has not yet been properly effected. There are signs that this is coming, however, as indicated by the appointment of certain co-ordinative committees, and the clearer general conception of the situation.

We cannot help feeling that the mining engineer is closer to the mining group than to the engineer group, lives more with his industry than with his class; and, therefore, that the mutual understanding and close co-ordination of the organizations representing the former group is, if anything, more vital to him than in the case of the latter.

International Use of "Engineering and Mining Journal" Quotations

FREQUENTLY letters and advices come to our office from out-of-the-way places of the earth requesting information about the market quotations for various metals and minerals, a circumstance that significantly denotes the widespread use of *Engineering and Mining Journal* quotations. This tendency has been especially marked of late when copper and other ores and mattes have been shipped to this country for reduction and refining from the four corners of the globe, necessitating some basis for equitable settlement not subject to exchange fluctuations. From North and South America to Africa the story is practically the same—shipments on *Engineering and Mining Journal* quotational settlements.

We have noted the regular appearance in the pages of *The Metal Bulletin*, of London, a tabulated list of *Engineering and Mining Journal* average prices for the major metals, attesting to the interest attached in metal-market circles abroad to our own quotations.

Hoover in the Cabinet

WE SALUTE the new Secretary of Commerce, Herbert C. Hoover. In a fog of political backing and filling, his appointment shines as a beacon of hope to a people harassed and distressed by the vacillation and incompetence of their misrepresentatives at Washington. Hoover measures up to the job; and no other man in the Republic possesses in so exceptional degree the confidence and love of his fellow citizens. His opportunity for great constructive service is without limit.

Hoover will have the country solidly behind him. The President-Elect has in this appointment at least consulted no other interest than the public welfare.

"Only a Correspondence School Mining Engineer"

SOME TIME AGO we used this phrase in an editorial, and were promptly taken to task for it by several correspondents, one or two of whose letters we published. As we looked over their letters, we agreed entirely with the points that they made—that the school did not make the engineer, that many graduates of engineering schools were worthless until they had had practical experience and training, that some high-class mining engineers had had little or no engineering school training; and that the initiative shown by a man who took a correspondence school course was some earnest of his character and, therefore, of his ultimate ability. Certainly we could agree with them in their contention that to be a correspondence school mining engineer was not necessarily to be labelled incompetent.

However, after due reflection, we submit the following evident facts: The personal character of a man, his energy and mental capacity, determine largely his worth and career. That is the natal difference between man and man. We have observed, for example, a man of the negro race vainly striving at college to assimilate the sciences, battling against an infinitely ancient unfavorable line of ancestry. Nevertheless, he went back home more quickened than if he had never seen the inside of a university.

In other words, the engineer is neither the man nor the training alone, but the man plus the training. The best engineer is the combination of the best man plus the best training. That the training is an essential part needs no arguing: or that the schools of mining engineering represent the best and most approved method of intensive training that assembled modern thought has been able to advise. If this were not so, we should need no mining colleges, no universities—no schools at all, in fact. Our correspondents will see to what unwarranted conclusions their generous thought will logically lead them.

Unquestionably, therefore, a correspondence school, shorn of the intimate personal contact and adequate laboratory training, is, it goes without argument, inferior to the real mining school. Where one can point out a case where a man who has thus been educated finally excels, one can find a dozen instances where men instructed by means of the correspondence course have simply acquired thereby that little knowledge which is a dangerous thing. Therefore, the correspondence school mining engineer as a class (and eliminating the variable element of the man) is altogether inferior to the mining engineer trained in the institution where he must give all his time and personality to his task, and where his teachers give him the benefit of personal contact. If the man who takes a correspondence school course shows initiative which foretells eventually a good engineer, what shall we say of the initiative which impels a man to devote his entire time for years to the task? The mining schools are full—very full—of men who have worked to get there, and many of whom break off in their course to spend a year or so in work, that they may accumulate money enough to finish.

The recognition of the schooling as an essential part of education—which is indeed axiomatic—may be easily and logically followed further, to the recognition that the highest example of the "regular" mining schools turns out, as a class, men who will be, in the end, better mining engineers than those who attend inferior schools. Otherwise, there would be no sense in mining schools striving for excellence or a high standard.

The reader who has thought thus far along these lines may well extend his reflections as to what a mining school should be, what are the best schools and why, and what the less desirable ones. We are much interested in this vital problem, and hope later on to take it up more carefully.

Where Copper Products Cost Less Than Iron

WE MAY have been too conservative, after all, in a recent issue, in suggesting that copper screening should not sell for more than 5 or 6c. per square foot instead of 15c., when iron screens were 4c. Our Berlin correspondent, as mentioned in the *Engineering and Mining Journal* of Feb. 12, states that "experience has conclusively proved that the cost of manufacture for copper and copper-alloy parts is in almost every case lower than for parts made of any other material, particularly of iron." Small screws, he says, can be made more economically of brass than of iron. High labor costs are the chief reason, copper and brass being easier to work. Can any of our readers imagine anything made of copper selling for less than its iron counterpart in this country?

So far, we have heard of no active campaign to reduce these prices nor to investigate if and why they are too high. The Copper and Brass Research Committee will no doubt give the subject its close attention. It is something which should not be delayed until business becomes good again, but which demands immediate action.

Some of the London journals continue to belittle the efforts of the American copper producers in widening their market: *The Metal Bulletin*, for example saying editorially in its issue of Jan. 25 that producers should have perceived the folly of demanding "famine prices" (18 to 19c.) last year without appointing a research committee to discover it. We do not think that copper has at any time been held at unjustifiably high prices, and, furthermore, since the price was reduced, less of it has been sold than when the price was higher. The demand has simply been absent at any price. However, the price of manufactured copper does seem too high. In widening the uses of and the demand for copper the committee has a big field, and one that will afford it ample opportunity to justify its existence.

Unwise Legislation

AN ATTEMPT is being made to legislate the oil industry of California into the class of public utilities by the present Legislature of the state. Of the several bills which have been introduced, one of the shortest, an Assembly bill, provides that:

"Every corporation, individual, or association of individuals, now or hereafter engaged in this state in the business of producing, refining, buying and selling or transporting crude petroleum or any of its products (except for its, his or their own use) is hereby declared to be a public utility, and shall be subject to the jurisdiction, regulation and control of the railroad commission of the State of California, and shall be subject to the provisions of this act and to all the provisions of the act of the Legislature of the State of California known as the Public Utilities Act approved Dec. 23, 1911, and of the acts amendatory thereof and supplementary thereto, which are in their nature applicable to the regulation of the public utilities herein created, where not in conflict with any of the provisions of this act."

Although the oil industry serves the public in a no uncertain way, it lacks many of the characteristics which determine a public utility. Power, light, telephone, water, and transportation are in themselves industries that serve the public, and in California operate under specific regulations prescribed by certain commissions. The petroleum industry of California is essentially a mining industry, highly organized, it is true, but operating now under the law of supply and demand. Presumably if it were to become a public utility, prices for crude petroleum and for the market products obtained therefrom would be subject to price control and regulation. It is difficult to see how this could be done.

Production of crude petroleum is sustained only by energetic action of the companies. Refining and marketing have been stabilized and standardized as much as circumstances will permit, but production depends upon individual incentive, business courage, and a relatively large capital account. New discoveries reward only a portion of the energy and capital expended. Without crude petroleum there would be no refineries, nor marketing, nor gasoline and lubricating oils. Valuation of oil lands is uncertain and at best extremely approximate.

Individual incentive is one of the most potent factors that have operated to build up our mining industry. Excessive regulation—and the mining industry has a good deal of regulation now, both state and Federal—will operate to curtail individual incentive, and in the long run the public will pay. Low-priced petroleum, and cheap copper, lead, and zinc are the direct result of the operation of the law of supply and demand. The public has benefited. The experience [illegible] of the post-war period prove the [illegible].

We hope that these bills will die in committee, as they represent the excrescence of a [illegible] bent upon forcing their extreme views [illegible] already burdened with many commissions [illegible] annual tax

WHAT OTHERS THINK

The Difficulties of the Consolidated Arizona Smelting Co.

Referring to your editorial in the issue of Jan. 29, entitled "Cheap Copper Hard on Yavapai County," I certainly appreciate the kindly reference to myself and my management of the affairs of the Consolidated Arizona Smelting Co., but I think you are not quite fair to Yavapai County, and naturally you have not been conversant with the special troubles of the Consolidated Arizona Smelting Co.

As to Yavapai County—you will surely recall that it contains the United Verde and United Verde Extension, two of the greatest and most profitable copper mines in the country, and there are several smaller mines, which, under normal conditions, hold a modest place among the ranks of steady and profitable producers.

As to the Consolidated Arizona Smelting Co., from the first of 1915 until the end of 1919 this company produced thirty-four million pounds of copper from its own mines, the Blue Bell and De Soto, and the net cost of production, after crediting gold and silver, was 15c. per pound. Certainly we could not claim to be among the most favored or the largest copper producers; yet considering the fact that much of this copper was produced with an extremely inadequate and inefficient equipment, and the remainder at a time when general operating costs were extremely high, the record would make it appear that your statement that "Copper had to go to 30c. per pound before the company paid its first dividend" is rather misleading.

The fact was that the company was heavily in debt at the beginning of 1915, that its mines were badly underdeveloped, and that it possessed an obsolete and almost useless equipment at mines, mill, and smelter. The earnings of the company, beginning with the first of 1915, were used, first, to pay a part of the debt and to replace and rebuild the plant, for which latter purpose $1,800,000 was required; also, dividends were paid, all from earnings; but, unfortunately, the company never did get out of debt, and when the Government returned about six million pounds of copper at the end of 1918 (some of which was custom copper purchased on the basis of 26c. per pound), the subsequent forced sale of this material at the low prices of the spring of 1919 reduced its value by approximately $500,000.

Since then the company has struggled to get back on its feet, but copper-market conditions were unfavorable, and the last drop of 6c. per pound from September to December of 1920, coupled with some financial troubles of a peculiar nature, made the struggle hopeless.

Personally I have believed and still believe that if this company can be reorganized on a sound financial basis, free from debt, and with proper funds provided for working capital and for mine development, it can continue to produce its own copper with profit for a number of years, and although I agree that there is no chance for custom business with 12c. or even with 15c. copper, I am convinced that before the price returns to 20c. many other properties will open up, and that our custom business can again be made as extensive and profitable as it was during the last five years, and that among the prospects of Yavapai County several more real mines will be developed.

G. M. COLVOCORESSES.

Humboldt, Ariz.

The Iron Cap Mill in 1920

In his article on Arizona in your Annual Review number of Jan. 22, Mr. Mitke is good enough to give the Iron Cap mill (completed during the year) favorable mention, calling attention to a recovery at times averaging over 90 per cent. There is an unintentional error in this statement which I would like to correct.

The Iron Cap mill was completed and started in operation in June, 1920. It operated steadily until curtailment of production became necessary in November. It is operating on about one-third time now, is making concentrates having a round-number average of 30 per cent copper, 30 per cent insoluble, and 30 per cent iron from a siliceous ore containing approximately 100 lb. of copper per ton (8.4 lb. of which is in an oxidized or acid soluble state) with a recovery that often exceeds 95 per cent, and has not been as low as 90 per cent for a single day since the mill was started. The average recovery for 1920 was 93.5 per cent of the total copper content of the ore handled.

DAVID COLE.

El Paso, Tex.

The Legal Status of Oil-Shale Deposits

In the letter of Leroy A. Palmer, under the heading of "The Legal Status of Oil-Shale Deposits," in *Engineering and Mining Journal* of Feb. 5, Mr. Palmer states that the width of lode claims in Colorado is 150 ft. on each side of the lode line. He is way out of date, as in 1913 the Legislature amended the law, so that except in the counties of Gilpin, Clear Creek, Boulder, and Summit, the claims are the full size allowed by the Federal laws, namely, 300 ft. on each side of the center line. In the four counties named, the width is 150 ft. on each side of the center line.

The present Legislature is considering a bill to make the width in these counties the same as in the rest of the state.

HORACE F. LUNT.

Denver, Col.

The Correspondence School Engineer

After reading the letter of Leroy A. Palmer in the Feb. 12 issue of the *Engineering and Mining Journal* I desire to say that I commend his action in sticking up for the correspondence school engineer. I haven't gotten above common labor in mining work as yet, but am making an effort to do so through a correspondence course in mining engineering, and it certainly is slow, uphill work. The contemptuous reference in the article referred to is most humiliating and discouraging; also snobbish and narrow.

Tonopah, Nev

RALPH M. CRAFTON.

THE FREDRIKSTAD COPPERWORKS IN NORWAY: A RAMENIA INSTALLATION

Chloridizing and Leaching as Practiced in Sweden

The Ramenia System of Treating Pyrites Cinder and Roasted Concentrates Containing Copper and Zinc—Leaching and Precipitation Difficulties Overcome—Spent Ore Valuable for Its Iron Content

BY N. OSTMAN

Written for *Engineering and Mining Journal*

THE chloridizing process should be given more consideration by metallurgists than has so far been accorded it. Many ores and concentrates now being reduced by other smelting operations could be treated to better advantage by the chloridizing method, which not only assures a higher total extraction of the metals ordinarily recovered, but in many instances also allows the recovery of the iron as a desirable iron ore.

The chloridizing process was invented by Longmaid in 1844, and in 1859 was applied to the extraction of copper from pyrite cinders by Henderson; therefore the name, the Longmaid-Henderson process. It consists in roasting the finely ground roasted pyrite or other sulphide ore with salt, whereby the copper compounds are made soluble. Many have stated that this process could be practiced only with ores containing less than 5 per cent of copper and that zinc, if present, could not be brought into a soluble state. It will be shown, however, that it has been successfully carried out with roasted concentrates containing 7 to 8 per cent of copper, and is, in fact, used in connection with the manufacture of lithopone.

CHEMICAL REACTIONS

Although the art of chloridizing cuprous cinders is comparatively old, few improvements had been made until the beginning of this century. At that time Ramén, then technical manager at the Copperworks in Helsingborg, Sweden, began research investigations, both theoretical and practical, to put the whole process on a more economical basis. In doing this work Ramén developed some new theories, by which he explains to a certain degree the chemistry of the process. To relate here all the reactions that take place in chloridizing roasting would be to go outside the scope of this article, and only the most recent work will be discussed. For a closer study of these reactions see Kothny in *Metallurgie*, 1911, heft 13, and Klason in *The Mining Magazine*, December, 1918. Ramén says:

> The process, in my opinion, depends principally upon gas reactions. One must assume an oxidation of the sulphides by the air, the iron pyrites being the most important of these sulphides. Thereby the sulphides are decomposed into metal oxides and oxygen radicals, which again drive the chlorine out of the common salt. The chlorine then acts, chloridizing as free chlorine.
>
> 1. $2\ CuCl_2 + RS = 2\ CuCl + S + RCl_2$
> 2. $2\ FeS_2 + O_{11} = Fe_2O_3 + 4\ SO_2$
> 3. $SO_2 + O + 2\ NaCl = Na_2SO_4 + Cl_2$
> 4. $CuS + Cl_2 = CuCl_2 + S$
>
> It is evident that these reactions are theoretical, so that the intermediate stages must be imagined. SO_2 forms first, which, owing to the effect of the furnace mass as a contact substance, is oxidized to sulphuric acid. But even assuming a direct conversion:
>
> 5. $RS + O_4 = RSO_4$
> 6. $RSO_4 + 2\ NaCl = RCl_2 + Na_2SO_4$
>
> between the salt and the oxidized sulphides, one has clearly to deal with a gas reaction, an oxidation with the aid of the oxygen in the air. It is possible that reactions 5 and 6 take place, although I consider that 2, 3 and 4 are especially important for a complete roasting of the copper to chloride.

In another connection Ramén says:

> The theories I advanced a few years ago on chloridizing roasting, which at the present time is performed in most metallurgical works in the well-known Ramén-Beskow mechanical furnaces, seem for the greater part to have been confirmed by experience. It has been proved with a certainty that the mass acts as a contact substance in the formation of the chlorine necessary for the reaction, and I consider it proved that this action takes place principally by alternate oxidation and reduction of the iron compound

present in the mass. It is also shown that the roasting is more complete in cases where the ore contains much iron than when it is poor in iron.

Later, Klason investigated these reactions and found support for Ramén's theories. In his investigations, Ramén laid special stress upon the fact that, considering the whole of the reactions that occur in chloridizing roasting, they are exothermic, so that an excess of heat is created, once the proper ore mixture has been brought to a temperature high enough to set the reactions going. Following up this idea, Ramén proved conclusively that if the ore had the right composition, and the heat of reaction was retained in the ore, it was not necessary to apply more heat to the roasting operation than was required to get the reactions started. To apply this to practice, Ramén, together with Beskow, at that time manager at Helsingborgs Superphosphate works, developed the Ramén-Beskow furnace.

The furnace is of the multiple-hearth type, having a revolving central shaft to which are fastened interchangeable arms provided with removable blades or rabbles. The heat, generally created by burning producer gas, is applied to the first floor, and the combustion gases go through a special flue to the stack. Between the first and second floors is an arrangement by which these two floors are separated from each other, so that the furnace really consists of two separate compartments. The acid gases, which form in the lower compartment, leave through flues leading to towers, where these gases are condensed by water. The draft of the furnace is regulated by fans. The air passing through the furnace is under close control, so that rich acid gases are obtainable, resulting in a uniform and strong tower acid. To preserve the heat in the furnace and also to take full advantage of the ground space around it, the furnace, though the working floors are circular, is built square-shaped, the corners being used for flues. The illustration shows this feature. Two horsepower, practical operation has demonstrated, is sufficient to run a furnace having a daily capacity of fifty metric tons of cinders.

The ore mixture on the first floor is brought to a temperature of about 300 deg. C. As the chloridizing action sets in on the second floor, the heat increases, and the maximum temperature reached is about 550 to 600 deg. C. By avoiding the introduction of extraneous heat to that part of the furnace where the chloridizing reactions set in, the temperature is even and overheating cannot occur. Loss of copper by volatilization therefore does not take place, and the caking of the ore is insignificant. In furnaces fired directly at all stages of the roasting or by muffle effect, caking of the ore becomes at times very serious and makes necessary frequent barring of the hearths, which is tedious and hard work.

OSCARSHAMN COPPERWORKS, OSCARSHAMN, SWEDEN

In the following table a comparison is given between this furnace and the old hand-muffle furnaces. The cost figures are given in Swedish kronor (Kr.) per ton of ore, based on pre-war prices:

COMPARATIVE ROASTING COST

	Hand-Muffle Furnaces Per Cent Based on Weight of Ore	R.-B. Furnaces Per Cent Based on Weight of Ore	Hand-Muffle Furnaces Kr. Per Metric Ton Ore Roasted	R.-B. Furnaces Kr. Per Metric Ton Ore Roasted
Coal.... ..	About 10	1.6 to 2	1.44	0.21
Repairs .			0.33	0.25
Wages.. ..			2.09	0.36
Total Kr. per metric ton ore roasted			3.86	0.82

Acid recovered, 1 to 1.5 per cent.; 2 to 2.5 per cent.
Cu in purple leached ore, 0.12 to 0.20 per cent., 0.05 to 0.09 per cent.

The figures refer to Helsingborgs Copperworks, Sweden, where hand-muffle furnaces were used before the Ramén-Beskow furnaces were introduced. Nine of these Ramén-Beskow furnaces are now in operation in this plant.

The Oscarshamn Copperworks, at Oscarshamn, Sweden, is of special interest, as it was put in operation only about two years ago and contains all the latest improvements that characterize the Raménia system.

A BATTERY OF RAMÉN-BESKOW CHLORIDIZING FURNACES AT THE HELSINGBORG COPPERWORKS

The plant, being situated on the coast, receives all the cinders by barges. These barges are unloaded by an electric traveling crane, provided with a grab bucket, the cinders being loaded into a hopper car, which is pushed into the cinder storage and emptied. This cinder storage is under roof and holds several thousand tons of cinders. With the same crane, other storage bins are filled, holding a twenty-four hours' supply of cinders and salt. Below these bins are weighing hoppers. By this arrangement it is possible closely to regulate the percentage of salt in the mixture, also carefully to mix the cinders, of which several kinds are generally in storage. The Scandinavian plants handle mostly Norwegian pyrite cinders, and as there are several different pyrite mines in Norway whose product differs widely both chemically and physically, the different cinders must be kept separate. One man weighs out in one eight-hour shift sufficient ore to last twenty-four hours. From the weighing hoppers the ore and salt go to the screens and the milling plant.

THE MILLING

To secure a good extraction of the copper, it is essential that the ore be properly ground before going to the furnaces. The ore treated by the chloridizing process is generally a previously roasted ore, which is soft and easily ground. It is important that the ore going to the furnace should not contain any too coarse particles, nor be ground to contain a large percentage of dust. Various types of mills have been used, but for the Norwegian pyrite cinders the Kent mill has been proved to be particularly suitable. A combination of Kent mills and screens is used and the ore is ground all to pass a 10-mesh screen.

Two Kent mills are installed in this plant, but only one is in use, the other being a reserve. It is wise to have one spare mill in case the other should get out of order, or the ore should be too coarse or too hard to allow a twenty-four hours' supply to be ground in the one mill in eight hours. There is storage capacity for 150 metric tons of ground ore.

The percentage of salt varies greatly. With some ores, containing up to 6 per cent of zinc the salt consumption is large, up to 20 per cent. In cinder mixtures with 2½ to 3½ per cent of copper and 2 to 3 per cent of zinc, 12 to 16 per cent of salt is used.

The roasting department consists of two seventy-five-ton Ramén-Beskow furnaces of the type already described. They are fired with producer gas, made from tarry wood. A fan blows the gas into the furnace, while by another fan, air is blown in and mixed with the gas at the gas intake. The wood consumed corresponds to about 2 per cent of coal, based on the weight of the cinders. To get the proper heat of reaction in the roasting operation, about 3.5 to 4 per cent of sulphur is wanted in the cinders, when these contain [illegible] per cent of copper. The cinders which are used [illegible] contain 4 to 6 per cent of sulphur, partly [illegible] high percentage of zinc. Cast iron fa[illegible] between the furnaces and the acid to[illegible]. [illegible] driven by motors provided with speed [illegible] which allows a close control of the draft. The furnace motors also have speed regulators.

One man on each of three eight-hour shifts attends to the two furnaces. On the day shift, one extra man helps the furnaceman to change the blades on the rabble arms and do the necessary barring on the floors. One man on each shift and one helper on the day shift, a total of four men, are thus required to attend to the two furnaces. In Helsingborgs Copperworks, where nine furnaces are operated, four men attend to three furnaces.

Tests were made recently on flotation concentrates made from Sulitelma pyrite. The desulphurized concentrates assayed Cu, 7.2 per cent; S, 4 per cent, and Fe, 42.5 per cent. These calcines were mixed with salt, the mixture containing 23 per cent of NaCl, and chloridized in a fifty-ton Ramén-Beskow furnace. In leaching the chloridized concentrates a bed, three feet deep, was kept in the tanks, and the purple ore, secured after leaching, contained 0.09 per cent of copper.

LEACHING

In leaching chloridized pyrite cinders in the old way hard lumps often form on the bottom of the leaching tanks, which lumps or cakes may cause a considerable delay in the leaching operation. In some plants this formation has been so bad that thousands of tons of such lumps have accumulated, not only giving great difficulties in recovering the copper from them but also causing considerable operating losses. To overcome this lump formation, Ramén designed the *pre-leaching machine*. In this apparatus a thin layer of the roasted, hot material from the furnaces is evenly sprayed with just so much water that the anhydrous sodium sulphate, which causes the formation of lumps, gets enough water for crystallization, thereby becoming easily soluble. The ore is moistened, but still remains in a powdery state.

A considerable amount of steam is generated during this process, which is condensed, giving hot water for the leaching, usually enough to eliminate the use of additional steam for heating purposes. In a plant leaching the hot ore according to the old method, there always was an atmosphere of steam and dust, which was very destructive to the woodwork and particularly corrosive on the iron and machinery. By using the leaching machine, this nuisance is entirely overcome, and a leaching plant having this apparatus is characterized by a clear atmosphere and, on account of the absence of all dust, by a clean appearance.

By preparing the chloridized ore in the leaching machine before going to the leaching tanks, a uniform leaching is obtained, and the time of leaching is considerably shorter than with the old way. The pre-leaching machine is run continuously, and the pre-leached ore then goes to a storage bin, where it is picked up by a grab bucket and placed in the leaching tanks. Two pre-leaching machines are erected at Oscarshamn, of which one is a reserve. To attend to this machine, one man is required for each eight-hour shift. This man, however, also does miscellaneous work around the plant.

The leaching tanks in Oscarshamn are built of reinforced concrete. They hold eighty to ninety metric tons of calcines and have an ore bed about three feet deep. The ore, after passing through the pre-leacher, is still hot enough to give the liquors such a temperature that the copper can be precipitated without the addition of extra heat, and yet not hot enough to damage the leaching tanks. The time of leaching, before these machines were used, was from thirty-five to forty-five hours to each tank, but this new system allows this time to be cut in half.

The liquors in the leaching department are pumped by centrifugal pumps of wood construction, which have been used ever since the plant was started and have proved successful. Air lifts are also used as a reserve.

From what was said in connection with the furnaces it can be understood that the tower acid is strong. It is kept with an acidity of 15 to 20 gr. HCl per liter. This acid allows a thorough extraction of all soluble copper. I may say, in this connection, that the Norwegian ores which are being treated here form less water-soluble copper in the chloridizing process than do the Spanish ores. A final wash with water is given to the purple ore before it is dug out. After the ore is thoroughly leached, the purple ore, containing, on an average, not over 0.07 per cent of copper, is dug out by a grab bucket.

The labor required to attend to this leaching plant is one craneman to each of two eight-hour shifts, and one leacher to each shift, making a total of five men in twenty-four hours. If the plant were extended to handle 300 metric tons in twenty-four hours, the crane would have to run another eight-hour shift, so the number of men in this department would then be increased by just one man.

In European copper works which have to buy their cinders the copper is expected to pay the cost of the whole process, and the profit lies in the purple ore. It is therefore readily understood that the production of a high-class purple ore with low copper and sulphur, such as is obtained here, is of the greatest importance.

PRECIPITATION

The chloridizing process, as it formerly was carried out, required a large number of men. With the present high price of labor it has therefore been necessary to reduce the number of men in the precipitation department by introducing mechanical aid. Precipitation is being done in revolving iron drums of large cubical contents, suitably lined to prevent corrosive action of the copper liquors on the iron. This mechanical precipitation, as carried out in Oscarshamn, also precludes the use of steam for heating the copper liquors. The solutions going to the precipitation process have a strength of 20 to 30 gr. of copper per liter. This liquor runs by gravity from the leaching department to storage tanks in the precipitation department and has a temperature that is sufficient to allow a good precipitation of the copper in the drums. It is only in very cold weather or when the liquors for some reason have been stored so long that they have cooled down considerably that steam is being used in heating the liquors. The only manual labor required in the precipitation department is for filling scrap into the drum and for emptying the filter presses.

While the liquor is running into the drum, the scrap iron is thrown in, whereupon the drum is started revolving. This operation requires from thirty to sixty minutes. After the copper is all precipitated it is transferred to a filter press and well washed.

This system of precipitation has several advantages, compared with the old way of precipitating in open tanks. Some of these advantages are:

1. The number of men employed is reduced to about one-half.

2. The solutions are treated at temperatures ranging

from 30 to 40 deg. C. By precipitating the copper in a closed vessel, the heat of reaction produced is utilized, and extra steam for bringing the liquors to the proper temperature is not necessary.

3. By pumping the liquors with motor-driven centrifugal pumps, steam siphons, so expensive in operation, are also discarded.

4. The air being excluded in the precipitation process, practically no basic iron compounds will be thrown down with the copper, resulting in a purer cement copper than is otherwise obtained.

5. The copper cement produced contains 85 to 90 per cent of copper, against 65 to 75 per cent with the old method.

6. By washing the cement copper in a filter press, a product is secured containing very little chlorine.

7. The copper in the waste liquor is infinitely small.

Two men on each of three eight-hour shifts, or a total of six men, attend to this department. With a 300-ton plant the same number of men would take care of the precipitation department. The following table indicates the labor requirements of the respective operations:

RÉSUMÉ OF THE LABOR USED IN THE OSCARSHAMN COPPER-WORKS, HANDLING 150 METRIC TONS CINDERS PER TWENTY-FOUR HOURS

	Number of Men per 24 Hours
Cranemen	
1 in the cinder storage on one 8-hour shift	3
2 in the leaching plant on two 8-hour shifts	
Milling	
1 weigher, on one 8-hour shift	2
1 attending to the crusher on one 8-hour shift	
Roasting and Chloridizing	
3 furnacemen, one man on each of three 8-hour shifts	6
3 for the gas generator	
Note: The gas is also used to fire a boiler. These three men are not needed if firing with oil.	
Leaching	
3 leachers, one on each of three 8-hour shifts	6
3 for the pre-leacher, one man on each of three 8-hour shifts	
Note: The three pre-leacher men are also used to do miscellaneous work around the plant.	
Precipitation	
2 men on each of three 8-hour shifts attending to the drum and the filterpress	6
Extra	
1 man as helper to the furnacemen	1
Foremen	3
Total	27

If the plant were doubled to 300 metric tons capacity, only nine men more would be required as follows:

3 furnacemen, 3 tending the ore going to the furnaces, 1 weigher, 1 millman, 1 craneman	9
Total	36

To this must be added the repair gang, which in Oscarshamn was made up of

Machinists	4
Leadburner	1
Helpers	4
Electricians	3
Carpenters	2
Total	14

The number of men in the repair gang depends on the plant in general. In the operations discussed no other process is connected with the plant, so the copper process must carry the whole burden of these men, whereas in most other works the cost of the general repair gang is divided among several processes.

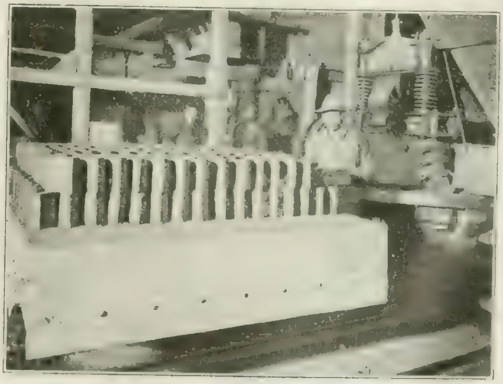
In one foreign plant using old methods and treating 300 metric tons of cinders daily, a force of 100 to 110 process men was required. These men, too, worked twelve-hour shifts.

The chloridizing process has, in late years, been applied to zinkiferous cinders with the object of securing zinc solutions for the manufacture of lithopone, and a number of Ramén-Beskow furnaces are now being operated for this purpose.

The salt used in the roasting is to a large extent converted into sulphate; thus, the sulphur in the ore goes largely into solution as sodium sulphate. Sulphuric acid otherwise used to dissolve metallic zinc or its oxide, or to leach roasted ore, thus is partly or altogether dispensed with in connection with the manufacture of lithopone by this method. Local conditions determine which process is the most advantageous, and in determining this one must also take into consideration that, as in some European plants, the residual leached ore or what is known as purple ore might be valuable as an iron ore.

BRIQUETTING THE PURPLE ORE

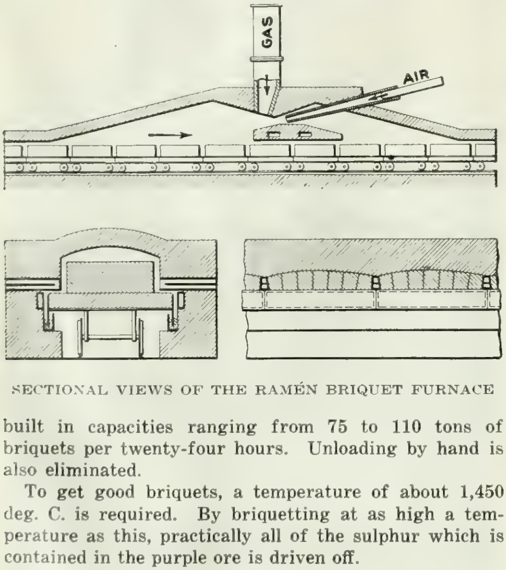
Although the purple ore might be a good iron ore, it is, however, not very desirable for blast furnace work in its original state, on account of its fineness. Its content of iron is governed by the pyrite or other ore from which it is made, and if made from ordinary pyrite cinders this generally ranges between 55 and 68 per cent. It contains as a rule not over 0.01 per cent of phosphorus; 0.2 per cent of sulphur, and 0.1 per cent of copper. It has been used, and in some places is still being used, in its original fineness in blast furnaces, mixed with lump ore, but owing to this fineness, a large percentage of it is likely to be blown away by the operation of the blast.



BRIQUETTING PRESS AND CAR LOADED WITH BRIQUETS READY FOR BURNING

In 1891, Bird found that the purple ore could be pressed and burnt to good briquets without using any binder. In 1896 Gröndal and Dellvik made the same observations regarding finely ground iron ore, which resulted in the construction of the Gröndal briquet press and furnace. In the first briquet presses, the briquets were formed by heavy blows. These briquets were not uniform and would often crack in the burning. Ramén introduced, at the Helsingborg plant, pr[illegible] principle of slow compression. By the [illegible] the briquets become stronger and st[illegible] better. These briquets, after the burning, are also more uniform and solid. One of these presses can make 1,200 an hour.

Tunnel furnaces for burning briquets were first used by Anderson in America in 1888. Later, Bird, in England, and Gröndal, in Sweden, introduced these furnaces and were granted patents on them. Their principal drawbacks were that the briquet cars would burn out and the briquets, as they were loaded on the cars, would get close to the walls, and, touching these, would form a slag with the brick, causing the walls to fuse, which would result in frequent repairs. Ramén has patented some improvements whereby these difficulties have been overcome. By building heavy arches resting on water-cooled supports, and using water-cooled boxes to protect the sides of the cars from the effect of the strong flame, a briquet furnace has been constructed that has proved very substantial. Ramén's briquet furnaces are generally built with a width of 2.1 meters, whereas the older furnaces were only 1.5 meters wide. The furnace is built in capacities ranging from 75 to 110 tons of briquets per twenty-four hours. Unloading by hand is also eliminated.



SECTIONAL VIEWS OF THE RAMÉN BRIQUET FURNACE

To get good briquets, a temperature of about 1,450 deg. C. is required. By briquetting at as high a temperature as this, practically all of the sulphur which is contained in the purple ore is driven off.

The briquets thus produced are desirable as iron ore. They are used extensively in England and Germany, and assure a saving of 8 per cent of the coke in the blast furnaces compared with ordinary iron ore. The capacity of the blast furnace has in some instances been increased by 30 per cent by using these briquets.

For a daily production of 150 metric tons of finished briquets two seventy-five-ton furnaces were used, at the Helsingborg plant, requiring a crew of seven men on each shift of eight hours. The cost of production per metric ton of briquets was, in 1914, in Swedish kronor, 2.91. Briquet furnaces of this type have been installed in works in Sweden, England, Germany, Austria, and Japan and are handling 600,000 tons of purple ore and iron concentrates a year.

[Note.—The Raménia system described has been installed in Norway, Sweden, Germany, Austria, Russia, and Japan. The Ramén-Beskow furnaces are somewhat similar to the American Wedge furnace. Their use has so far been confined to Europe and Japan, though an early model was used for several years, and may still be, at the West Norfolk plant of the Virginia Smelting Co. The American agents are Hamilton & Hansell, of New York.—EDITOR.]

New England Economic Minerals and Gem Stones Exhibited in Boston*

By GEORGE F. KUNZ

Written for Engineering and Mining Journal

Few are aware that New England has precious minerals that are used as gems after being cut in various forms. The southern part of Maine, in the towns of Paris and Auburn, is the best-known locality where the gem minerals are found. Another, not now as productive as Maine, is in central Connecticut. Boston also can boast of producing a few of the semi-precious stones. In the Museum of the Boston Society of Natural History in Boston an excellent collection of New England minerals has been placed on exhibition. There is an economic geology collection consisting of building stones, ores, and minerals. Among the ores are several specimens of the silver-bearing galena from a mine in Newbury, Mass.

The minerals from the Maine gem quarries and pegmatite area, the Connecticut pegmatite area, the Bolton, Mass., mineral region, and the local minerals found in the Boston city area are arranged according to localities. Practically half of the collection is from Maine. Maine tourmaline, a mineral which is prized most of all by those engaged in working the quarries of the Mount Mica-Mount Apatite region, is exhibited in groups according to the color, green, blue, pink, and parti-colored crystals. Another case contains all the other varieties of minerals from this southern Maine area except quartz.

The beryls form the most striking group, aquamarine, pink, blue, white, and yellow or "golden beryl," in both opaque and transparent forms, being represented. Topaz, chrysoberyl, cassiterite, apatite, lepidolite, and feldspar, as well as some of rarer species, are represented. The purple apatites of Maine have been conspicuous because of their depth of color and beautiful crystal form. The Natural History Society has the second-largest crystal of apatite ever found in Maine, and it also possesses the largest crystal of chrysoberyl.

A third case contains quartz from the same area. There is a great variety, rose, milky, amethyst, and citrine. The prize specimen is a large crystal of amethyst from Denmark, Me. It is said to be the finest crystal of its kind ever found in Maine, and many gems of high quality could be cut from this crystal. A specimen of rose quartz, one of the two known specimens of this mineral in a crystal form, was added last year to the collection.

The minerals in the fourth case are from Middlesex County, Conn. The more important species are tourmaline, beryl, rose beryl, chrysoberyl, columbite, iolite, rose quartz, lepidolite, and mica. Many of these vary markedly in color from the same varieties found in the pegmatite area of Maine. The Bolton case presents a strong contrast to the others, as the minerals exhibited are not associated genetically with pegmatite, as are those of Maine and Connecticut. The principal mineral is scapolite or wernerite, which is often of a lilac color. Other minerals include forsterite, boltonite, and titanite. The greater part of this collection was obtained from George L. Brigham, a farmer living in Bolton.

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*A more extended description of this exhibit is given in Bulletin No. 23 of the Boston Society of Natural History.

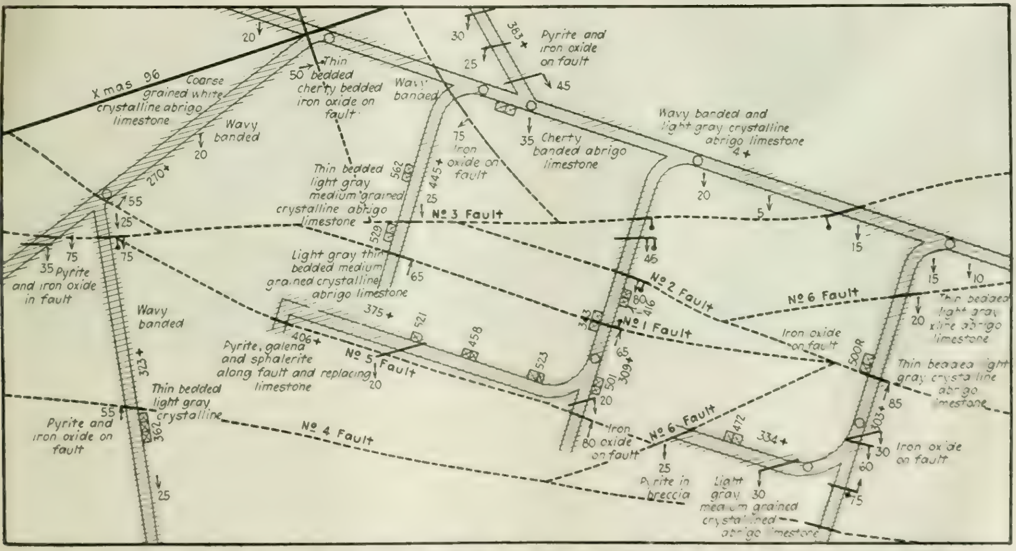
Mine Geological Surveying

Study of Underground Geology Often Necessary in Planning Prospecting—Detailed Mapping Of Levels Important—Value of Such Work to Mining Operations Depends on Type of Deposits

BY GRAHAM JOHN MITCHELL

Written for *Engineering and Mining Journal*

ONE FEATURE which marks the advance in the mining industry of today is the building up of strong co-ordinate working organizations. The increased scope of mining operations has led to the creation of various departments, such as executive, operating, engineering, safety, accounting, geological, and others. I purpose discussing here the work of a geologist in connection with an operating mine and to outline methods found serviceable in carrying on such work.


Xmas 96
Coarse grained white crystalline abrigo limestone
20
Wavy banded
20
210
55
25
75
35 Pyrite and iron oxide in fault
75
Wavy banded
323
Thin bedded light gray crystalline
55
Pyrite and iron oxide on fault
362
25
Thin 50 bedded cherty bedded iron oxide on fault
Wavy banded
Thin bedded light gray medium grained crystalline abrigo limestone
562
445
25
529
Nº 3 Fault
Light gray thin bedded medium grained crystalline abrigo limestone
65
375
406
521
458
Pyrite, galena and sphalerite along fault and replacing limestone
Nº 5 Fault
20
523
Nº 4 Fault
30
363
25
Pyrite and iron oxide on fault
45
75 Iron oxide on fault
35 Cherty banded abrigo limestone
Wavy banded and light gray crystalline abrigo limestone
4
20
5
15
46
Nº 2 Fault
Nº 1 Fault
80
333
65
501
509
20
Iron oxide on fault
Nº 6 Fault
15
10
20
Thin bedded light gray crystalline abrigo limestone
Iron oxide on fault
500R
Thin bedded light gray crystalline abrigo limestone
85
Nº 6 Fault
412
334
303
Iron oxide on fault
80
30
60
Iron oxide on fault
25
Pyrite in breccia
Light gray 30 medium grained crystallized abrigo limestone
75

GEOLOGICAL MAP OF UNDERGROUND WORKINGS, DEMONSTRATING MANNER IN WHICH FORMATIONS MAY BE DESIGNATED. ABBREVIATIONS WILL LESSEN SPACE NEED FOR NOTES

The fundamental purpose of geological surveying in an operating mine is to determine the areas most likely to be ore bearing and to direct prospecting toward such sections. To carry out this purpose, a study of the geology must be made and the plans for prospecting based upon data thus secured. Geological studies can be of further service in the development of orebodies by locating faulted portions, by directing development raises, sub-raises and sub-crosscuts advantageously, and in other instances, as will be pointed out later.

The resident geologist has an advantage over one called in for a special examination, in that he can be constantly in touch with operations and thus secure and act upon information which might not be available later. He can also be on hand to alter any plans which new geological evidence indicates to be necessary or to suggest further work based on these new facts.

Before starting detailed investigation, it will be found helpful to make a reconnaissance of the mine in company with some one familiar with the different workings. By so doing a general idea of the underground operations can be secured which will aid in making preliminary plans for the work to follow. One of the first questions to be considered is the scale upon which mapping is to be done. It is advisable to use the same scale as that of the engineers' level maps, thus permitting the tracing of the workings on each level upon the base maps for recording geological data. These base maps are of tracing cloth and vary in dimension according to the size of area included. Sheets 48 by 33 in., allowing for an inch border, are of a convenient size. In some instances more than one sheet may be needed, and when this condition arises the mine can be divided into sections, each section numbered and made to join the adjacent one.

The scale of level maps varies with different mining companies, 50 and 100 ft. to the inch being common, with 40, 80, and 200 scales sometimes in use. For work of any considerable detail, 50-scale maps will be found satisfactory, as practically all necessary data can be recorded on such maps. If desirable, a larger scale map can be used for areas having [illegible] problems, such as complicated faulting or where refined stratigraphic studies are required. From the base maps, the crosscuts, raises, and winzes of each level are transferred to sheets to be taken underground. These being 8 by 10 in., of medium-weight co-ordinate paper and their location on the base maps determined by east-west and north-south co-ordinates. For work on 50 scale this will allow the mapping of an area 400 by 500 ft. on each sheet.

Transferring of workings from the base maps to the underground co-ordinate sheets is done by means of a glass-topped draughting table. If such a table is not available one can easily be made by placing electric lights under a piece of plate glass set upon supports.

The equipment carried underground can be reduced to the following: A Brunton transit, a pick, a metal holder for co-ordinate sheets, colored pencils, 2H and 4H pencils, a 50-ft. cloth tape, sample sacks, a sample book, a small note book for detailed sketches, an eraser, a celluloid combination scale and protractor, a carbide lamp, a match case, a wire for cleaning the lamp, and a small piece of candle. All this equipment can be carried conveniently in a hunting vest.

Work Should Start with Detailed Mapping

The survey should begin with a detailed mapping of each level, the one to be taken up first being determined by conditions at the mine under examination, and mapping proceeding consecutively from one level to the next. By so doing, data such as faults, formations, and mineralization, can be correlated between levels as the work progresses. Lithology, structure, and mineralization should be the first features to receive attention. If the mine is in an area of igneous rocks, the determination of the different igneous members, their distribution, age, structure, relation, and genetic bearing upon metallization are of prime importance, and faults, fractures, and fissures should be considered in the light of their bearing upon ore genesis and structural deformations.

Where both igneous and sedimentary rocks are involved, the sequence of the sediments must be determined, especially if the ore is found to occur at certain stratigraphic horizons. It is also important to find index beds in the stratigraphic series which can be used for correlative purposes. The associated igneous rocks should be classified, and if possible their importance as sources of metallizing solutions determined. Mineralization should receive close scrutiny, the mode of occurrence, age relation, and alteration of the minerals being important factors.

Is the orebody a vein or a bed? Are the walls of the vein sharply defined, or do they show irregular replacement? Does ore follow certain beds, or is it an irregular replacement without regard for any particular formation or bed? Is the ore disseminated through the igneous rock? Are the ore minerals of the same age, or do they represent successive periods? What alteration has taken place in the primary minerals and what are the resulting minerals? These are some of the important questions which arise and which can be solved only by detailed geological work.

Method of Procedure

Mapping will begin, say, at the shaft from which main crosscuts radiate. Choosing one of these, the work may be carried along the drift to its end, provided caving or other obstructions do not block the opening. The formations are recorded in black, and the conventional U. S. Geological Survey symbols for sedimentary, igneous, and metamorphic rocks are used. Faults are shown in blue, and red is used for fissures and fractures as well as for mineralization. In depicting mineralization, the minerals occurring at each particular point are noted.

Distances are determined by pacing, the length of pace for the individual having first been determined and checked between points of known distance such as raises, crosscuts, winzes, or stations. It has been found that practice will enable one to pace very closely distances of 50 or 100 ft., and measured points can generally be found for checking distances thus paced. If closer measurements are needed they can be made with a tape which has a nail at one end for fastening in timbers or fissured rock. When one drift has been mapped, adjoining ones can be taken up until the level has been completed. The geology in raises, winzes, and stopes should be studied, as such workings supply data which may not be available on the levels.

The accompanying sketch illustrates a method of mapping. The strike of limestone is shown and the dip indicated. The faults are projected from drift to drift and their age relation is shown.

The numbering or naming of faults will be helpful when their correlation between levels is attempted. Abbreviations will lessen the space needed for notes. Transferring of underground notes to the base maps is done by tracing from the co-ordinate sheets. The colors and symbols used for formations are the same as employed underground, and mineralization can be differentiated from ore by using different colors. All data on base maps should be in ink. Other office work includes making structure sections, which are essential in planning prospecting and developing. Sections on a 100 scale taken every 100 ft. will show the essential features, although a larger scale may be used in special cases.

Planning of Prospecting and Development Follows

With the initial survey completed, and the data thus secured studied and correlated, the next work will be the planning of prospecting and developing. Some work of this nature will suggest itself during the examination, but general plans can best be made after the initial survey has been finished, this being particularly true for work on new levels. For example, if the primary survey shows the orebodies to be replacements in sedimentaries along zones of faulting or fracturing, the determination of trend and location of these zones will make it possible to direct new work so as to cut them on the other levels with the least amount of drifting.

To make maximum use of the results of his work, the geologist should keep in close touch with underground operations and visit new work as often as possible. He should transfer to the operating department without delay geological facts which have a bearing on its work. In companies where the superintendent keeps in close touch with underground work he is the proper person with whom to discuss such matters. Proposed work can be suggested to the operating department by notations on blueprints of the different levels. New crosscuts, raises, and other openings can be shown in pencil, with their direction and distance to be run indicated. The foreman who is in charge underground will thus be able to see at a glance the work proposed and can fit it into his scheme of operation. In developing stopes or in prospecting for faulted portions of ore, a blueprint of the area in question, showing the proposed work, is a satisfactory way in which to bring the matter to the foreman's attention.

The assistance which geological surveying can render mining operations will vary according to the type of deposit under consideration. In some instances, such as in a deposit of disseminated copper, geological work practically ends when the ore-bearing rock has been determined and drilled. On the other hand, if the orebodies are small and scattered replacements in sedimentary rock, or if they are a series of veins with repeated faulting, the geologist's work is not completed until the last possible chance for finding ore has been exhausted.

A Trip to the Top of Mount Popocatepetl

MINING ENGINEERS will no doubt be interested in the accompanying photographs of Mount Popocatepetl, which were taken by Bennett R. Bates, manager of the Dorr Co. at Mexico City, during a recent trip to that famous peak.

According to "Political and Commercial Geology," "It has been reported several times that a British company was about to operate the sulphur deposit of the Mexican volcano, Popocatepetl, near Mexico City. Statements regarding the deposits in the volcano are conflicting, but investigations indicate that their magnitude has been much exaggerated. Many other deposits occur in connection with local volcanic areas, but so far are of little economic value because of inaccessibility."

The photographic views furnished by Mr. Bates give ample evidence of this latter opinion, for it is quite apparent that effective operation could be carried on only by means of gas masks or other self-contained breathing apparatus. It is also worthy of note that to reach the peak of "Popo" requires somewhat of a climb, for the elevation attained is over 17,000 ft. above sea level.

The picture on the left was taken from Rancho de Tlamacas. Close observation shows steam issuing from the crater, although this feature is not so well shown as in the photograph reproduced on the front cover. A "blow-off" is shown in the picture on the right, the action being somewhat similar to that of a geyser in eruption. The "blows" occur about every ten minutes, although the periods are not regular, nor is the volume discharged at each "blow" the same. The framework shown is the old gallows frame used for hoisting the sulphur.

There are no ashes rising from the crater, although the so-called smoke, which is ordinary steam, carries a small amount of dust, and the presence of this may account for the newspaper report of the local roofs being covered with ashes. The steam also carries considerable hydrogen sulphide and sulphur dioxide gas, the latter no doubt resulting from the action of the superheated steam on the sulphur.

Practically no snow remains on the east or Puebla side of the mountain, and only a fraction of the former amount remains on the west side. The disappearance of the snow could be accounted for either by the heat of the rocks from below, a rise in temperature of surrounding atmosphere by the large amount of ste now leaving the crater, or a combination of both caus As the east side of the crater is lower than the we practically all the steam escapes there, and it is on th side that there is least snow, so that it is probable that the disappearance of the snow is due mostly if not entirely to the rise in temperature of the surrounding atmosphere brought about by the large amount of steam now leaving the crater. Mr. Bennett states that he does not anticipate a new eruption of lava, as the emission of steam is nothing extraordinary for an old volcano.

MOUNT POPOCATEPETL FROM RANCHO DE TLAMACAS

A "BLOW-OFF" AT "POPO"

Roasting and Chloridizing Tin Ores

The metallurgical treatment of sulphide silver-tin ores mined in Bolivia was covered in a short paper by M. G. F. Söhnlein, which was written for the New York meeting of the A. I. M. E. and read in abstract form by E. H. Robie. The most important and difficult step in the process of reducing these ores is that of chloridizing roasting. Furnaces of the McDougall type were found unsatisfactory, chiefly on account of high dust losses, and a straight-line furnace was developed which proved much more suitable for the purpose. Mr. Söhnlein points out that whenever it is important to obtain a uniform roast, the operation should be conducted in furnaces operated on the intermittent system, for if anything goes wrong in a continuous furnace, much time is lost and a product unsuited to the following operations is discharged. The advantages of a roasting furnace of the straight-line type in roasting for magnetic separation or for differential roasting of complex sulphide ores preceding flotation were explained in considerable detail in the paper.

No discussion of this paper was offered at the time the abstract was read.

Industrial Development of Zinc

A Comparatively Young Metal Whose Production and Uses as a Metal and Chemical Are Increasing — Although Operators in the Industry Were Individualistic in Their Business Tendencies a Few Years Ago, a Change Is Taking Place

By Stephen S. Tuthill
Secretary, American Zinc Institute

Written for *Engineering and Mining Journal*

ZINC, sometimes called "the metal mysterious," is, like the oriental woman, fast ridding itself of the veil. To Paracelsus, the Swiss medical philosopher, is credited the discovery of zinc, in 1520. "Zinc," as Walter Renton Ingalls has said, "is commercially a relatively young metal. The ancients did not know it at all. The Chinese had it, probably in only a small way, several hundred years ago, but the production in Belgium was not begun until 1807. Then for many years the industry was only a trifling and struggling affair. There was no broad market for the metal. The people did not know what to do with it. It was not until Dominique Mosselman, a man of vast energy, entered the business in 1818, and devoted himself to establishing a market for zinc by educating the people in its various uses, that the industry could be said to have its commercial birth, and even at his death, in 1837, it could scarcely be said to exist in the west of Europe except in expectancy."

Although zinc remains an indispensable ally of the pharmaceutical chemist, in the last decade it has become of absorbing interest, also, to the technical chemist. Clarke places its atomic weight at 65.37, its specific gravity at 7.12, and its fusing or melting point at 418 deg. C. Found generally throughout the world, zinc occurs in ores as oxide, silicate, sulphide, and carbonate.

In the United States, the principal zinc-mining districts are in northern New Jersey, east Tennessee, Illinois-Wisconsin, Missouri-Kansas-Oklahoma (Tri-State), and in some of the Western States. C. E. Siebenthal, geologist, U. S. Geological Survey, who is the historian of the zinc industry in this country, estimated in 1918 that the United States possesses 36 per cent of the zinc resources of the world.

THE DIFFERENCE BETWEEN COPPER AND ZINC MINING

William A. Ogg, one of the best informed zinc men in the United States, said in 1919:

"Deposits of zinc in the United States, as a general rule, can be more easily, quickly, and cheaply opened up, developed, and operated than deposits of other metals, such as copper, silver, gold, and, perhaps, lead, although there is not so much difference between lead and zinc as regards accessibility." (In the Tri-State and Illinois-Wisconsin fields the zinc orebodies are only between 150 and 300 ft. below the surface.)

In further explaining the overproduction of zinc at times, with resultant low prices, Mr. Ogg said:

"To give some idea of the difference in productive value between an investment in a Missouri-Kansas-Oklahoma zinc mine, which for convenience of expression we shall call a Joplin zinc mine, and an investment in, say, a copper mine in Arizona, I have compiled some figures which indicate that $1 invested in the average Joplin zinc property will produce in a year approximately 60 lb. of recoverable slab zinc, worth, at 6c. per lb., say, $3.50, whereas $1 invested in a copper property in Arizona will produce in a year only about 4½ lb. of recoverable copper, worth, at 15c. per lb., about 70c., a ratio in quantity of about 14.5 : 1, and in value of about 5 : 1. It is clear, therefore, that a rise of a cent in the quotation of slab zinc means about fourteen to fifteen times as much on his investment to the Joplin producer as a rise of one cent in the quotation of copper does to the Arizona copper producer on his investment, subject, of course, to whatever share of the advance he may have to distribute to labor, smelter, etc."

RECORD PROSPECTING IN TRI-STATE FIELD

It is, therefore, not strange that Otto Ruhl, a prominent Joplin mining engineer, recently stated that in the Tri-State field ten years' prospecting had been done in two years' time. In that field there are now more than 200 zinc mines and mills, representing an average outlay of approximately $150,000 each. Another cause for keeping up the high output of zinc in the Tri-State field is that the percentage of lead in the ore runs from one-fifth to two-fifths, and sometimes one-half, of the total.

After the ore has been mined, concentrated, roasted, and distilled or electrically treated, it becomes the slab zinc of commerce, and in this form it is extensively used in the arts, as in the manufacture of brass, for zincking or galvanizing iron and steel, and for roofing and the like. With the exception of several electrolytic zinc plants, the ore is distilled in natural or in producer-gas-fired retort furnaces.

The ore is roasted at the smelter to remove the sulphur content, and this in turn is converted on the premises into sulphuric acid, to be used in the manufacture of explosives and fertilizers and in the refining of oils.

Mr. Siebenthal has stated that the period between 1835 and 1860 was one of experimentation and inconsiderable production of zinc; in fact, he estimates at 800 tons the production of slab zinc in 1860, the beginning of the second period in the development of the industry. Slowly but consistently this tonnage grew, until it reached 400,000 tons in 1914. The output of slab zinc rose in 1916, on account of the war, to 720,000 tons. It dropped to 700,000 tons in 1917, to 550,000 tons in 1918, and to 485,000 tons in 1919. Of the latter amount about 145,000 tons was exported. In 1920 the output of slab zinc approximated 480,000 tons, and a satisfactory export market existed until September, when a reverse movement set in and has continued ever since.

Slab zinc was selling at the close of the war under four general specifications; high grade, intermediate, brass special, and Prime Western, with a zinc content ranging from 99.85 to 98.00, and a relatively corresponding differential in price, but since the signing of the armistice this differential has at times practically disappeared—although many manufacturers continue to specify the grades and brands with the work of which they have become familiar.

About 50 per cent of the slab zinc produced prior to 1914 was used in zincking or galvanizing plates and wire, but the requirements of zinc for war purposes seriously affected its application for that purpose. At that time about 40 per cent of the slab zinc produced was used, with copper, for making brass, practically one-third of the composition of which is zinc, and because of the demand for brass for ammunition and gun parts the greatest outlet for zinc during the world war was naturally in this direction. The remaining 10 per cent of the pre-war output was rolled into plates and sheets. Two of the new uses for sheet zinc are in the manufacture of shingles and corrugated sheets. These in considerable quantity are now being used at home and exported the world over.

USE OF ZINC INCREASING

In rolled as well as in spun and drawn form, the use of zinc is multifarious and is rapidly growing. The War Industries Board, in its efforts to conserve for war purposes the use of other metals less plentiful than zinc, published a list of over 150 different channels in which zinc in its various forms can be advantageously utilized. The high explosives sent abroad during the war were shipped in zinc-lined containers, because zinc resists atmospheric influences. Without the zinc sender, an automatic telegraphic device, high-speed signaling through cables could not be done.

Rolled zinc is susceptible to a high, a dull, or a frosted polish, and is easily formed into complicated shapes. It can be enameled or plated with gold, silver, nickel, or brass without annealing, and given any of the finishes commonly used for brass or bronze articles. Sheet zinc for sheathing in homes, factories, and farm buildings prevents molding and keeps out water, cold, and vermin. The durability of zinc is almost axiomatic. Just as nature gives to the fur-bearing animals coats to protect them from the cold, so the weather gives to exposed zinc a thin and firmly adherent coating of basic carbonate, which completely protects it from the atmosphere.

VARIETY OF APPLICATIONS

The compounds of zinc have variable applications; for example: Zinc oxide (made by burning zinc in the air) is fast growing in favor as a pigment in paints, to the life of which it adds appreciably; it is essential to resiliency and durability in rubber automobile tires, comprising from 40 to 50 per cent of the whole in weight, and it is a valuable agent in pharmaceutical preparations. Zinc chloride is used in medicine for cauterizing and as an astringent and disinfectant; in the arts, it serves as a preservative of wood, and as an etching medium; in microscopy, for differentiating fibres of silk, wool, and plants. Zinc sulphate (a compound obtained by the action of sulphuric acid on zinc) is used in medicine as an astringent and an emetic and in electrogalvanizing. Lithopone (a dry white pigment made of zinc sulphate and barium sulphate) is used in wall paint and in making wall paper and linoleum. Zinc dust (a powder obtained by atomizing molten zinc or by condensing zinc vapors) is used as a reducing agent in dye making and in cyaniding and sherardizing. It is also employed by naval vessels in making smoke screens.

Not a few men still active in the industry knew some of the pioneers in zinc in the United States, among whom were Wetherill, Wharton, Matthiessen (F. W.), Hegeler (E. C.), George, Lanyon, Meister, Weyman, Hesselmeyer, Squire, Farrington, Burrows, and Curtis. There are others, some living and some dead, to whom the industry is equally indebted. In fact, the business structures which their successors and beneficiaries are today rearing rest upon the foundations which all of these men of faith and ability laid in the days when zinc slowly was making its way to the commercial front, and when the centennium of zinc in the United States is completed the names of many of the men now identified with the industry will have been added to zinc's distinguished service roll.

Until the war demands of the Government necessitated the mobilization of the zinc industry, the zinc men of the United States were probably more individualistic in respect to the conduct of their business than those engaged in any other business. Lack of co-operation not only within each branch, but also between the different branches of the business, prevented the development of that craft acquaintanceship which means so much in furthering the interests of any industry. During a meeting with some of the zinc producers in Washington in the summer of 1918, however, Pope Yeatman, an eminent mining engineer then in charge of the Non-ferrous Metals Sections of the War Industries Board, advanced the opinion that the interests of the zinc men as a whole might be greatly helped by an organization similar to the American Iron and Steel Institute. Soon afterward (July, 1918) the American Zinc Institute was formed by these men, and today its members, numbering more than 200 and representing 125 zinc mining, smelting, and rolling-mill interests in the United States, are working as one to increase the use of zinc. These business men now admit that they know one another better and understand better one another's problems.

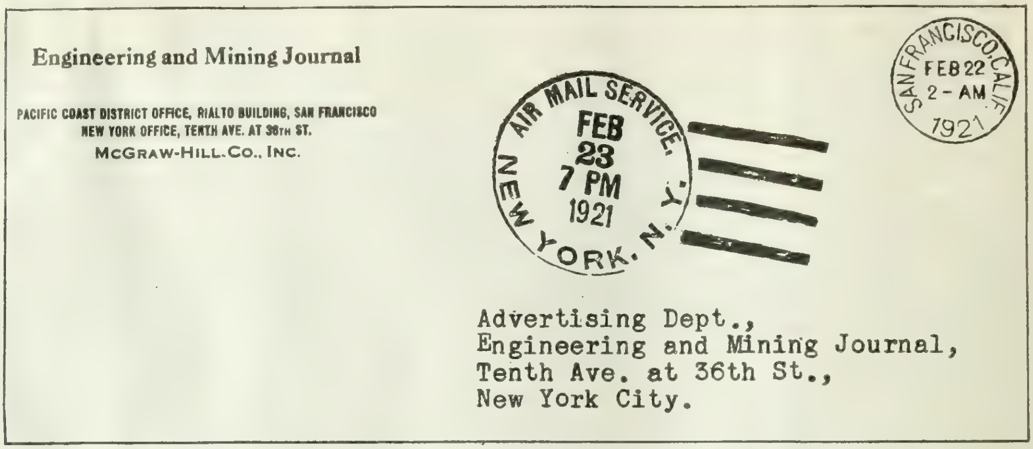
To take up the slack in the consumption of zinc growing out of the cessation of hostilities the Institute has for some time been working upon a plan to introduce zinc for roofing purposes as extensively as it has been used for many years in England and upon the Continent and in other ways to increase the use of zinc.

Several of the larger zinc companies have erected laboratories, in which they are spending hundreds of thousands of dollars annually in finding new uses for zinc, and as an evidence of the spirit of co-operation which has begun to prevade the industry, these laboratories have been opened to the problems of every zinc man in this country.

Since the American Zinc Institute divested zinc of its nicknames, the most glaring of which was "spelter," the consuming public, through the printed page and the motion picture, has begun to learn in a large way of the metal zinc and its manifold uses.

Increased Production of Cadmium in 1920

The output of metallic cadmium in 1920 was 129,288 lb., compared to 99,939 lb. in 1919 and 127,164 lb. in 1918, according to the U. S. Geological Survey. The production of cadmium sulphide was [illegible] lb., compared to 31,197 lb. in 1919. The combined value of metallic cadmium and cadmium sulphide in 1920 was about $188,500, compared to $159,36[illegible] in 1919 and $[illegible] 518 in 1918. Though prices were a [illegible] lower in 1920 than in 1919, the industry closed [illegible] in better condition than in 1919.



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ONE OF THE LETTERS CARRIED ON THE RECORD TRANSCONTINENTAL AIR MAIL TRIP

Spanning the East and West

THE LETTER ENVELOPE which is reproduced above formed a part of the mail cargo which was carried from San Francisco to New York by all-air route in thirty-three hours and twenty minutes. The letter reached our office Thursday morning. For obvious reasons the stamps affixed to the envelope have been left out of the illustration, but we give our assurance that they are bona fide one-cent stamps, two of them, green in color, and with the picture of George Washington on each.

No doubt many of our readers are familiar with the details of this transcontinental trip, which has established a record and promises to serve as a forerunner to an even shorter-period mail service between New York and San Francisco. However, we outline herewith some of the particulars of the journey, believing them to be of considerable interest.

Pilot Allison descended at Hazelhurst field, Mineola, Long Island, at 4.50 p.m. on Feb. 23, having left Cleveland at 1.03 the same afternoon. Fifteen minutes later Pilot Hopson reached the field, having left Cleveland thirty-one minutes after Allison. Both flyers used the standard D.H.4 biplane. Little time was lost at the various relay points on the journey, for at each station the mail was transferred to a new plane in which the engine was running and for which a fresh pilot was provided.

After leaving San Francisco, the first stop was made at Reno. A serious mishap occurred at Elko, Nev., when Captain William E. Lewis fell to his death in his plane. Stops were also made at Salt Lake City, Cheyenne, and Chicago. According to reports, the hero of the trip was Jack Knight, who acted as pilot from Cheyenne to Chicago, flying all night, a good part of the time encountering snow and fog. The highest altitude reached was about 12,000 ft., while crossing the Sierra Nevada Mountains in Nevada.

The record established during this flight along the trail made famous by the Pony Express will undoubtedly be accelerated. With the building of higher-altitude flying machines, it will be possible to take advantage of the trade winds, engines of greater capacity will be constructed, and other conditions will be modified and improved to permit even greater speed.

Imports and Consumption of Talc

IMPORTS of talc in 1920 were larger than ever before, according to the U. S. Bureau of Mines. Reports indicate total imports of more than 24,000 tons, valued at more than $475,000, which includes about 1,000 tons of crude talc, with a value of about $8,000. Imports in 1919 were 14,602 tons, valued at $259,004, compared with the previous record tonnage reached in 1916 of 18,882 tons, valued at $230,875. The average declared value of imported talc per ton in 1920 was about $20, as compared with about $17.50 in 1919. About 70 per cent of the imported talc came from Canada, about 20 per cent from Italy, about 8½ per cent from France, and the rest, 1½ per cent, was from England (probably originated in India), Austria, British West Indies, Denmark, Germany, and Sweden. The Candian talc had an average declared value of about $16 per ton, the Italian $35, the French $15, and the British (Indian?) $50. From these figures it appears that the chief competition which domestic producers must meet is that of Canadian talc, much of which is of high grade, suitable for the toilet-powder trade, and which sells for a comparatively low price. The total indicated consumption of talc from preliminary estimates is summarized below:

INDICATED TALC CONSUMPTION IN 1920

	Tons	Value	Value per Ton
Domestic	213,000	$2,360,000	$11.00
Imported	24,000	475,000	20 00
	237,000	$2,835,000	$12.00

Before the war most of the talc imported into the United States came from France and Italy at an average rate of about 4,000 tons per year from each country. The war caused little difference in these imports, except that those from Italy increased to over 7,000 tons per year, until 1917, when those from France dropped to about 1,500 tons and from Italy to about 4,100 tons. In 1918 the imports from France fell to 22 tons and from Italy to 490 tons. In 1919 there was only a slight increase over 1918. In 1920 the indicated imports from France were about 1,900 tons and from Italy about 4,400 tons. In the absence of definite information, it appears that the talc industry in Italy has recovered to its pre-war efficiency, but that of France has only partly recovered.

Metallurgists of Note

Harry A. Guess

HARRY A. GUESS

CANADA has furnished more than her fair proportion of metallurgists and mining engineers. They seem to have overflowed that country, and graduates of McGill, Queens, and Toronto are likely to be found almost anywhere in the United States where important work connected with the mining industry is to be done. The subject of this brief sketch is one of our northern sister's best-known representatives. Our favorite table of memorable dates says that Nov. 21 is chiefly famed by the fact that North Carolina ratified the Constitution on that date in 1789. This event is of little importance in the Guess family, however, compared with that day, eighty-six years later, when Harry A. first looked out upon Hartington, Ont. (A little mental arithmetic needed here.) Following a public-school preparatory course, when fifteen years old he entered the School of Mining of Queen's University, at Kingston, which was not far from his home, and from which he secured an M.A. degree five years later, For two years thereafter Mr. Guess was engaged in surveying, assaying and mine examination in British Columbia. Severing his connection with this work in 1897, he became surveyor and assayer and later manager of the Ottawa Gold Mining & Milling Co. at Keewatin, Ont., a company which has since gone out of business. In 1901 he decided that the job was not as pretentious as the title, and accepted the call of the Guggenheim interests, who, by this time, had had wind of this promising young Canadian engineer. Rather than risk his life in a new country alone, however, he persuaded Miss Eva Young, of Winnipeg, to come along too. Mr. Guess's activities thereafter were divided among several properties in the United States and Mexico, but for the first few years he was at the Silver Lake mines, at Silverton, Col., where the complex ore problem offered plenty of opportunities to test his ingenuity. Later, Mr. Guess returned to the plant as superintendent. In 1907 he became general superintendent of the American Smelters Securities Co.

Mr. Guess was one of the pioneers in using the flotation process in this country in the form in which it is now commonly employed. Since 1908 much of Mr. Guess's attention has been devoted to the Federal Lead Co. of Flat River, Mo. He is now president of that company, after occupying several minor positions. The plant has a capacity of close to two million tons of ore per year, which is treated in two mills by Hancock jigs, tables, and vanners, flotation equipment being provided for the slimes. In addition to his position as head of the Federal Lead Co., Mr. Guess is at present vice-president and managing director of the Federal Mining & Smelting Co.; vice-president and consulting engineer of the New York & Honduras Rosario Mining Co.; vice-president and managing director of the Premier Gold Mining Co., Ltd.; and consulting milling engineer for the Guggenheim Bros., the Braden Copper Co., and the Chile Copper Co. Mr. Guess was responsible for the very successful installation of crushing equipment at Chuquicamata, in which jaw, gyratory, and Symons disk crushers are used to reduce the ore to $\frac{3}{8}$-in. size preparatory to leaching. As managing director of the mining department of the American Smelting & Refining Co., as well as being the final authority on milling for the Guggenheim interests, it can be well imagined that Mr. Guess finds his time well occupied. Even now he is on a two months' trip to South America. This is the reason why he is not a more familiar figure at the meetings of technical societies in New York. The local section of the A. I. M. E. for instance, he says, usually meets either the day before he has to leave town or else so soon after he gets back that he is too busy to get around.

Like the Hamiltons and the Howards and the Richards, the Guesses are sometimes confused. We forego the opportunity of making a pun. George A. Guess is professor of metallurgy at the University of Toronto, and is Harry's brother. Another brother, Ross, is manager of the Bank of Montreal at Renfrew, Ont. Then there is another Guess on the way, but as he is only thirteen years old he has probably not yet decided whether or not he will follow his illustrious father into mining.

CONSULTATION

The Uses of Graphite

"We understand there are two qualities of graphite—ground and flake. May we trouble you to advise in what industries the respective qualities are used. The difference in the price of the two qualities is very great, and it may be that the flake graphite is used only in small volume compared with the ground."

The two general classes of graphite are not ordinarily termed "ground and flake," but, rather, crystalline and amorphous graphite. This division is made according to the character of the mineral. Thus, crystalline graphite is ordinarily understood to include flake graphite (the scaly or lamellar form of the mineral usually found disseminated in metamorphic rocks), and the crystalline variety found in the form of more or less well-defined veins or as pockety accumulations along the intrusive contacts of pegmatites with limestones and schists. There is not much distinction between these two forms of crystalline graphite. The amorphous variety is an earthy-looking graphite containing crystals too small to be seen except with the aid of a microscope. Amorphous graphite is an extremely finely divided flake graphite, but it exhibits to the naked eye no appearance of crystalline structure. Because of this characteristic, amorphous graphite cannot be used for many purposes to which the flake varieties are adapted.

In order of importance, the principal uses of natural graphite are in the manufacture of crucibles, foundry facings, lubricants, paints, stove polish, and dry cells. Small amounts are also used in electrotyping and as a boiler scale preventive. The U. S. Geological Survey estimated that in 1918 the percentages of natural graphite consumed in the United States for these purposes were as follows:

	Per Cent		Per Cent
Crucibles	45	Pencils and paints	5
Foundry facings	25	Stove polish	5-10
Lubricants	10	Other uses	10- 5
Total			100

Both crystalline and amorphous graphites may be used in several of these classes of graphite consumption. In graphite crucible manufacture, however, the crystalline variety is demanded. It should be of high grade, lump, chip, flake, or vein graphite containing at least 85 per cent graphitic carbon, usually 90 per cent carbon, and free from easily fused impurities such as mica, pyrite, calcite and also quartz. Crucible manufacturers prefer to use Ceylon graphite exclusively, or with small amounts, up to 25 per cent, of American flake. It has been found that the Ceylon graphite requires smaller amounts of clay as a binder than the domestic material and is a purer grade of product. The lower limit in size of crucible graphite is 125 mesh, the higher 20 mesh, the ordinary range being 20-90 mesh.

For foundry facings amorphous graphite is mainly used. High-grade material is not essential, and the graphite is commonly mixed with talc or some other substance before being applied. Practically the only trade use for low-grade dust graphite, 40-60 per cent carbon, from the refining of flake material, is in foundry facings. There are no definite specifications for this grade of graphite or for foundry facings in general, and the flake product is also employed where a high grade of foundry facing is desired. The U. S. Geological Survey estimates that about 10,000 tons of graphite is consumed in this branch of industry annually.

Lubricants consume increasing amounts of graphite annually. The prime requisite for this class of product is that it should be free from abrasive impurities. Both crystalline and amorphous grades are utilized. It has been claimed that the amorphous and artificial grades of graphite are both purer and more capable of being reduced to an impalpable powder that will remain in suspension in oil than the natural flake graphite.

In the manufacture of pencils the amorphous variety of graphite is used chiefly, the soft earthy material being best suited for the purpose. Flake graphite and the Ceylon grades, plumbago, do not possess the same marking power. In American pencil manufacture, Mexican amorphous graphite is the principal graphite used, as it can be readily ground to a fine powder, whereas flake graphite, even after fine grinding, retains its flaky characteristics. Suitable hardness is obtained by mixing the graphite with varying proportions of clay.

Paints made of graphite have the property of being able to withstand corroding attacks of acids and alkalies, and hence make a valuable protective covering for metal parts subject to such attack. High-grade graphite is not required, and amorphous, crystalline, or artificial graphite may be used.

For stove polish, amorphous graphite is usually worked up in the form of a paste with the addition of various ingredients. High-grade material is not necessary, and carbon, or "lampblack," may be added to intensify the color.

Graphite for preventing boiler scale may consist of the very finely ground flake or amorphous and artificial varieties.

As fillers in dry cells, all three classes of graphite may be used. The fine dust from graphite mills or other low-grade concentrates, when properly cleaned, has also been found suitable.

Graphite brushes for dynamo and motor commutators may be made from the three common varieties of the finely ground material, with the addition of suitable binding ingredients.

Imported Ceylon graphite is customarily divided into three classes, ordinary lump, chip, and dust. Each of these classes is further subdivided into two or more grades, best, medium and poor. Prices vary with the class and grade of the product. Ceylon lump graphite contains about 90 per cent graphitic carbon, chip about 80 per cent, and dust approximately 70 per cent.

The domestic graphite is commonly graded into No. 1 flake, No. 2 flake, No. 3 flake, dust, and amorphous graphite. The first three or highest grades during the war were specified to contain 90, 85, and 80 per cent carbon, respectively.

THE PETROLEUM INDUSTRY

The Sanga Sanga Oil Field of Borneo

Several Interesting Features in Connection With the Accumulation of Petroleum Are To Be Found in the Koetei Region of the Dutch East Indies, Where the Principal Wells of the Dutch Shell Company Are Situated

By W. H. Emmons and J. W. Gruner

Written for Engineering and Mining Journal

THE oil fields of the East Indies are of interest to geologists not only on account of their production but because of their structural features. The detailed report and maps of the Sanga Sanga field, by Jezler,[1] have only recently come to the authors' attention.

The field is in the Koetei region, Dutch East Borneo, north of Balik Papan. Drilling was begun in the Sanga Sanga field in 1897. Early efforts were successful, and in 1911 the production was 495,124 tons. The preliminary drilling was guided by oil seeps entirely, but later work was directed by geological advice. The field is controlled by the Dutch Shell interests, which operate a refinery at Balik Papan.

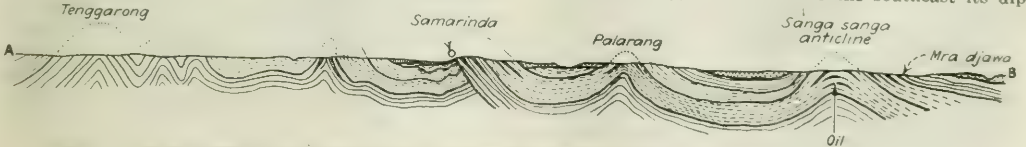

FIG. 1. CROSS-SECTION OF SANGA SANGA OIL FIELD ACROSS ANTICLINES AND ALONG THE MAHAKAN RIVER (AFTER JEZLER)

The country is an area of Tertiary sedimentary rocks that dip southeast away from the older rocks that are found toward the center of the island. The Tertiary rocks are thrown into a series of long folds that are almost parallel and strike northeast about parallel to the coast. The field may be regarded as a great monocline with smaller folds developed on it. The eastmost fold is the Sanga Sanga anticline, and this anticline contains the principal producing wells. This fold is the lowest fold developed. The greatest oil accumulation is thus formed on the lowest or basinward fold. This relation was shown by Hewett and Lupton to exist in the Bighorn basin, and it is a noteworthy feature in certain other fields in the United States.

The Sanga Sanga anticline is 80 km. long and plunges probably at both ends. It has an undulating crest, and the oil pools are developed at the high places or domes on the crest. At the surface along the anticline oil seeps and asphalt deposits are numerous. Gas seeps are found also, and when visited by Hooze in 1888 these were aflame. The oil is associated with salt water. The anticline is a steep fold. The crest is nearly flat for a width of about 300 m. The southeast limb near the crest dips gently, but further to the southeast its dip becomes steeper, reaching a maximum of about 35 deg. The west limb is steeper, dipping in places about 60 deg. or a little more. Thus the basinward limb is the more gentle one, as is the condition in many mountain folds.

In the East Indies, practically all of the oil produced comes from Tertiary rocks, although the Permian, according to Jezler, is oil-bearing in Ceram and Timor. The Tertiary rocks are generally unconsolidated or poorly consolidated. After folding in the Koetei field there has obviously been extensive base-leveling, and laterites are developed in places. The oil of the Sanga Sanga field comes from the Miocene. Mud volcanoes and gas seeps are found above the crests [illegible] in Oligocene beds, but thus far (1916) the [illegible] has not yielded oil.

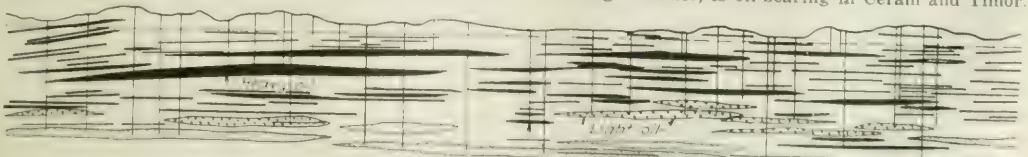

FIG. 2. LONGITUDINAL PROFILE ALONG THE SANGA SANGA ANTICLINE SHOWING POSITION OF SANDS (AFTER JEZLER)

The petroliferous beds of the Miocene [illegible] are covered with clays and marls. The [illegible] series is of the Burdigalian division [illegible]. Coals are found in this formation [illegible] th

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[1] Jezler, H., Das Oelfeld Sanga Sanga [illegible] Borneo: Zeitschr. für prakt. Geologie, Vol. [illegible] 1916.

Oligocene below it and in the Pliocene above. In the oil-bearing series these coals at places form the cap rock of the oil sand and at other places lie immediately below the oil sand. A noteworthy feature of the coals or lignites is the variation of their water content with depth. Thus the Pliocene coals contain 30 per cent of water, the upper Miocene coals 20 per cent of water, the lower Miocene coals 14 per cent, and the Oligocene coals 10 per cent of water.

In this region fossils, except the Foraminifera, are rare. The water content of the coals is so nearly uniform that it can be used to determine the age of the rocks. This relation was first noted by Hooze[2] in 1887 and is confirmed by Jezler.

Three kinds of oil are produced in the Sanga Sanga field, namely a heavy oil, a light oil, and a paraffin oil. The heavy oil has a specific gravity of 0.96 to 0.89, the light oil 0.88 to 0.85, and the paraffin oil 0.86 to 0.84. The heavy oil is found at depths from 30 to 290 m., the light oil at depths from 200 to 400 m., and the paraffin oil at from 300 to 500 m. The names are not well chosen, for analyses reported by Jezler show that the heavy oil contains as much paraffin as the paraffin oil, if not more, although the paraffin content of the "light oil" is much less than that of the paraffin oil, that is found below the "light oil."

The origin of these oils is naturally of great interest. The heavy oil has obviously lost some of its lighter constituents by seepage to the surface. It yields no fraction below 150 deg. C., although the other oils yield between 16 and 33 per cent. The deep light oil called "paraffin" oil has obviously undergone metamorphism, as is suggested by the marked dehydration of the coals associated with it. Possibly it has undergone a natural cracking process.

As pointed out by David White, there is shown in many American fields a close relation between the grade of the oil and the character of associated coals. In the Sanga Sanga field the oil recovered is, as already stated, in the Burdigalian, which contains coal with 14 per cent water. Although oil is not reported by Jezler from the Oligocene, which contains coal with 10 per cent water, the dehydration of coal with depth and the increase in the lighter constituents of oil with depth are noteworthy.

Jezler has calculated the amount of oil obtained from wells in each of the three oil horizons for the years 1901-1906, and has plotted the production of each with respect to the axes of the anticline. It is shown that the northwest or mountainward side of the fold, that is the steep limb, yielded more light oil than the southeast limb. The basinward side of the fold, on the other hand, has yielded more paraffin oil, which, as noted, comes from deeper strata. Thus it is shown that production migrates basinward in depth, as is the condition in many other fields.

Illinois Drilling Attracts Attention

SPECIAL CORRESPONDENCE

Considerable excitement has been created by the results of recent drilling on the Columbia structure between the towns of Columbia and Waterloo, in Monroe County, Ill. The district is only twenty miles south of St. Louis and alongside of the Waterloo trolley line and the M. & O. R.R., and so is conveniently situated and accessible for operators.

Three wells have been found recently on a strong anticline that was mapped by the Illinois Geological Survey several years ago, but which attracted no attention until some oil was struck in drilling for water at Waterloo last spring at about 500 ft. The Ohio Oil Co. promptly secured a string of leases, and has recently completed three tests, one of which was a duster and the other two of which are reported as making 3 to 25 barrels of a fair grade of petroleum after being heavily shot.

The O. P. & R. Co., of Tulsa, recently brought in a well that is reported as good for 200 to 1,000 barrels, and four tanks of oil have just been pumped from it that indicate that it is at least a good well, especially as it has not yet been shot. The oil from the No. 8 sand, or Trenton limestone, is through a heavy fault, here found at the shallow depth of 400 ft. This well has attracted much attention from operators and speculators, and the value of leases is rapidly advancing There are now six rigs on the ground, with several more moving in, as the shallow depth and low cost for drilling are highly attractive, with Illinois oil now bringing $3.52 a barrel.

Another well was recently brought in at Centralia by Iowa interests on the Illinois pipe line, and much interest is being taken in the prospecting by the Petro Oil Co. at Irvington, a few miles south, where the presence of a strong dome points to the opening up of another rich pool in a district that has eight sands at 600 to 2,600 ft. The Petro Co. is drilling two wells.

Oil Industry as Public Utility Condemned

SAN FRANCISCO CORRESPONDENCE

The committee on mineral resources of the Commonwealth Club of California met at luncheon at the Engineers' Club of San Francisco recently, at which time the legislation pending before the California Legislature, to declare the oil industry of California a public utility, was discussed. This proposed legislation is the latest that has appeared and belongs to the regulatory type from which there is so pronounced a reaction. No one at the meeting appeared to be in favor of this attempt to shackle the industry by placing it under the regulation and control of the existing state commissions.

William E. Colby discussed the legal aspect of the proposed law and expressed the opinion that it was unconstitutional, but he pointed out that the broad interpretation attached by the courts to the police powers of a state were such as to make it uncertain whether the courts would sustain such an enactment if it were placed on the statute books.

A. C. McLaughlin, of the Associated Oil Co., expressed the opinion that it was not practicable to put a mining business on a public utility basis. M. L. Requa said that the proposed legislation would not help the end desired, but would handicap the oil companies. It would operate to discourage individual incentive and in the end cause serious loss to the public. In his opinion it would make it difficult for the oil companies to serve the public. The sense of the meeting was as a whole against the legislation in question. S. H. Dolbear and C. A. Grabill presided at the meeting, which was attended by over forty oil men, geologists, and mining engineers.

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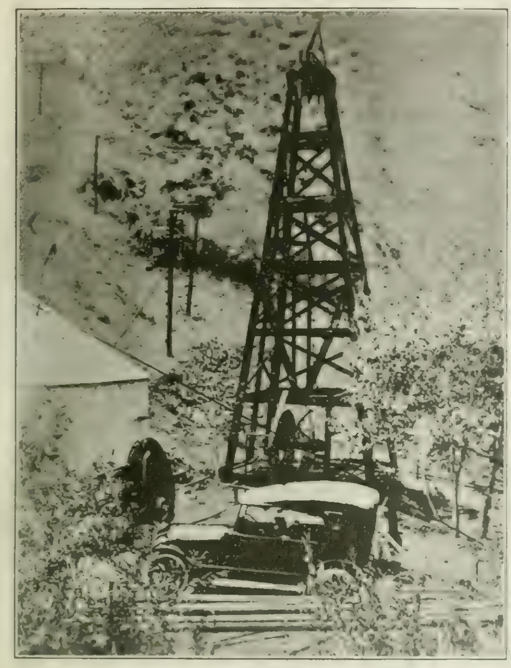
[2] Hooze, J. A., Onderzoek naar Kool in het Rijk van Koetei, Jaarb. v. h. Mijnw in N. O. I., Vol. 16, 2, s 5-94, 1887.

California's Oldest Oil Well



In the accompanying photograph is shown the first oil well driven in California, in Los Angeles County, near Newhall. Oil has been pumped from this well for forty years, and it is still producing.

Northwest Canada Oil and Gas Prospecting Regulations Announced

SPECIAL CORRESPONDENCE

The new regulations governing the disposal of oil and natural gas lands in the northwest territories of Canada have been made public. They supersede all previous regulations and are retroactive in effect. Permits may be issued to prospect for oil and gas over a maximum area of 2,560 acres for a period of four years. This area may be staked in not more than five blocks, for which five separate permits may be issued, requiring the installation of individual drilling outfits on each location. In the event of discovery, a lease of one-quarter of the area covered by the prospecting permit will be issued, at a rental of 50c. per acre for the first year, and $1 per acre for the second and third years. The royalty on the output is fixed at 5 per cent for the first five years and 10 per cent thereafter. The minimum area of a location is fixed at eighty acres, the remainder of the ground covered by the prospecting permit remaining the property of the Crown. An adequate drilling outfit must be installed on a location within two years of the date of the permit; drilling to a depth of 500 ft. must be conducted during the third year and to an aggregate depth of at least 2,000 ft. during the fourth year. Where these requirements are not fulfilled, the permit immediately lapses without the declaration of a forfeiture by the Crown.

Lessees who secured their tracts under the suspended regulations will experience no great difficulty in adapting their claims to the new regulations. In the case of applications for more than five leases consideration will be given to only five, and if fewer than five have been applied for an opportunity will be given to make up the number. If a lessee desires to surrender his lease and obtain a permit under the new regulations, he may be permitted to do so, provided the conditions of his lease have been duly observed. Leases issued under former regulations subject to renewal, the terms of which may expire, may be renewed in accordance with the new regulations.

World's Production of Petroleum

The estimated world's production of petroleum in 1920 is 688,474,251 bbl., against 554,505,048 bbl. in 1919, according to figures assembled by the American Petroleum Institute. This represents a gain of 133,969,203 bbl., or 24.2 per cent.

Of the total production in 1920 the United States supplied 443,402,000 bbl., or 64.4 per cent. Mexico supplied 159,800,000 bbl. (based on exports of that amount plus production marketed at home), or 23.2 per cent of the world's output.

By far the greater gains were made by the United States and Mexico. United States production increased from 377,719,000 bbl. in 1919 to 443,402,000 bbl. in 1920, a gain of 65,683,000 bbl., or 17.4 per cent. Mexico increased from 87,072,954 bbl. to 159,800,000 bbl., a gain of 72,727,046 bbl., or 83.5 per cent.

The estimated production in barrels by countries follows:

	1920	1919
United States	443,402,000	377,719,000
Mexico	159,800,000	87,072,954
Russia (a)	30,000,000	34,284,000
Dutch East Indies	16,000 000	15,780,000
India	8,500,000	8,453,000
Roumania	7,406,318	6,517,748
Persia	6,604,734	6,289,812
Galicia	6,000,000	6,255,000
Peru	2,790,000	2,561,000
Japan and Formosa	2,213,083	2,120,500
Trinidad	1,628,637	2,780,000
Argentina	1,366,926	1,504,300
Egypt	1,089,213	1,662,184
France (b)	700,000	
Venezuela	500,000	321,396
Canada	220,000	220,100
Germany (b)	215,340	925,000
Italy	38,000	38,254
Total	688,474,251	554,505,048

(a) No exact information available.
(b) The Alsatian field's production appears under Germany in 1919 and under France in 1920.

Applications for Utah Oil Leases Heavy

SPECIAL CORRESPONDENCE

Interest in the possible discovery of oil in commercial quantity in Utah continues to increase. Reports of the activity of companies affiliated with important interests in three fields—Circle Cliff, Gainesville and Huntington—have brought a greater volume of business to the Salt Lake City land office. On Feb. 14 there was such a rush of applicants for leases—50 in all—that several were waiting their turn when the doors closed late in the afternoon. Most of the applications [illegible] for the maximum acreage—2,560 acres—allowed by the oil land leasing act of Feb. 25, 1920. The [illegible] sought are in various counties in southwestern [illegible] Emery Oil Co., which is preparing to [illegible] the San Rafael region not far from [illegible] has listed its stock on the Salt Lake exchange. The incorporators of this company are Salt Lake and Ogden men.

Book Reviews

This World of Ours. By J. H. Curle. Cloth; 5¾ x 8¼; pp. 313. George H. Doran Co., New York. Price, $2.50.

"It is not everybody's good fortune to go to Corinth," says William J. Locke in his "Far Away Stories," but J. H. Curle, in 1898, when, as he says, "the Elizabethan era of gold mining was at its height," resolved to go down into every gold mine in the world. Making a start in the Transvaal, where he served his apprenticeship as miner, millman, and assayer, and finally rounding off his education as a managing director, he continued a successful engineering career until the goal had been attained. The tally came to over five hundred mines in thirty-eight countries.

Concerning these years, which we may believe to be well filled, the author has only sketched, but reading between the lines we find a life of interest, full of excitements and experiences which many of us may envy. India, Queensland, Australia, South America, Siberia, the West African Coast, the United States, British Columbia, Mexico and Alaska—certainly a globe-trotting record that few mining engineers can equal.

But the wanderlust is still strong. An American engineer said to Mr. Curle, "They tell me it is a pity you have gone out of business. But my idea is you are the wisest of us all." This, following his determination to travel instead of continuing his professional work. So, "on the right side of forty," he proceeds.

The remainder of the book—and we forget for the time being that our guide has viewed the world as a place of drifts, shafts, stamp mills, and cost sheets—is a continuation of kaleidoscopic effects; familiar and strange countries, living conditions, climate, customs, a bit of history here, a personal incident there, and through it all the reader cannot fail to grasp some of the author's enthusiasm for the great adventure. The bull fight in Spain, the prayer hour of the Mahomedan, and the racing carnival at Calcutta—all impress us with the striving of many peoples in their attempt to solve the riddle of life.

The book is of intense interest, although it leaves the reader with a feeling of dissatisfaction, or, let us say, envy, because he has not followed in Mr. Curle's footsteps. As Mr. Curle stated in the early chapters, the world was his oyster—he opened it and therein found what he has so well expressed.

D. E. A. C.

Finding and Stopping Waste in Modern Boiler Rooms. Vol II. Second edition. Flexible cloth; 5 x 7; pp. 414; illus. Published by H. S. B. W.-Cochrane Corporation, Philadelphia. Price, $1.

Publicity matter issued by manufacturers has in many cases grown beyond a mere advertising of the company's product. Many firms now issue authoritative data books, but this is the most pretentious one that has come to our notice. The first 94 pages are devoted to Fuels; a classification of the different varieties, their analyses and uses, with data on proper methods of storage and suggested specifications for purchasing. Then come 200 pages on Combustion, covering all phases of the subject and including combustion of powdered coal in stationary boilers. Section III treats of Heat Absorption; Section IV of Boiler Efficiency and Boiler Testing; and the concluding section, of Boiler Plant Proportioning and Management. The information given is from authoritative sources, much of it based on work done by the U. S. Bureau of Mines, and, except in the last few pages, no attempt is made to advertise the products of the company publishing the book. Its reasonable price should assure it a wide distribution among power-plant engineers.

Technical Papers

Mineral Resources—Recent separates of "Mineral Resources in 1919," issued by the U. S. Geological Survey, Washington, D. C. (obtainable on request), include: Foreign Graphite, thirty pages; Chromite, five pages; Gems and Precious Stones, 15 pages; Secondary Metals, thirty-four pages; and Mineral Waters, thirty-four pages.

Potash—Bulletin 715-B of the U. S. Geological Survey, Washington, D. C. (obtainable on request) is an illustrated pamphlet of thirty-eight pages descriptive of the potash deposits of Alsace. The bulletin is based on information previously published in foreign languages plus data secured by the author in a trip to the district in the spring of 1919. Bulletin 715-I discusses the potash resources of Nebraska and gives a list of the location and area of the productive potash lakes in that state.

Phosphate in Montana — U. S. Geological Survey Bulletin 715-J contains five pages and a map descriptive of the phosphate rock deposits near Maxville, Granite County, Mont.

The Divide District — The Divide silver district in Nevada forms the basis of a twenty-three-page pamphlet recently issued by the U. S. Geological Survey as Bulletin 715-K, and which may be obtained on request. The geology of the region, which lies just south of Tonopah, is discussed, and the following mines are described as of the summer of 1919, when the field work was done: Tonopah Divide, Divide Extension, and Tonopah Hasbrouck.

The Mogollon District — U. S. Geological Survey Bulletin 715-L describes the geology and important mines of the Mogollon (pronounced, mo-go-yohn) district in New Mexico. This important silver-gold camp, whose production has averaged consistently over a million dollars a year, is eighty-five miles from Silver City, the nearest railroad point.

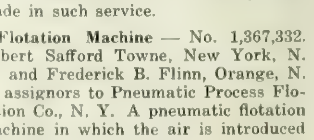
Manganese—A report on "Manganese Deposits at Horseshoe Range, Peak Hill Goldfield, Western Australia," has been prepared and issued by A. Montgomery, State Mining Engineer, Perth, Western Australia. The report covers locality, topography, geology, and ore estimates of the two principal deposits, which occur in a district formerly of interest only as a gold-mining section. Analyses of samples and consideration of transportation and costs are included, together with sketch maps.

Rhodesia Resources.—The 1921 report of the Rhodesia Resources Committee has just been received and may be obtained on request to the committee, P. O. Box 4, Bulawayo, Rhodesia. Most of the book is devoted to agricultural subjects, but about 75 pages will prove of interest to the mining profession. Mineral occurrences are described and good practical articles on prospecting and mining and milling on a small scale are included.

Swedish Mineral Statistics — A 104-page book giving the detailed mineral statistics for Sweden in 1919 may be obtained on application to Kungl. Kommerskollegium, Statistiska byran, Stockholm. The principal ore mined was iron, with pyrite, quartz, zinc, feldspar, manganese, and copper following in the order named. The production of electrolytic zinc amounted to 2,320,538 kg.

Recent Patents

Conical Ball Mill — No. 1,367,777. Harry W. Hardinge, New York, N. Y. A mill of the ordinary Hardinge type, with the exception that the conical portion is perforated, thereby allowing the escape of the ground material without passing through the trunnion. We are informed that this mill is designed to operate on dry or slightly moist pulp for which mills of the Krupp type are commonly employed, and that two or three installations have already been made in such service.



Flotation Machine — No. 1,367,332. Robert Safford Towne, New York, N. Y., and Frederick B. Flinn, Orange, N. J., assignors to Pneumatic Process Flotation Co., N. Y. A pneumatic flotation machine in which the air is introduced at some distance from the bottom, thus providing a quiet zone in the bottom of the machine for the settlement of non-floatable particles.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Hoover Starts His Assay of Waste in Industry

Special Staff of Field Workers Active in New England, New York and Pennsylvania

According to a statement issued by American Engineering Council the offer of a Cabinet post to Herbert Hoover found the former Food Administrator deep in the details of a plan to promote economic, social, and political betterment within his own profession. Following his speech at Syracuse, in which he outlined the purpose of the American Engineering Council, of which he is president, to conduct a national assay of waste, a complete organization, known as the Committee on the Elimination of Waste in Industry, was set up, and it was announced that results of the preliminary survey started by Mr. Hoover were already beginning to come in to the headquarters of the council.

Largely through the efforts of Mr. Hoover, it was said, permanent organization of the council has been effected, and work begun in many directions. In co-operation with L. W. Wallace, J. Parke Channing, and other prominent engineers, Mr. Hoover is now directing a preliminary survey of industries east and west to ascertain at first hand facts upon which the Committee on Elimination of Waste in Industry can act.

This survey is being conducted by a special staff of trained field workers, principally in New York, New England and Pennsylvania, and is designed to furnish results which shall be the working basis of the most exhaustive investigation into the causes of labor unrest and industrial defects ever made in the United States.

As one of the investigators said, "We shall find out why three million idle men are walking the streets. If Mr. Hoover can be of greater service in the Cabinet then that is the place for him. It is doubtful, however, whether he can find a job much bigger than the one he has tackled as an engineer. His associates on the American Engineering Council regard his work as president of that body as even more important in its potentialities than was his work as food administrator. Under Mr. Hoover the engineer is becoming an enormously powerful force for constructive and disinterested public service. Mr. Hoover's labors in this field have only just begun, and it is the hope of the entire engineering profession, now auspiciously launched for the good of the nation, that they will bear the fruit which present progress promises."

The American Engineering Council's activities are closely linked in character and purpose with the type of work Mr. Hoover would be called on to perform as Secretary of Commerce.

American Mechanical Engineers Discuss Materials Handling

The meeting of the metropolitan section of the American Society of Mechanical Engineers, held on March 4 at Public Service Terminal, Newark, N. J., was particularly devoted to problems in the handling of materials. Benjamin F. Cresson, Jr., consulting engineer for New York and New Jersey Harbor Development, discussed the proper development of a seaport as a place where great quantities of materials must be handled promptly and economically. He was followed by Chief Engineer J. A. Shepard, of Montour Falls, N. Y., and by W. W. Lighthipe, of the Otis Elevator Co., who discussed material-handling machinery as applied to loading vessels and to charging warehouses, respectively. E. Logan Hill, of Heyl & Patterson, discussed the mechanical loading and unloading of freight cars. General Manager R. S. Parsons, of the Erie, closed the session with a rather complete summing up of the problems and solutions presented.

Graduate Fellowships in Mining Open at Urbana, Ill.

The Engineering Experiment Station of the University of Illinois announces twelve vacancies in its research fellowships (stipend of $600 annually), and some of these are available for the students of the Mining Department. This department is thoroughly equipped for laboratory work in coal, ore-dressing, hydrometallurgy, mine gases and dusts, rock drilling and explosives. There are also special courses in industrial chemistry of coal, and in mining economics, as well as association with resident engineers and chemists of the U. S. Bureau of Mines. Prof. H. H. Stoek, of the mining department, states that he will gladly furnish further information concerning these fellowships, which are free from most college fees during the two years for which the holder is appointed.

Belgium Founds a National Mining Institute

A royal Belgian decree dated Jan. 18, 1921, provides for the creation of a National Mining Institute at Frameries. The institute is charged with the study of everything that bears on an improved utilization of the mineral resources of Belgium. This will include the perfecting of methods, of tools, and of mining machinery, as well as the improvement of working conditions in the mines.

Engineering Society of Queen's Hears Mining Engineers at Annual Dinner

Queen's University of Kingston, Ont., has an active engineering society that dines annually in February to discuss the state of the Dominion. At the twentieth annual banquet, held on Feb. 17 last, a number of mining men took part in the program. Replying to Major-General Macdonnell's toast "Keep Canada Canada to the End", the Deputy Minister of Mines, Charles Camsell, responded by emphasizing Canada's need for young men to prospect and to survey her mineral resources. Prof. W. P. Wilgar toasted the engineering profession in a quizzically humorous speech, to which R. L. Peek, managing superintendent of the refinery of British America Nickel, responded, emphasizing the fact that engineers must realize their responsibilities, avoid early specialization, face the facts, and develop nimbleness of mind. T. Kennard Thomson, of New York City, also responded and spoke on projects for developing the Niagara and St. Lawrence Rivers.

G. C. Bateman, manager of the La Rose mine, at Cobalt, Ont., responded to Dean Clark's speech of welcome, and commented on the prevailing political and social unrest as being a transient phase in the struggle for democracy; and Fraser D. Reid, of Coniagas Mines, Ltd., pleaded for greater recognition by Canada of her debt to the scientist, and contended that "Canada should have a Bureau of Standards to make science more efficient." He thinks systematized work might bring a six-hour day.

Nation-wide Invitation To Take Part in Mining Exposition in Chicago

Preliminary announcement is made that the twenty-fourth annual convention of the American Mining Congress will be held in Chicago, Ill., next fall. A committee of twenty leading Illinois coal and iron producers, manufacturers, and bankers is being organized by Hon. Francis S. Peabody, who will be general chairman. Convention headquarters in Chicago are already open in the Congress Hotel, and John T. Burns, assistant secretary of the Mining Congress, is in charge.

Chicago's great Coliseum, [illegible] the National Republican Convention was held, has been leased, and plans are being made to hold a [illegible] position of mines and machinery during "convention week." A nation-wide invitation is going [illegible] ministrative officers, [illegible] mining bodies, and [illegible] generally to participate in [illegible] mining show of [illegible] ever given in America.

MEN YOU SHOULD KNOW ABOUT

C. L. Beckwith is making examinations in the Morenci district, Arizona.

Stanley C. Sears, mining engineer, of Salt Lake City, Utah, was in New York City recently.

P. L. Foster was in Telluride, Col., recently on business connected with the Tomboy Gold Mines Co., Ltd.

Senator Frederic Nicholls, of Toronto, Ont., has resigned his position as president of the Dominion Steel Corporation.

T. D. Walsh, of Los Angeles, Cal., has taken a position as engineer with California Rand Silver, Inc., Randsburg, Cal.

Howard Birkett, mining engineer, recently returned to New York City from the Texas oil fields, where he has personal interests.

C. W. Mitchell has resigned as manager of the Montclair Mining Co. to develop property in the old Camp Fleming district of New Mexico.

Charles W. Potts, president of Northern Minnesota Ore Co., was before the Minerals Relief Commission recently in the interest of the Northland mine.

Dr. George K. Burgess, chief of the division of metallurgy of the U. S. Bureau of Standards, spoke before the Cleveland Engineering Society on Feb. 25.

Fredrick Bradshaw, general manager of the Tonopah Belmont and subsidiary companies, spent several days in Tonopah, Nev., recently inspecting the Belmont mine.

D. E. Sutherland, assistant general superintendent of the Oliver Iron Mining Co., Ironwood, Minn., is spending a few weeks at his winter home in West Palm Beach, Fla.

Gaichi Yamada, who is professor of metallurgy in the Kyoto Imperial University, Japan, is in Canada studying mining methods and processes. He was in Toronto recently.

William Brand, for many years connected with the Bacis Gold & Silver Mining Co., Ltd., has resigned as manager, and is now with the Compañia Mexicana de Petroleo "El Aguila" S. A.

E. P. Mathewson, **Edwin Ludlow**, **Col. H. S. Dwight**, and **E. H. Robie** are among the New York mining engineers attending the annual meeting of the Canadian Institute of Mining and Metallurgy at Montreal this week.

Joseph H. Ivey has resigned as manager of the Poderosa Mining Co.'s mines at Collahuasi, Chile, and is now in charge of the Corocoro United Copper Mines, Ltd., properties at Coro Coro, La Paz, Bolivia.

Dr. R. F. Ruttan, head of the Department of Chemistry at McGill University, Montreal, has been temporarily appointed to succeed Dr. A. B. McCallum as administrative chairman of the Canadian Advisory Council for Scientific and Industrial Research.

J. G. Newton, metallurgical superintendent formerly with the Cerro de Pasco Copper Corporation at La Fundicion, Peru, is now with the American Smelting & Refining Co., Maurer, N. J.

Don Juan Gómez Ortiz, mining engineer, of Spain, is traveling in the United States to study the applications of electricity in the mining industries. He was in New York City recently.

C. F. Powell, of Oklahoma City, Okla., has been appointed chief of the subdivision on natural resources of the office of the U. S. Commissioner of Internal Revenue. He succeeds **J. C. Dick**, who has resigned. Mr. Powell was born in McPherson, Kan., and received his public-school education in that state. His higher education was obtained at the State Agricultural and Mechanical College, Stillwater, Okla., where he took the general engineering course. Early in the life of the mid-continental oil field, he took up oil work as a consultant and as a practical oil operator. In 1919 Mr. Powell joined the staff of the Commissioner of Internal Revenue as chief of the oil and gas section. He just has been promoted from that post to chief of the natural resources subdivision.

Harris & Ewing

C. F. POWELL

H. C. Bellinger, vice-president of Chile Copper Co.; **Fred Hellman**, consulting engineer for Guggenheim Brothers' interests, and **C. B. Lakenan**, general manager of Nevada Consolidated, have been inspecting Utah Copper property at Bingham and the concentrating plant at Garfield.

Mining engineers and geologists recently visiting New York City included: **W. J. Reynolds**, 2 Crescent Gardens, London, S. W.; **Spencer R. Logan**, Coffeyville, Kan.; and **Carl O. Lindberg**, Los Angeles, Cal.

SOCIETY MEETINGS ANNOUNCED

The second **conference of engineers and economists** at New School for Social Research will be held March 9, at 8:15 p.m. L. W. Wallace, W. C. Mitchell, and others will discuss "Waste and the Engineer." These conferences meet at 465 West 23d St. New York City, on the second Wednesday of each month.

OBITUARY

Howard M. Hanna, Sr., of Cleveland, Ohio, died at his winter home in Thomasville, Ga., on Feb. 8, at the age of eighty-one years. Mr. Hanna was one of the founders of the M. A. Hanna Ore Co. With the aid of his two brothers, the late Senator Marcus A. Hanna and Leonard C. Hanna, he had built the company into a large shipping and industrial corporation.

Don Manuel Gomez, managing director of the great Spanish Société des Hauts Fourneaux de Bilbao, Spain, is dead from wounds received in a murderous attack upon him recently at Bilbao. He entered the service in a minor position, and by hard work, combined with high intelligence, had risen to the highest post in the company's organization.

Alexandre Gouvy, metallurgical engineer (E. C. P. 1879), died suddenly on Jan. 21 while on a mission to Leipzig. He had held various important positions in French and Russian metallurgical establishments, and was widely known for his labors in popularizing modern metallurgical methods. M. Gouvy was sixty-five years old.

William L. Watts, for many years geological engineer for the Kern River Oil Fields of California, Ltd., died while returning from London to Trinidad, B. W. I., where he was working for his company. Mr. Watts, who was born in Edmonton, England, Sept. 24, 1850, was a former student of the University of Kansas, and studied under several prominent English geologists. In 1884 he became chemist to the Oregon Mountain Mining & Smelting Co., and from 1884 to 1889 he was in general practice in San Francisco, and was an expert for the California State Mining Bureau from 1889 to 1901. As the bureau's representative he studied the oil and gas formations of southern California in 1894. Since 1901 he had been in private practice again in Los Angeles, Cal. Mr. Watts was a member of A. I. M. E., of several California academies of science, and of many other societies and had written several non-technical works. He made many contributions to the annual California State Mining Reports.

THE MINING NEWS

LEADING EVENTS

Conkling-Silver King Coalition Decision Reversed

Supreme Court Sets Aside Judgment for $570,000 Awarded Plaintiff by Court of Appeals

The U. S. Supreme Court has reversed the decision of the Circuit Court of Appeals at St. Louis in the litigation between the Silver King Coalition Mines Co. at Park City, Utah, and the Conkling Mining Co. and has set aside the judgment for $570,000 awarded the latter company for ore taken by the Coalition from ground claimed by both companies. The ore in the Elephant stope was mined chiefly from a strip of ground 125 ft. in length. The Coalition company claimed the ore through apex rights and prior location.

In regard to the disputed ground, there was a discrepancy between the length of the Conkling claim as given in the patent and as marked by the location posts, the Conkling company claiming the ground carrying the ore according to the patent and the Coalition claiming it because of the position of the location posts.

The case was first tried in the U. S. District Court in Salt Lake City, Judge John A. Marshall presiding, and the Conkling company was the loser. In the Court of Appeals this decision was reversed and judgment for $570,000 awarded the Conkling company.

The Silver King Coalition then appealed to the U. S. Supreme Court for a writ of certiorari and the case was re-tried at Washington. The Government intervened in the last trial for the purpose of determining the question of priority of patent over location. It was ruled that the size of a claim is determined from the survey as marked by the location posts, and not by the figures as given in the patent when there is variance between the two. With interest to date of decision March 1, the amount at issue would have been approximately $706,800.

Iron Ore Freight Rate Hearing Set for March 12

Six Roads, Meanwhile, Announce Further Increase Plus Dock Charge—Shippers Ask That This Be Suspended

The hearing on ore freight rates, which concerns eighty-seven Lake Superior iron mining companies and the ten railroads serving the ore industry, will be held March 12 in Chicago by the Interstate Commerce Commission. The application is for a deduction of the rail rates from the mines to the upper lake loading docks. All mining companies except the Oliver Iron Mining Co. are parties to the action. Owing to the close relationship between two of the defendant railroads and the Oliver, the Oliver could not be a party to the suit.

A new angle to the situation has been created in the meantime by the fact that six of the railroads connecting the Michigan and Wisconsin ranges with Lake ports have announced an increase of 10c. per ton and an additional 5c. dock charge. A petition has been presented to the I. C. C. by thirty-six Michigan and Wisconsin ore producers to have this proposed increase of rates suspended.

WEEKLY RÉSUMÉ

At Washington the Senate has passed a more liberal war minerals relief measure, but favorable action by the House is said to be extremely unlikely. Considerable opposition has developed to the proposed 33⅓ per cent ad valorem tariff on cyanide, it being pointed out that this would be detrimental to the interests of gold producers. Attacks by Representative Mason, of Illinois, on Bernard Baruch, John D. Ryan, and copper producers in general, made on the floor of the House, were warmly answered. In a letter to Representative Garrett President Wilson has vindicated Messrs. Ryan and Baruch. Through opposition of Senator Thomas, of Colorado, the tungsten tariff measure failed to get a hearing in the Senate.

From Salt Lake City it is announced that Jesse Knight, long prominent in mining circles, is retiring as president of the Knight Investment Co. The hearing by the Interstate Commerce Commission on the new $6.50 freight rate between Utah points and San Francisco has attracted much attention. The commission's hearing on iron ore freight rates in the Lake Superior district has been set for March 12 at Chicago. A bill calling for a tax on iron-ore royalties has been introduced in the Minnesota Legislature. On the Gogebic Range the Steel & Tube Co. of America has cut its mining operations to a four-day-week basis. In Washington a renewal of activity in silver mining in the Oroville-Nighthawk district is reported.

British America Nickel Shuts Mine and Smelter Down

The mine and the new smelter of the British America Nickel Corporation at Nickelton, Ont., in the Sudbury district, were shut down indefinitely on Feb. 26, owing to the condition of the metal market. Between 600 and 800 men were thus thrown out of work. Four hundred more will lose employment when the company's refinery at Ottawa shuts down, which will occur soon.

Eilers' Campaign for Proxies Continues

In Two Letters to Stockholders Former Vice-President of A. S. & R. Co. Repeats Charges Against Guggenheims

Continuing his campaign against the management of the American Smelting & Refining Co., Karl Eilers has again circularized the stockholders of the company under dates of Feb. 24 and Feb. 26 in a continuation of his effort to secure their proxies for the annual meeting next month. He reiterates his charge that the Guggenheims have sold out, giving the number of shares held by the Guggenheim family as 324 and the total held by the board of directors as 2,444, out of a total of 1,100,000. He continues:

"In 1905, 1906, and 1907 the American Smelting & Refining Co. appeared to be at the height of its prosperity. Its common stock commanded $174 per share at the New York Stock Exchange. With its splendid credit, its officers could readily have financed for its account any of the opportunities that were presented to obtain interests in Utah Copper, Nevada Con., or Kennecott, and later in Chile, but, instead, the Guggenheims, although they were officers of A. S. & R. Co., and in receipt of large salaries therefrom, took these opportunities for themselves.

"In the case of Utah the amount expended by the company to build a smelter to treat the ore was greater than the Guggenheim investment in the mines, but the great profit has not come to A. S. & R. Co. Utah has paid $101,000,000 in dividends, it has a surplus of over $49,000,000 and the ore reserves are 368,000,000 tons. It is the most profitable mine in the world.

"Nevada Con. and its plant and railroad could easily have been financed for account of A. S. & R. Co. It has paid dividends of $45,000,000 and has a surplus of $8,000,000.

"The Bonanza properties in Alaska were obtained in 1906 for a moderate investment well within the financial ability of the A. S. & R. Co. This has become the Kennecott, which is a $117,000,000 corporation which has already distributed over $49,000,000 in dividends.

"Chile Copper was obtained about the year 1911—it is the greatest mine in the world. An initial expenditure of about $200,000 by the Guggenheims through their Chile Exploration Co. confirmed an enormous tonnage which they at once capitalized at $110,000,000.

"Had these four properties been taken over for account of the American Smelting & Refining Co., as they should have been, the stock of the com pany would have been worth many times what it is today.

"In the statement issued by President Guggenheim, Jan. 20, it is indicated that the American Smelting & Refining Co. did not participate in the above-mentioned ventures because they were 'distant and hazardous enterprises.' This amazing and misleading statement is made in the face of the fact that while this company was deprived of the opportunities above indicated, the Guggenheims unloaded on the company various mining properties in Mexico and other distant places and took from Smelters about $22,000,000 in cash and its equivalent, but the return to A. S. & R. Co. has been an utterly insignificant sum compared with the profits the Guggenheims derived from the four copper properties mentioned.

"Recently the agency for the sale of copper from the mines of Utah, Nevada Con., Chino, Chile, Braden, Ray, Beatson, and Kennecott was transferred without consideration from A. S. & R. Co. to Guggenheim Brothers, thus depriving the company of commissions of over $1,000,000 a year.

"The attempted explanation fails utterly in the light of the language of the contracts which fully protected the A. S. & R. Co. if President Guggenheim and his brothers had but observed the terms and refrained from gambling in copper."

In the letter dated Feb. 26, Mr. Eilers says:

"A weekly paper entitled the *Financial World*, published in New York, has issued a prospectus announcing a series of articles which it proposes to publish beginning Feb. 28, purporting to be an independent review of the history of the American Smelting & Refining Co., and an independent and unbiased judgment regarding a movement on the part of several thousand owners—in their own names—of stock of the company who demand representation upon the directorate in order that they can have a share in the management, the conservation, and protection of their property.

"Note:—These stockholders are not making an attack upon their own corporation. The attack is upon Guggenheim management. It is a case of stockholders versus Guggenheim domination.

"The independent and unbiased character of the subject matter which it is proposed to print and mail to stockholders, and likely to bankers, brokers, and newspapers pretty generally, is a matter of grave doubt.

"The envelopes addressed to the stockholders, containing the prospectus mentioned, were addressed on the addressing machine of the American Smelting & Refining Co.

"The reproduction of the addresses on the envelopes and the stencils of the American Smelting & Refining Co.'s addressograph show them to be exact duplicates.

"This coincidence leads to the suspicion that the independent and unbiased subject matter to be printed, in four issues, was prepared in the offices of the company, and will reflect the selfish opinions of the Guggenheims who are using every means in their power and every subterfuge to continue their strangle-hold on our company.

"If the Guggenheims are truly conscientious and are eager for you to know the truth, let them tell you over their own signatures—

1.—Why they sold their $35,000,000 of stock?

"2.—Why they withdrew this vast sum and ceased to give the company their financial support?

"3.—Why they failed to turn into the company the great copper mines which they took for themselves?

"4.—Why they turned into their Kennecott Copper Co. their stock holdings in the Utah Copper Co., and caused the American Smelting & Refining Co. to buy their less desirable mines and pay them $22,000,000 therefor?

"5.—Why they caused a mortgage of $31,000,000 to be placed ahead of your preferred and common stocks in order to retire an inferior stock of a subsidiary corporation?

"6.—Why the quick assets of the company per $100 of capitalization have not increased in fourteen years?

"7.—Why the common stock has failed to receive more than an average of 4½ per cent?

"8.—Why the Guggenheim Brothers took over the copper selling agencies which had netted the company more than $10,000,000 in eight years?

"9.—Why the stocks of the company are selling today below the level of twenty years ago, when they first entered 'Smelters' and after twenty years of Guggenheim management?

"10.—Why according to latest record furnished us they own in their own names no more than 324 shares out of 1,100,000 shares outstanding, and still insist upon dominating the company?

"11.—Why they have failed for years to allow representative stockholders to be elected to the directorate?

"12.—Why they carry stock in the names of brokers and other individuals instead of in their own names?

"13.—Why they address you in the names of other people, and anonymously through newspapers and magazines?

"See how these vital questions are discussed or answered in the forthcoming series or articles inspired but not vouched for by them with their own signatures!

"Respectfully,
"KARL EILERS."

Tax on Iron Ore Royalties Proposed

Another method of taxation to derive money from the iron ore mined in Minnesota has been recommended by the House Committee on Taxes of the Minnesota Legislature. This bill as presented would tax royalties on iron ore on a basis of 5 per cent. Many arguments have been presented against the bill.

A Letter From Rio Janeiro

Market for Iron and Steel Small in Brazil—Export Situation Bad—Refusal of Merchants To Accept Shipments Has Injured Credit Greatly

BY MARK R. LAMB

Statistics show that the consumption of iron and steel in Brazil is approximately equal to that of Los Angeles County, California. Nevertheless, it is proposed to build blast furnaces, plate and bar mills, equipment for the manufacture of bars, tin plate, structural steel, rails, and in fact, everything that Brazil consumes in the way of iron and steel. The smallest practical plant for the manufacture of any of these items would produce in one day sufficient for Brazil for the year.

Manganese and Brazil go together. A walk along the docks at Rio will show important quantites awaiting shipment. One lot is warehoused in the customs house. It has been in storage since the beginning of the war, when Brazil took over the German ships, first unloading them. It has taken a great faith on the part of the owners of this manganese to continue paying storage, as such charges increase seriously after the first month. They are now paying the tidy sum of 5,000,000 reys per month on 4,000 tons.

Diamonds are offered the innocent traveler in Brazil with the tempting bait that it is easy to smuggle them back into the States with a sure profit, since prices there are higher on account of the heavy import duty. For the ordinary buyer, prices are no lower in Rio than in New York. Besides this, the unknown seller must be terribly tempted to exploit the ignorance of the buyer. It is surprising what bargain hunters will buy, thinking they are getting diamonds. These innocents will proudly hand you their latest purchase for approval, and when it is actually a diamond it is frequently off color and chipped or else flawed. The defects, though plainly visible to the naked eye, are for some reason invisible to ordinary people, who consider themselves incapable of passing even a superficial judgment on the mechanical condition of the gem. It would be a crime to undeceive them, even if one of them was a famous mining engineer!

DIAMOND FIELDS PECULIARLY SITUATED

The diamond mines are not far from here by train, but Rio is a very long way from the mines on foot, over woods and jungle and swamps. The bravest Brazilian will not attempt it. This peculiarity of being nearer in one direction than in the other is of considerable importance and use to the port authorities. After a sailor man of any nationality becomes known as a confirmed and incurable beachcomber, the authorities are likely to become so exasperated with him that they take extreme measures. These consist of giving him a free ride on the train to the diamond mines, where he can easily (and necessarily, if he wishes to continue to eat) secure a job. This job does not pay particularly well, and liquor is easily obtainable, so that it is a long, long time before our hero saves enough for his fare to the port. He not infrequently decides to stay, and at least temporarily improve the race.

A similar incident happens in the routine of running ships out of Rio. Recently one steamer carried a number of unintroduced passengers, namely, forty-two stowaways. It can be imagined that the mate was angry, as it meant demoralization of his crew, and there was not nearly enough work for all of them. Besides, it was necessary to feed them more or less, up and back, as only American stowaways are permitted ashore in New York. Cape Frio is some distance north of Rio. It seems close when the journey is made on the ship, but to be put off in a row boat to walk back is extremely disconcerting and quite invariably results in strong protests.

UNEMPLOYMENT APPEARING IN SOME PARTS

Owing to the reduction in the market values of many of the products of Brazil, unemployment is making its appearance, and has resulted in an important increase in the production of gold, black diamonds, borts and the gem stones. The production of the latter is of course negligible as compared to that of South Africa, but nevertheless constitutes an important element in the economic life of Brazil.

We hear strange tales here of the American paper money being at a premium in B. A. It is said that the officers of the ships are employing their capital very profitably, turning it over every trip with a profit of from 5 to 10 per cent. It is prohibited to export anything but very small quantities of gold, yet it is at a discount—probably for that reason. If it is really true, you may cable your remittance and I will go fifty-fifty with you on the profit. Sounds like Ponzi, doesn't it? Will have more of this to tell you from Buenos Aires.

EXPORT SITUATION BAD AND CREDIT RATINGS DAMAGED

The docks here at Rio are running over with merchandise shipped in from all parts of the world, much of it refused by the buyer, delivery of much of it refused by the seller. It is not fair to generalize regarding the situation, though it is possible to say "as between North and South America, the former has not acted correctly: and as between American exporter and Rio buyer the latter has not acted correctly." Each case must be decided upon its merits, and it is for this reason that many houses here which formerly enjoyed the highest credit rating are going to have very black marks against their names. The excuse for non-acceptance is low prices and bad exchange rate. These are not of the slightest value as reasons for refusing to pay, unless we are to have a new system of business morality. The bank managers and the managers for Dun and Bradstreet are emphatic in saying that the credit of a firm will hereafter be judged exactly the same as heretofore. All credit information from whatsoever source is now prefaced by the statement, "That information is two months old—too old to be of any service except as a general guide."

It is not possible for an exporter to force a shipment on a reluctant buyer unless the former has been extremely fortunate, and has such a clear case, with all stipulations in writing, that there is no escape for the buyer. The Chamber of Commerce is doing a great work in making settlements. Curiously enough, the best of its work results, not from arbitrations, but rather from settlements made before that point is reached.

The banks of all nationalities are doing a very good work in constantly calling attention to the fact that credit ratings are often injured much more than the value of the shipment in dispute. They are firm regarding renewals, some going so far as to refuse a renewal unless the acceptee of the draft first deposit the value of the draft in milreis at the exchange of the day, the balance or difference either way, at due date, to be adjusted according to how exchange has varied.

EQUIPMENT OF ENGLISH MAKE IN EVIDENCE

All the equipment on the docks here is of English make. There are scores of cranes of light capacity and long reach, which can discharge from ship or lighter to the platform of the warehouse. The equipment is light throughout—light locomotives, small cars of the European pattern with four wheels and light enough to be pushed by one man. The negro porters work with extreme economy of effort, but in their place on these hot days so would anyone work.

There are forty ships waiting their turn to reach the dock or to secure lighters for unloading. These freighters cannot afford a dock of their own, so are compelled to wait.

The strange point about the entire export situation is the fact that the larger the exporter, the worse he is hit. The most fortunate, both among importers and exporters, are those whose ratings were low, who had few connections abroad or who were too conservative (or afraid) to take risks of any kind, and who confined their operations to orders based on letters of credit. If they continue this practice, they will be wise. It will be a long, long, *long* time before it will be safe to give sixty days to Brazilian importers *en masse*, and it will take many more months of bankruptcies to prepare the list of acceptable credit customers. It is much better to close the office, play golf and live on capital, than to distribute capital as loans to insolvent merchants.

Long live the export business, but only the nice, clean, letter of credit export business.

Idaho Mining Association Meets

Wants Tariff Protection for Lead and Zinc—Would Repeal 640-Acre Homestead Law

At the recent annual meeting of the Idaho Mining Association at Boise a resolution was adopted favoring the repeal of the 640-acre homestead law for the reason that in its operation land that is chiefly valuable for mineral is taken up and patented, and it not infrequently happens that mineral locations under development are included in these enlarged homestead entries, since no record of mining locations is required in the government land offices. The executive committee was authorized to employ counsel and contest the validity of the law.

The advance in railroad rates was condemned and mine operators and railroad companies were urged to get together and adjust rates on a basis that would insure a continuation of mining operations.

The association declared in favor of a tariff rate of 2c. per lb. on imported lead in all forms and a duty on zinc in accordance with the recommendation of the American Zinc Institute.

Among other resolutions adopted was one in favor of the McFadden Gold Bonus Bill and calling on the Idaho delegation in Congress to support it, making Sept. 1 the end of the year as far as assessment work on mining claims is concerned; providing for displaying in the capitol building the mining exhibit of Idaho that was shown at the Panama-Pacific exposition; calling upon the legislature for a continuance of support of the state bureau of mines and geology; urging the legislature to raise the salary of the mine inspector of the State of Idaho to $3,000 and make more liberal allowances for the maintenance of his office.

The old officers were re-elected as follows: Jerome J. Day, of Wallace, president; J. B. Eldridge, of Boise, vice-president; Ravenel Macbeth, of Mackey, secretary and treasurer.

Salt Lake-San Francisco Rate Hearing in Progress

The hearing before the Interstate Commerce Commission in regard to the reasonableness of the rate of $6.50 a ton recently granted by the Western Pacific railroad from Salt Lake to San Francisco is being watched with interest by Salt Lake mining and smelting men. Copper producers of Salt Lake City and vicinity were recently cross-examined to show the rate was both reasonable and remunerative to the carrier. By shipping to San Francisco and from there via the Panama Canal to the refineries at Perth Amboy and Baltimore, Md., a saving in freight can be made.

Cerro de Pasco produced 4,056,000 lb. copper in January, as compared with 4,258,000 in December.

Old Dominion produced 2,655,000 lb. copper in January, against 2,822,000 in December.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Tariff on Cyanide Vigorously Opposed

Would Cause Further Loss to Producers of Gold and Silver Ores Requiring This Chemical

Application by the Roessler & Hasslacher Chemical Co. for a tariff of 33⅓ per cent ad valorem on cyanide has brought out the most determined opposition to any such proposal. It is declared that such a rate of duty will give a monopoly to this company and will place a great burden on the mining industry.

It was pointed out to the committee that the great development in the extraction of gold and silver from their ores has come by the use of cyanide. It was declared that it has made possible the profitable working of low-grade ores and the creation of a great industry that had not existed until this method of recovering increased percentages of gold and silver had been devised. Prior to 1917, it was alleged that the mining industry in the United States "was at the mercy of a great foreign combination originating in Germany." In that year, competition was undertaken by another company operating plants at Niagara Falls, Ont., and at Warners, N. J. It was declared that this competition has saved the mining industry large sums.

Attention was called to the fact that cheap cyanide is of the greatest importance, especially at this time when gold and silver mining is in a precarious condition. In the Tonopah district, it was stated, 2½ lb. of cyanide extracts 15 oz. of metal in the average ton of ore. It was pointed out to the committee that 20,000 men are employed in gold and silver production, where the cyanide method of recovery is in use. These men, as well as employees of allied industries would be adversely affected were there to be any further decline in gold and silver mining. Such a condition certainly would result, it was declared, if this high rate of duty were enacted into law. Should the Payne-Aldrich tariff bill be re-enacted, as now seems possible, sodium cyanide would be on the free list, but cyanide of potassium would be dutiable at 25 per cent ad valorem. Each is on the free list in the existing (Underwood) tariff act.

During January the Geological Survey reported upon the geological structure involved in 426 applications for prospecting permits under the oil sections of the Mineral Land Leasing bill. This brings the number of these reports rendered since July 1, 1920, to more than 3,600.

More Liberal War Minerals Bill Passed by Senate

House Unlikely To Consider Measure—As Precedent, May Be Helpful at Extra Session

The Senate on Feb. 24 passed a bill which would make possible a more liberal interpretation of the "request or demand" feature of the War Minerals Relief Act. Before passing the bill the Senate eliminated a provision that the law "shall be liberally interpreted." Senator Smoot contended that there is only one way to interpret the law and that is to interpret it correctly.

The bill, as passed by the Senate, provides that claims will be considered whenever a personal, written or published request or demand originated in the Government.

Since there is not one chance in a thousand of securing action on the bill by the House the Senate's action in this respect will have no influence on the existing war minerals relief situation, although it constitutes a precedent which will be helpful if new legislation along this line is acted upon during the extra session.

Tungsten Tariff Measure Fails

Senator Henderson, of Nevada, made an unsuccessful effort on Feb. 24, to take up the bill providing increased duties on tungsten. The Senate quickly passed the measure over, however, when Senator Thomas, of Colorado, stated that he was prepared to speak in opposition to the bill throughout the remaining time of the session.

Urges Development of Potash Industry

Development of a domestic potash industry is recommended strongly in a communication to the Senate by the Chief of the Bureau of Soils. It is pointed out that during 1920 there were large imports of potash.

Few Bids for Government's Brass

The Director of Sales is having great difficulty in securing a purchaser for the 48,000,000 lb. of brass cartridge cases which the War Department has declared surplus. Only four bids were received at the last attempt to find a purchaser, and one of those did not comply with the regulations and was thrown out. The high bidder was the Hess Briggs Corporation, New York, but that company withdrew its bid before an award was made. Bids by the International Minerals & Metals Corporation, of New York, and the Standard Iron & Steel Co., of New Haven, Conn., were rejected as being too low.

Attack on Baruch and Copper Men Arouses Defenders

Illinois Representative's Extravagant Remarks Elicit Many Replies—President Vindicates Ryan

There was another outburst in the House of Representatives last week aimed at Bernard Baruch and John D. Ryan, as well as at the copper producers. Charges, preferred by Representative Mason of Illinois, were couched in sensational phrases and many extravagant allegations were made. When called upon for proof, Mr. Mason said that the proof of Mr. Baruch's wrongdoing was his own conduct.

President Wilson flatly denied the charges made by Representative Mason. In a letter to Representative Garrett he branded them as "utterly foolish." He said:

"There was not a suggestion of scandal connected with either of these gentlemen in any of the war activities in which they played so important a part, and I wish, before the closing days of this administration, again to say how admirably they served the needs of the nation and how unselfishly they devoted their fine talents to the Government in every crisis which faced us during the critical days of the war.

"As a matter of fact, Bernard M. Baruch and John D. Ryan, whose names have been linked with irresponsible gossip in connection with the fixing of the price of copper, had nothing whatever to do with the price fixing negotiations, which finally resulted in the statement I made fixing the price, either at the time the price was fixed, or subsequent thereto.

"Judge Lovett acted as chairman of the committee which considered the first price fixing of copper, and after due consideration recommended to the President, in September, 1917, that he had fixed the price at 23½c. per pound on condition that the wages of the employees of the copper producing companies should not be reduced below the then prevailing price, which was based on 27-cent copper.

"A year later a readjustment of the price was made necessary by an increase in the railroad rates and costs of supplies, and after negotiations which extended over many months a further increase was recommended by Robert S. Brooking, chairman of the War Industries Board. Neither Mr. Baruch nor Mr. Ryan had any part in these negotiations, which resulted in the fixing of the price announced by me."

The discussion led Representative Garrett of Tennessee to say:

"The proof shows that Mr. Baruch

did bring about an arrangement whereby there was purchased for the Navy and War Departments 45,000,000 lb. of copper, at 16⅔c. per lb., the average price for the last ten years, when in the markets of the world and the United States copper was selling at from 26 to 33c. a pound; and that was all he did."

This remark brought forth prolonged applause.

The attack on Mr. Baruch in the House led Senator Thomas, of Colorado, to go exhaustively into the defense of Mr. Baruch and Mr. Ryan in an address on the floor of the Senate. A bit of unwritten history was brought out by Senator Thomas, when he said:

"It so happened, Mr. President, that in 1917 my attention was drawn to an agreement which had been entered into between Mr. Baruch, as chairman of the War Industries Board, and representatives of the copper industry of America, some time during the early summer of 1917, which fixed the price for Government consumption at 16⅔c. per lb., as against the then prevailing rate of over 26c. per lb.

"That arrangement, while beneficial to the Government, which had become the great consumer, threatened to close a number of small mining concerns which were making a small profit at the prevailing price, owing to the enormous increase in the cost of production. One of those mines was situated in the State of Utah, and, being requested by Mr. Smoot, the senior Senator from that state, to accompany him, we interviewed Mr. Baruch, calling his attention to this drastic consequence of the fixation of that price for copper.

"A few great companies would profit, not unduly, but profit considerably, under that arrangement, while a number of small concerns would necessarily go to the wall, and it was that condition, Mr. President, quite as much as any other, which resulted in a subsequent elevation of the price to a point under which the smaller producer could exist. The Senator from Utah, well posted regarding the industry, laid the facts and figures before the chairman, who reluctantly acknowledged their correctness. As a matter of course, he could not establish one price for the large and another price for the small producers."

NEWS BY MINING DISTRICTS

AUSTRALIA

Base Metal Industry of Commonwealth Hard Hit

Melbourne—The Australian base metal industry has been hard hit by recent falling markets and a total or partial cessation of operations is general. The Hampden-Cloncurry company, in Queensland, has closed down the McGregor group of mines, which are too low grade to be worked profitably at present prices. Operations at other mines have temporarily ceased with the exception of a little development work. The Broken Hill Associated Smelters at Port Pirie, South Australia, have closed down and it seems inevitable that the Wallaroo & Moonta Mining & Smelting Co. will follow suit.

The position in Victoria and South Australia is aggravated by the strike of marine stewards which is preventing the transport of New South Wales coal to these states. The Victorian situation is made worse by the fact that the state black coal mine at Wonthaggi and the brown coal mine at Morwell are closed down, the men being on strike in consequence of the State government's refusal to accept the award of the Hibble tribunal appointed by the Prime Minister, Mr. Hughes, under the Industrial Peace Act, one of his recent hobbies. The general opinion is that if Mr. Hughes persists in interfering between employers and employees Australia is likely to lose her present status as "a land wherein industrial peace sometimes breaks out" and become a center of perpetual strife.

Tasmania

Electrolytic Zinc Co.'s Test Plant Shut Down

Risdon—The Electrolytic Zinc Co. of Australasia, Ltd., which had intended to continue running its 10-ton plant until the larger one was ready to begin operations, has been nonplussed by the metal market slump and ceased productive operations temporarily at the end of the year.

Construction of the large plant will continue without material alteration, and the board of directors has authorized the management at Risdon to confer with the co-operative council and the works' committee to obtain their views as to the distribution of employment, particularly as affecting employees with dependents and those of long service with the company.

The first half of the large plant will be completed before the end of 1921. The start-up of operations on this unit is necessarily dependent upon the completion by the hydro-electric department of construction work at the Great Lake, the Ouse, and Waddamana, to enable that department to deliver at that date the 15,000 hp. which is part of the 35,000 hp. contracted for with the Tasmanian government.

Queensland

Government To Market Sapphire Output in Europe To Stabilize This Industry—Gold Output Drops

[illegible]

Brisbane, Jan. 25—With a view, if possible, to stabilizing the sapphire mining industry of Queensland, the Government has entered into an agreement with Rubin Brothers, of Bombay, Paris, London, and elsewhere, for the marketing of the gems in Europe. The intention is for the Government to secure the whole of the output (except fancy stones) of the Anakie sapphire mines, advance to the miners 75 per cent of that output based on the estimate of a grader on the field, and then sell through Rubin Brothers, who are to get a commission of 5 per cent, paying the miners the balance of the purchase money, less charges, when the gems are sold. That firm is, in the first instance, to provide the money for the advances. The ups and downs of the market have in the past seriously affected the industry. For instance, things were very prosperous on the field at the beginning of last year, but a few months later prices went down and many left the district. It is hoped that the new arrangement will lead to their return, and that the mining community there will in future become more settled and prosperous.

Official returns of the gold yield of Queensland for 1920 are not yet complete, but approximately the output is given as 114,180 oz., valued at £485,000—a decrease, when compared with like returns for 1919, available at this time last year, of 6,700 oz.

The Bamford State Battery is now at work, treating tin only.

The Wonbah molybdenite mine, described by a Queensland government geologist, J. H. Reid, in *Engineering and Mining Journal* for Nov. 13, 1920, p. 947, has been closed down for several months, owing to the low market price for the metal. Mr. Reid said the mine is not only of extreme geological interest but is the premier molybdenite mine in Queensland and apparently also in Australia. It will therefore no doubt be reopened when prices again improve.

CANADA

British Columbia

Trail—During the week ended Feb. 21 the Consolidated smelter received 8,565 tons of ore from the company's mines, 95 from the Horn Silver at Similkameen and 5 tons from the Nip & Tuck at Sandon.

Sandon—Although [illegible] mine is in excellent [illegible] production, the [illegible] evince any intention of beginning milling operations soon. It is hinted, instead, that the force, which now numbers between 30 and 40 men, may be further reduced.

The Dunsmuir estate, owning the Noble Five group, has taken up the bond held on a number of adjoining claims, the option being secured by the late James Dunsmuir over two years ago from the Harris & Kelly interests. Operations at the Noble Five mine and mill will not be resumed yet, it is stated, and it is believed that an effort will be made by the Dunsmuir interests to dispose of the entire property, including the additional ground acquired under bond.

Alamo — Clarence Cunningham returned recently from New York, where he is reported to have secured capital for additional development of the Queen Bess mine and other properties in which he is interested.

MEXICO

Hidalgo

Engineers Investigating Failure of Xotol Dam Said To Have Reported

Pachuca—The committee of engineers commissioned to investigate the cause of the breaking of the Xotol dam here on Jan. 19 have rendered their report, attributing responsibility for the catastrophe to carelessness on the part of the Maravillas Mining Co., according to reports from Mexico City.

Coahuila

Torreon—Louis de la Mora and associates have denounced a group of twenty pertenencias to be known as the Ampliacion de la Alianza, in the Nazas district. Samples taken from several prospect shafts which have been sunk along the vein assay well in copper and silver. Other copper mines of the Nazas district are preparing to resume after being closed down for several months. The ores from these properties are shipped to the Torreon or Velardeña smelters.

Mining is becoming very active in the Ramirez Mountains of the San Juan de Guadalupe district since the Torreon smelter has blown in. The ores from this district run high in silver and lead with a large percentage of lime.

CALIFORNIA

Operators More Optimistic Over Improved Conditions — State Legislature Gets Numerous Mining Bills

San Francisco—A greater abundance of labor is acting like a spring thaw upon a persistent snow bank in dispersing the chilly blanket of pessimism that has covered the mining industry of California for some time past. Increasing efficiency is also helping to brighten the gloom which is being gradually dispelled. Mining men are getting a fresh grip, and the return of the industry is believed to be here.

Many bills of interest to mining men have been introduced in the present legislature of California. Among these is Senate Bill No. 10, which is intended to provide a mining and metallurgical experimenting station at the mining building of the University of California as well as an appropriation of $20,000 for the purpose. This bill is like many of a similar nature. It promises an elaborate campaign of research in the mining industry. If it goes through, the mining industry of California will be more than amply served by the State Mining Bureau, the U. S. Bureau of Mines and the U. S. Geological Survey, and the new laboratory.

Assembly Bill No. 1116 is an act to provide for the organization and government of mining districts and to provide for the acquisition or construction of transportation systems for such districts. The bill provides for the incorporation of a mining district with power to purchase, construct and operate railroads, pipe lines and other means of transport. This is an elaborate and impractical plan as it presupposes a degree of co-operation of political and commercial agencies that will be almost impossible to attain.

Senate Bill No. 922 is a bill to reserve all minerals in state lands and to provide for classification, the granting of permits and leases to prospect and the royalties to be paid. This legislation is derived no doubt from the Federal leasing law and is distinctly experimental.

Assembly Bill No. 1102 provides an appropriation of $30,000 for the construction, renewal and repair of works for controlling debris resulting from mining operations. It is contingent upon the Federal Government providing a like appropriation. Its administration would be under the California Debris Commission.

Assembly Bill No. 198 would fix eight hours as a standard day, and time and a half for overtime, and double time for Sunday labor. As the bill does not recognize competitive conditions in industry, it falls into the group of unwise legislation.

Assembly Bill No. 501 provides for a more general observance of Sunday as a day of rest. It would operate to prevent operation of mines and mills on Sunday and would thus increase overhead charges in the mining industry. It is not viewed with enthusiasm by operators.

Jackson—The Kennedy mine is unwatering at a rate of 500,000 gal. per day against an inflow of approximately 75,000 gal. per day. Substantial progress is being made.

At the Argonaut a cave between the 3,900 and the 3,700 levels has been caught up and unwatering resumed.

Central Eureka and Old Eureka at Sutter Creek, the Fremont at Dry Town and the Bunker Hill at Amador City, as well as other properties are operating good working forces or preparing for increased activity. Local reports credit the Old Boston property near Mokelumne Hill with preparations for increasing milling capacity from 250 to 1,000 tons per day.

NEVADA

Tonopah Dividend To Be Reorganized on Assessable Basis

Tonopah—In the Tonopah district the Belmont is producing about 400 tons of ore per day, Tonopah Extension 230, West End 200, Tonopah Mining 200; with a more or less regular production from the Rescue, California, North Star, Midway, and Montana amounting to perhaps 75 tons per day more.

A lessee in the Montana Tonopah has recently cut what may prove to be an extensive body of high-grade ore. At one point the ore is 12 ft. wide. The leasing system, as used in some of the mines of this district, has proved very remunerative from a company viewpoint, this being especially true where the veins are small and mill tonnage hard to maintain. The Tonopah Extension has completed preliminary work on the 1,540 station of its McCane shaft and sinking has been resumed.

Divide—The Tonopah Divide company reports no change in the conditions in the southeast faces of the drifts on the 800 and 1,000 levels. Developments on upper levels are normal and the 50-ton daily ore shipments are being maintained.

The Tonopah Dividend, which owns ground northwest of the Divide orebody, is to be reorganized on an assessable basis to provide funds for further development. This is one of the few companies which has been working practically steady since the discovery of the Divide district. The Knox Divide, which has purchased the Golden State mine in the Klondike district, is shipping about 25 tons per day from that property.

Pioneer—The management of the Consolidated Mayflower mine at Pioneer has announced that milling will be resumed on March 1. There is plenty of ore of milling grade in both the Mayflower and Starlight workings, with good possibilities for high-grade developments. The Mayflower shaft is to be sunk to water level, estimated to be at about 800 ft. depth.

Silverhorn—Weir Brothers & Co., of New York, has recently become heavily interested in the new Silverhorn district near Bristol and associated with them are a number of New York and Tonopah mining men. Active work is now being done by the Navada Silver Horn Mining Co., on the big upstanding ore dike, and already a strike of much importance has been made which greatly enlarges the profitable ore zone. At a point a hundred feet to the north of the United States Mineral on the Horn Silver No. 1 claim and distant at least 150 ft. from the sectors recently sampled by T. H. France and engineers representing the New York interests, C. E. Blount, superintendent of the mine, discovered high-grade silver ore. Sectional sampling of this important discovery gave assays which averaged over an area ten feet square, 32.7 oz. silver with 60c. gold.

Pioche — Ore shipments from the Pioche district for the week ended Feb. 17 totaled 2,270 tons. Shippers were as follows: Virginia Louise, 955 tons; Prince Con, 915; Black Metals, 150; Bristol, 200; and Con. Nevada-Utah, 50.

W. E. Brodie, who recently secured a lease on the slag dumps of the two old Pioche smelters, shipped the first car to the American Smelting & Refining Co., at Salt Lake City, last week.

Shipments of silver-lead-zinc ore from the Combined Metals mine will be started immediately.

Ely—Another substantial cut in the payroll of the Nevada Consolidated Copper Co. has been made, and only about 30 per cent of the men formerly employed by the big company are still on the payroll. Operations at the mines at Ruth and at the mill and smelter at McGill have been reduced to a minimum. Married men have been retained wherever possible and there are now hardly any single men on the payroll.

Other mines in the Ely district are working on a small scale and shipments have practically ceased.

IDAHO

Cœur d'Alene District

Independence Lead May Resume Operations After Long Idleness

Mullan—After being idle several years there are indications that the Independence Lead Mines Co. will soon be active. A few men are now engaged in retimbering the main tunnel. The Independence joins the Morning on the east and extends almost to the Hunter, presumably including one or more of the great orebodies which have made those mines productive for many years. It was acquired by the Stewart Mining Co. at the time the late F. August Heinze was the dominant figure in the Stewart. M. W. Bacon, formerly manager of the Stewart, is now a large stockholder, as is also Harry L. Day.

WASHINGTON

Okanogan Valley Power Co.'s New Plant Completed, Assuring District Ample Power Supply

Oroville—The stability of the domestic silver market is being reflected in a renewal of mining activity in the Oroville-Nighthawk district of northern Okanogan County, Washington. The Okanogan Valley Power Co. has completed its new power plant at Similkameen Falls and the mines of the district can now be assured of a continuous power supply. There has been an exceptionally heavy snowfall in the mountains this winter and the smaller companies are waiting for the spring thaw before resuming operations.

The Pyrargyrite Mining Co. has its new 75-ton concentrator ready for its first run and is awaiting power. This mill is a modern installation.

The Four Metals Co. is planning to erect during the summer a 75 ton concentrator for treating silver-lead-copper ore. After two years of consistent development work this company has its property in an excellent physical condition.

The Kaaba Mines Co. has completed 630 ft. of drifting on the 200 level; all of this work is on a large medium-grade quartz vein. During the summer it plans to deepen the shaft to the 400 level and lower levels run to block out the ore. The Lone Pine company has kept the two men at development on its property during the winter.

Conconully—In the Ruby-Conconully district the Arlington mine has closed down temporarily on account of the deep snows hampering operations. It will resume shipments early in the spring. A road has been broken through the snow as far as the Last Chance mine and occasional shipments are being made from that property.

Northport—The Electric Point mine, Washington's major lead producer, closed down last month to await a more favorable market. The management prefers to hold a large tonnage of ore in stock at the lower tram terminal, rather than accept the present price for lead.

Index—The Sunset copper mine in the Index district has also suspended and it seems that the only production that can be expected during the next few months will come from those mines which have an appreciable amount of silver in their ores.

MICHIGAN

Menominee Range

Operations Slow at Iron County Mines

Crystal Falls—Mines at the east end of Iron County are operating at a slow pace. At the Odgers one group of men works two weeks and then lays off two weeks that another set may find employment. A new level is being opened and the shaft will be continued 80 ft. below this and an ore pocket and crusher installed.

At the Carpenter and Monongahela one shift is working without change throughout the month.

At the Balkan and Judson mine forces have been reduced to the minimum.

At the Amasa-Porter and Warner a slightly larger number of men are employed. At the Warner a new shaft is being sunk that will take a year to finish.

Wells—The furnace and chemical plant is to be started as soon as a working force of men skilled in this work can be secured.

Gogebic Range

Steel & Tube Co. at Ironwood Cuts Week to Four Days—Accident at Pabst Kills One

Ironwood—The Steel & Tube Co. of America, operating the Anvil-Palms and Newport mines and the second largest operator on the range, reduced operations to four days per week starting Feb. 24. It had previously reduced forces and wages considerably.

The Republic Iron & Steel Co. has also reduced work at its mines, the Townsite now being on a three day per week schedule.

A fatal accident occurred at the Pabst mine Feb. 23 in what was apparently one of the safest stopes in new ground where there was little "weight." A post broke suddenly, letting a lot of fine run through the lagging and burying a miner, who was suffocated.

MINNESOTA

Mesabi Range

Inland Steel Defendant in Two Suits

Hibbing—The Inland Steel Co., operator of many large properties on the Mesabi Range, is named as defendant in two suits, one involving $157,916 damages and the other for $212,500.

The actions involve certain tracts of iron bearing land in Minnesota which were leased by George H. Crosby as agent for the plaintiffs to the Inland company. The plaintiffs contend that the properties were not mined as per contract and that owing to the operations conducted a certain amount of ore was lost and that the property was also damaged by the methods of mining that were used.

The blacksmith shop and several small buildings of the Laura mine, a property of the Inland Steel Co., were burned last week. The fire spread very rapidly, endangering for a time all the buildings at the plant.

NEW YORK

State Ranks High as Producer of Non-Metallic Minerals—Several Iron Ore Companies Operating

Special Correspondence

The products of the mines of New York State, in order of value, are magnetic iron ore, rock and evaporated salt, gypsum, graphite, zinc, garnet, talc, pyrites, hematite iron ore, feldspar, granite, and marble. Production during the last year was about normal, with some slackness at the close and increased stocks on hand. New York is the largest producer of clay products in the United States and ranks high in its output of portland cement.

The operators producing magnetic iron ore are: The Chateaugay Ore & Iron Co., with mines at Lyon Mountain. This low-phosphorus ore is smelted at Standish furnaces. A program of extensive development is being successfully carried on under the supervision of J. R. Linney. It is planned to deepen the main hoisting shaft to the [illegible] level at once. The rolling formation of this great orebody calls for more than one method of mining. Milling is adopted where the formation is favorable, and the room and pillar system elsewhere.

At Mineville, Witherbee, Sherman & Co. are operating the Barton Hill and New Bed, a continuation of the old Orchard mine, the ore being low [illegible] phosphorus and coarsely crystalline, and the Harmony mine, the ore here being somewhat similar to that of Barton Hill, and in which the lens is of great size and apparently extends and connects with the Barton Hill orebody and resembles it in appearance. South of this, and pitching under it at depth, is the ore bed known as Lower Old Bed. Both mines are connected at depth. The mines have the most up-to-date electrical equipment. Continuous prospecting by core drills and the steady, well-planned development work extending over several years have brought good results. The introduction of electric shovels and other mechanical loaders in these deep mines has kept costs down, and, notwithstanding the scarcity of labor, production has been maintained.

The Port Henry Iron Ore Co. operates two mines, the Clonan and the Welch. Both mines are electrically equipped, and considerable development work is being done in the former. The shaft has been deepened 300 ft. to reach the Lower Old Bed, which is identical with the Lower Old Bed of Witherbee, Sherman & Co.

The Fort Montgomery Iron Corporation, 20 Vesey St., New York, operates the old Forest O'Dean mine, about six miles west of West Point. The ore is of very high grade. In form it is a heart-shaped chute dipping about 19 deg., with hardly a degree of variation for over 4,000 ft. Its formation and its dip under a mountain limit production by long haulage, which up to the present time is carried on in one stage.

The Ramapo Ore Corporation two years ago acquired the iron property of the Sterling Iron & Railway Co., at Sterlington. The mines are near Sterling Lake, in Orange County, and seven miles from Sterlington. The Lake mine deposit is a lens dipping under Sterling Lake, and is now at a depth of 3,200 ft. This lens has continued to that depth in about uniform width, with indications of splitting on lower floors. The Scott mine is also being electrically equipped, and a 400-ft. vertical concrete shaft has been completed and crosscuts driven to the ore. A test mill has been erected, and preparations have been made on an extensive scale for large production.

Hematite iron ore is mined by two operators. At the Clinton Hematite mines, owned by Mrs. A. Borst, of Utica, the deposit is about 32 in. thick, and it is estimated that the bed, as owned, is about twenty-five square miles in extent. The mine, which is just northeast of Clinton, is worked on the longwall advancing system. The ore is first mined, and then about 2 ft. of slate is taken down and gobbed. Hardly any timber is used. This mine is handicapped by being unfavorably situated for the transportation of the ore to the Pennsylvania market. The ore is 48 per cent sesquioxide, with about 6 per cent lime. Facilities for shipping this ore via the Barge Canal should be obtained to relieve the high railroad freight now imposed.

The other hematite mining operator is the Furnaceville Iron Ore Co. at Ontario Centre in Wayne County, where surface or open-pit mining is used. The ore is about 20 in. thick and the overburden to the south is getting heavier with every cut until it has almost become unremunerative. Much of this ore as well as the Clinton ore is used for making paint.

SALT AND GYPSUM PRODUCTS OF IMPORTANCE; LATTER INCREASINGLY SO

The Retsof Mining Co., at Retsof, and the Sterling Salt Co., at Cuylerville, are the only rock-salt miners in the East. The salt bed is about 80 ft. thick, of which a 9 to 11-ft. layer is of commercial value. The bed is reached by vertical shafts at about 1,100-ft. depth. Both corporations are preparing for increased production by adding to their hoisting facilities, and have electrically equipped the mines.

Gypsum is becoming scarcer and more valuable—scarcer owing to the demand for the material by cement manufacturers, for it acts as a retarder, of which they add 3 per cent to their cement. Gypsum is getting more valuable as the number of gypsum products increase. The principal producers of gypsum and gypsum products are: U. S. Gypsum Co., of Oakfield; Niagara Gypsum Co., of Oakfield; American Cement Plaster Co., of Akron; Ebsarn Fireproofing & Gypsum Block Co., of Rochester, with mines and mills at Wheatland and Garbutt; Lycoming Calcining Co., with mine and mill at Garbutt; Empire Gypsum Co., of Rochester, with mine and mill at Garbutt, and American Gypsum Co., of Rochester, with mine at Akron.

Other corporations preparing for production are the Phœnix Gypsum Co., of Rochester, with a mine being developed at Wheatville, and American Hardwall Plaster Co., of Utica, with a property near Oakfield, on which a shaft is being sunk. The Victor Plaster, Inc., of Rochester, has been organized to develop a gypsum property at Victor, in Ontario County. This is a new territory, claimed to contain 4½ million tons of high-grade gypsum, and it is the company's intention to grind mostly for land plaster and also for the cement trade.

GRAPHITE AND ZINC

Graphite is mined by the American Graphite Co., of New Jersey, at Graphite, six miles from Hague on Lake George. This is the source of supply of the Dixon Crucible Co. Frank C. and George Hooper, pioneers of the graphite mining and milling industry, operate a graphite mine and mill about five miles from Whitehall, north of South Bay, Lake Champlain. The product and separation are good, but slackness in the market and fuel scarcity has caused a temporary shutdown, and it is not likely that work will be resumed until spring, 1921. The development of an hydro-electric plant on the property is anticipated.

The Northern Ore Co., at Edwards, in St. Lawrence County, has been a large producer of zinc, with mines and mill about a mile north of Edwards. The New Jersey Zinc Co. built and operated a separator last year at its mine near Talcville, in St. Lawrence County.

TALC, GARNET AND FELDSPAR

Garnet for abrasive purposes is mined by H. H. Barton Sons, of Philadelphia, at the Gore Mountain mine near North River. This is an open quarry in fairly soft rock. The North River Garnet Co. (Messrs. Hooper & Richards, of Glens Falls), North River, mines garnet rock near Thirteenth Lake, six miles from North River. The mine and mill were operated night and day last year. The separation of the garnet is effected in water and is close work, owing to the very slight difference in the specific gravity of the garnet and the rock. About five miles north of North River at Minerva the American Glue Co. erected a mill last year for recovery of garnet from its mine ore.

Talc is mined almost exclusively by the International Pulp Co., of Gouverneur, at Talcville, in St. Lawrence County. The deposit is found in lenses and is difficult to mine. Most of the mining is done by level stoping. The Loomis Talc Co. is mining talc at Little York, near Gouverneur, and its new mill is nearing completion. The Uniform Fibrous Talc Co. is planning to deepen its new vertical shaft so as to reach the ore at depth below the old mine.

Feldspar is mined by Kinkle Sons Co., of Bedford, Westchester County; McLear Bros., at Gouverneur, and the Maco Co. at Wilton. The feldspar of Kinkle Sons Co. is pink. The mill is about four miles from Bedford Station. The McLear Bros. mine is near Old De Kalb, St. Lawrence County. The deposit is about half gray feldspar and gray quartz, and is very extensive. Properly equipped it should be a large producer.

GRANITE, MARBLE AND PYRITES

Granite is quarried by the Mohegan Granite Co. at Peekskill, the Finch Pruyn Co., of Glens Falls, which quarries a fine quality of black marble, and by George Brothers, of Ausable Forks, who quarry syenite for monumental purposes. The Vermont Marble Co., of Proctor, Vt., quarries some pink-eye marble limestone at Bluff Point, in Clinton County.

The mining of pyrites is limited to the operation of the New York Pyrites Co., at Gouverneur. This mine was developed during the war, and a fine mill hurriedly erected, but since the armistice the demand for pyrites has fallen off. An extensive deposit of 33 per cent ore has been developed, and since the property is newly opened under ordinary conditions it should be remunerative, but at present the market is discouraging.

THE MARKET REPORT

Daily Prices of Metals

Feb.	Copper, N. Y. net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
24	12.25	28.25	32.25	4.00	4.00	4.80
25	12.25	27.75	31.50	3.90	3.90	4.80
26	12.25	27.50	31.00	3.75	3.75@3.90	4.80
28	12.10@12.15	27.00	30.00	3.75	3.75	4.75
Mar. 1	12.10@12.15	27.25	30.00	3.75@4.00	3.75@4.00	4.75
2	12.10@12.15	26.50	29.25	3.75@4.00	3.75@4.00	4.75

*These prices correspond to the following quotations for copper, "delivered": 12.50, 12.50, 12.50, 12.375, 12.375, 12.375c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Feb.	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
24	70	69¼	73½	168½	171¾	18¼	19	25½	[illegible]
25	69¼	68¼	73	165½	169½	[illegible]	17¼	23¾	24¾
26	..	..	..	....	....				
28	68¼	67½	73	159½	[illegible]	[illegible]	18¼	23¾	24½
Mar. 1	68¼	67¼	73	152	162	[illegible]	[illegible]	23¾	[illegible]
2	67½	67¼	73	155½	[illegible]	18¼	[illegible]	[illegible]	24¾

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Feb	Sterling Exchange	Silver New York, Domestic Origin	Silver New York Foreign Origin	Silver London	Feb	Sterling Exchange	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
24	[illegible]	99½	56	32	28	[illegible]	[illegible]	[illegible]	[illegible]
25	385½	99½	[illegible]	31⅞	Mar. 1	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	99½	[illegible]	32	2	[illegible]	[illegible]	[illegible]	[illegible]

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, March 2, 1921

The week has been exceedingly quiet in all of the metal markets. Copper and zinc have made further declines, but lead, after declining to below 4c., has recovered slightly. The two political factors, the inauguration and the beginning of a new administration at Washington, with the uncertain situation with respect to the amount and terms of the reparation to be exacted from Germany, undoubtedly exert a large measure of influence and are partly responsible for the stagnation in the existing market. Consuming demand is, however, practically nil, and that fact, in the ultimate analysis, is responsible for the condition noted.

Copper

The volume of domestic business transacted in the last week has been pitifully small. Even those producers who are attempting to sell in the market at current prices had difficulty in tempting purchasers. Many producers refuse to enter the market at the present level and are in a favorable position for delaying offerings. Low prices, instead of encouraging buying, have apparently scared away prospective business.

Manufacturers of copper products maintain that dullness in retail trade, cancellations, and the resulting restriction of business are largely responsible for their unwillingness to enter the market at this time. Copper can be obtained for early delivery today at 12.37½c., delivered, in moderate quantities. The market is set by comparatively few sales and by those interests that are willing to dispose of their output at the low prices now prevailing. Today's quotation for copper is the lowest since 1914. Export demand is still weak, and little interest is manifested in futures.

Lead

The American Smelting & Refining Co. reduced its official price of lead, New York and St. Louis, from 4.40c. to 4.20c. on Thursday, Feb. 24, and to 4c. on Friday, Feb. 25, at which price it remains. Business was fair at the low prices, several hundred tons being purchased at 3.75c. The decline from 4c. to 3.75c. was accompanied by a large number of inquiries from dealers, brokers, and manufacturers, the latter particularly among the paint, electrical, and automobile trades. Some producers refused to sell their lead at the 3.75c. level, preferring, instead, to purchase the metal. At 3.75c. New York, lead is below production costs for practically every producer in the United States. Incidentally, this price is the lowest since January, 1915.

Zinc

The zinc market has exhibited a further decline, despite lowered production and the attitude of the producers in meeting the situation. Sales for the week by the [illegible] country have been disappointingly small. The market for ordinary brands is 4.75c., and 7.25c. for high-grade zinc. The little metal that has been changing hand has been [illegible] material.

Monthly Average Prices for February:

Copper:	
New York Electrolytic	12.556
London Standard	70.925
London Electrolytic	75.925
Lead:	
New York	4.373
St. Louis	4.228
London	20.650
Silver:	
New York, foreign	59.233
New York, domestic	99.500
London	34.745
Sterling Exchange	385.932
Zinc:	
St. Louis	4.928
London	24.850
Tin:	
99 per cent	28.534
Straits	32.142
London	166.250
Antimony	5.250
Quicksilver	49.545
Platinum	70.227

Tin

The Malay government on Friday removed the "peg" on tin, and has withdrawn as a buyer of the Straits product. The market there is now open and spot tin during the last week has shown a decline of £13 in London. The attempt of the Straits government to artificially support the market has thus apparently ended in failure. The stock accumulated in the East will be withheld from sale for an unspecified period.

Straits tin in the domestic market has declined to below 30c., the lowest price since the latter part of 1914, and the market is quiet.

Straits tin for future delivery: Feb. 24th, 33@33.25c.; 25th, 32@32.50c.; 26th, 31.75@32c.; 28th, 31@31.25c.; March 1st, 31@31.25c.; 2d, 30@30.25c.

Arrivals of tin in long tons: Feb. 21st, Liverpool, 35; 22d, China, 10; 24th, Straits, 100; China, 25; Argentina, 75; 25th, London, 350; Straits, 150; 28th, Liverpool, 75. Total arrivals, 2,500 tons at Atlantic ports in February; 85 tons at Pacific ports.

Silver

The silver market declined the last week to 31⅜d. in London on the 25th, and then reacted to 33d. on the 28th; but has declined again on China selling, and closes weak at 31½d. The Eastern exchanges are all at very low rates, with stocks of silver large in both China and India, and the basic economic conditions all indicate lower prices for silver. On the other hand, the production of silver is being seriously affected by the fall in price, and there is likely to be a decided reduction in the output of mines producing silver outside the United States.

Mexican Dollars — Feb. 24th, 41½; 25th, 41⅝; 26th, 42⅛; 28th, 42⅞; March 1st, 42½; 2d, 41⅝.

Gold

Gold in London: Feb. 24th, 105s. 11d.; 25th, 106s. 4d.; 28th, 106s. 1d.; March 1st, 105s. 10d.; 2d, 105s. 8d.

Foreign Exchange

Legitimate trade demands are light, and speculative interests are holding aloof.

On Tuesday, March 1, demand francs were 7.19c.; lire, 3.65c.; and marks, 1.62c. New York funds in Montreal, 14[illegible] per cent premium.

Other Metals

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 24@25c. per lb. Market quiet.

Antimony — Chinese and Japanese brands, 5¼c.; market quiet. W.C.C. brand, 6¼c. per lb. Cookson's "C" grade, spot, 9⅜c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony (200 mesh), 6½@7c. per lb. Demand light, with heavy supplies available.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 7c.

Bismuth—$1.45 per lb., 500-lb. lots. London price reduced Feb 12 from 12s. 6d. to 7s. 6d. accompanied by a decline here.

Cadmium—Nominal, $1.40 per lb., in 1,000-lb. lots.

Cobalt—Metal, $4.50 per lb.; black oxide, $3@$3.10 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $300 per oz. Some dealers feel iridium is in a strong position.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 38@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $70@$80 per troy oz.

Palladium—$65 per oz.

Platinum—$70 per oz. Steady.

Quicksilver—Nominally, $47@$48 per 75-lb. flask. San Francisco wires $47. Market dull.

[1]**Rhodium**—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 50@55c. per long ton unit, f.o.b. Atlantic ports.

Manganese Ore—40c. per unit, seaport; chemical ore (MnO_2) $60 per gross ton, lump; $65@$70 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

[1]**Tantalum Ore**—Guaranteed minimum 60 per cent tantalic acid, 40c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¼@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Feb. 26—Zinc blende, per ton, high, $25.10; basis 60 per cent zinc, premium, no sales; Prime Western, $22.50@$20; fines and slimes, $17.50; average settling price, all grades of zinc, $24.84.

Lead, high, $46.30; basis 80 per cent lead, $40@$32; average settling price, all grades of lead, $40.65 per ton.

Shipments for the week: Blende, 5,524; lead, 905 tons. Value, all ores the week, $175,090. Shipments for two months: Blende, 47,699; lead, 7,968 tons. Value, all ores two months, $1,765,720. Compared with last year, the shipment is a decrease of 53,203 tons zinc and 7,059 tons lead—about one-half.

Nine purchasing agents were shipping this week from advance purchases. Only two agencies purchased ore last week, and there was only light buying this week. All but one were offering $20 per ton, Prime Western, with sellers of 2,400 tons accepting this price.

Lead declined $8 per ton, closing the week with offerings of $32 basis.

One zinc buyer says prices are not pre-war but pre-historic. Not since 1897 have they averaged so low. That year the average price was $22.28 per ton. A weekly average of 3,403 tons was sold. Lead sold in 1896 at an average of $32.30 per ton.

Platteville, Wis., Feb. 26—No market for zinc or lead. Shipments for the week: Blende, 675 tons. Shipments for the year: Blende, 6,471; lead, 510 tons. Shipped during the week to separating plants, 579 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $2,000@$3,000; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, $23; ground (white), $35; ground (off color), $25@$30 per net ton, less than carload lots, f.o.b. New York. Crude, first grade, $10 per ton, f.o.b. cars, Missouri; floated, $28 per ton in bbls.; $26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis.

Chalk—English, extra light, 5@5½c.; light, 5@6c.; dense, 4½@5c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$10; washed, $10@$12; powdered, $15@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $15@$20, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30;

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[1] Furnished by Foote Mineral Co. Philadelphia, Pa.

imported lump, $15@$25, f.o.b. American ports; powdered, $35@$45, f.o.b. New York.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $25 per ton, f.o.b. Illinois mines, and $25, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, $60; lump, $17.50, f.o.b. Heathden, N. M. In Canada 85 per cent calcium fluoride sells for $20 per ton, f.o.b. Madoc; output limited. Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines. Demand very slack, with ample stocks on hand.

Fuller's Earth—$16 per ton, carload lots, f.o.b. mines.

Graphite—Ceylon lump, first quality, 8@9c. per lb.; chip, 7c.; dust, 5½c. No. 1 flake, 7½c.; high-grade amorphous crude, 3c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Dolomite, 1@2 man size, $1.60@$1.65; 2@8 in., $1.55@$1.65 per net ton, f.o.b. Plymouth Meeting, Pa.; fluxing, $1.65@$1.75 per net ton, f.o.b. Howellville, Pa.

Magnesite, Calcined — High-grade caustic calcined, lump form, $35@$40 per ton, carload lots, f.o.b. California points. In Chicago district, $57.70; Atlantic seaboard, $61@$63.

Dead-Burned — $38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); all f.o.b. New York.

[1]**Monazite**—Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Domestic demand weak; movements of stocks into consuming channels reported slow. Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $8.35; 68 per cent, $7.85; 68@66 per cent, $7.60.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 16c., c.i.f. Atlantic seaport; furnace size, 16½c.; Spanish lump, 14@16c.; domestic fines, f.o.b. mines, Georgia, 12 @ 14c.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$45, talcum powder grade. Southern talc, powdered, carload lots, $10@$14 per ton; less than carload, $25, f.o.b. cars; freight to New York $5.25 per ton, carload lots; less than carload lots, $9.25. Imported, $40@$50; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 9@10c. per lb. in carload lots. Usual spring demand is not being felt for insecticides. Supplies are plentiful and market is dull.

Sodium Nitrate—$3 per cwt. ex vessel, Atlantic ports. Market quiet.

Sodium Sulphate—For 95 per cent material, $20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; $32 per ton, New York.

Potassium Sulphate—Domestic, $220@$230 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 16@17c. per lb. of chromium contained; 4 to 6 per cent carbon, 16@17c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $100, f.o.b. furnaces; resale, $90, delivered; English, $100, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $40@$45, f.o.b. furnace.

[1]**Ferromolybdenum**—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $55@$60; 50 per cent, $80@$85; 75 per cent, $145@$150.

Ferrotungsten—Domestic, 70 to 80 per cent W, 55@60c. per lb. of contained tungsten, f.o.b. works. Foreign, 60c.

Ferro-uranium—35 to 50 per cent U, $7 per lb. of U contained, f.o.b. works.

Ferrovanadium—Basis 30 to 40 per cent, $5 per lb. of V contained, plus 75c.@$2 differentials and according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York list price, 21½c. per lb.; wire, 15¾.

Lead Sheets—Full lead sheets, 8½c.; cut lead sheets, 8¾c. in quantity, mill lots.

Nickel Silver—33½c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets, 19¾c.; sheathing, 19¾c.; rods, ⅝ to 3 in., 16¾c.

Zinc Sheets—$11 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $80 per net ton, shipping point; arches, keys, wedges, $85; splits, soaps, $100.

Fire Brick—First quality, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $45@$50.

Magnesite Brick—9-in. straights, $90@$100 per net ton; 9-in. arches, wedges and keys, $105; soaps and splits, $120.

Silica Brick—9-in., per 1,000: $45@$55 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, March 1, 1921

Few declines in finished-steel products have occurred in the last week, not so much because mills are not willing to make additional cuts as because there is little incentive by way of attractive orders. Plates have been quoted at 2.10c., against 2.25c. a week ago, and the Industrial Board price of 2.65c. Black sheets can be done readily at 4.10c., against 4.15c. a week ago, and the Industrial Board price of 4.35c., and galvanized are available at 1.15c. above black, instead of 1.20c. Structural shapes have shown no activity. Bars are still quotable at 2c. It is believed that 1.90c. or possibly even 1.85c. could be done on a sufficiently attractive order.

The extreme stagnation of the last few weeks is likely to be followed by a moderate amount of buying this month and next, on account of the season, but no widespread buying movement is expected for any time this year.

Pig Iron—Foundry iron is quotable $1 lower, at $27, Valley, bessemer remaining at $27 and basic at $25. Some stocks of basic in the hands of steel works could probably be bought for less than $25.

Semi-finished Steel. A large independent producer has quoted sheet bars at $42, against the Corporation price of $47, but did not interest the consumer. Billets may be quoted by [illegible] at $40

Charcoal and Coke

Charcoal—Willow, 7c. per lb. in bbls., hardwood, 5½c. per lb., in 250-lb. bbls Barrel charge is 35c. additional.

Connellsville — Furnace [illegible] $5.50; foundry, $6@$6.50.

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[1] Furnished by Foote Mineral Co, Philadelphia, Pa

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York 1920	New York 1921	London 1920	London 1921	Sterling Exchange 1920	Sterling Exchange 1921
January	132.827	65.950	79.846	39.985	367.082	372.650
February	131.295	59.233	85.005	34.745	337.466	385.932
March	125.551		74 194	.	370 870	......
April	119 779		68.848	......	392.438	......
May	102.585	.	60.010	......	383.360	......
June	90.957		51.096	......	393.663	......
July	91.971		53.736	......	385.538	......
August	96.168	.	59.875	......	360.404	......
September	93.675	..	59.476	.	350.370	......
October	83.480	.	54.197	......	346.460	......
November	77.734	. .	50.952	......	342.333	......
December	64.774		41.845	......	348.101	......
Year	100.900	. .	61 590	......	364 840	......

New York quotations cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York Electrolytic 1920	New York Electrolytic 1921	London Standard 1920	London Standard 1921	London Electrolytic 1920	London Electrolytic 1921
January	18.918	12.597	118.095	70.964	123.238	79.119
February	18.569	12.556	120.188	70 925	126 950	75.925
March	18.331	.	109.533		118 348	
April	18 660		103 025		111 500	..
May	18.484	.	96.750	......	109.200	
June	18.065		87.864	......	101.909	
July	18.576		90.148	......	106.455	.
August	18.346		93.935	......	111.143	
September	18.144		96.381	......	111.905	
October	15.934		93.327	......	104.905	
November	14.257		84 807	......	94.614	
December	13.188		75.702	......	85.905	
Year	17.456	......	97.480	......	108 839	

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York 1920	New York 1921	St. Louis 1920	St. Louis 1921	London 1920	London 1921
January	8.561	4 821	8.300	4.747	47.095	23 387
February	8.814	4 373	8.601	4.228	50.256	20 650
March	9.145	.....	8 894	......	46 054	......
April	8.902	. .	8.618	......	39.225	......
May	8 576	. . .	8.352	......	38.488	. .
June	8.323	.	8 169	.	34 330	. . .
July	8.338	.	8.283	......	34.960	. . .
August	8.687	.	8.725	......	36.304	. .
September	8.177	..	8 160	.	35 452	.
October	7.070		7.018	......	35 238	. . .
November	6.159	. ..	6 127	.	32 489	. . . .
December	4.727	.	4.717	......	24.089	.
Year	7 957	.	7 830	.	37 832	.

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton.

Tin

	New York 99% 1920	New York 99% 1921	New York Straits 1920	New York Straits 1921	London 1920	London 1921
January	61.596	36 000	......	36 000	376.512	190.464
February	58.466	28.534	59.932	32.142	395.750	166.250
March	61 037		61 926		369 489	. .
April	61 120		62 115		345.450	. .
May	53.230	......	55.100	......	294.813	. .
June	46 125		48 327		250 614	
July	45 798		49 154		261.886	
August	43 856	.	47 620		274 048	.
September	41 940		44 465		270.120	. .
October	39 310		40 555	.	258 190	.
November	35.667	......	36.854	......	241.080	.
December	31.135	......	34.058	......	212 440	.
Year	48 273		49 101		295 866	.

New York quotations, cents per lb. London, pounds sterling per long ton.

Zinc

	St. Louis 1920	St. Louis 1921	London 1920	London 1921
January	9.133	5 413	58.643	25 262
February	8 708	4 928	61.338	24 850
March	8.531		53 467	
April	8.184		47.388	. .
May	7.588		45.088	.
June	7 465		41.193	
July	7.720		41.886	.
August	7 835		41 220	
September	7.661		39 690	
October	7 150		39.756	
November	6 247		35 028	
December	5 824		27 762	
Year	7.671		44 372	.

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a) New York 1920	Antimony (a) New York 1921	Quicksilver (b) New York 1920	Quicksilver (b) New York 1921	Platinum (c) New York 1920	Platinum (c) New York 1921
January	10.577	5 258	90 192	48 440	154 23	73 400
February	11.588	5 250	84.432	49 545	151.59	70.227
March	11.056	......	92.611	......	138 56	.
April	10.500	....	102.192	......	127 04	
May	9.655		89.560	......	97 50	.
June	8.289	. .	90.154	......	85 19	.
July	7.500	.	90.333	......	83 94	.
August	7.177	..	83.806	......	111 44	.
September	7.113	.. ..	75.000	......	115 20	. .
October	6.723	. .	67.200	......	101 70	. .
November	6.109	. . .	58.417	.. ...	84 75	.
December	5.534	. ..	49.577	......	79 62	..
Year	8 485	. . . .	81.123	......	110 90	..

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer 1920	Bessemer 1921	Basic 1920	Basic 1921	No. 2 Foundry 1920	No. 2 Foundry 1921
January	$40.47	33 96	$39.88	31 96	$39.86	33 88
February	42.95	28 96	42.61	26 96	43.40	30 12
March	43.40		42.90	.	43.40	. . .
April	43.72		44.22		43.90	.
May	44.00		44.88	..	45 36	.
June	44.89		45.41	..	46.40	. .
July	47.21		47.42	.	46 56	. .
August	48 90		49.88	.	49 35	.
September	50.46		50.46	.	51 96	. .
October	49.21		44.38	.	48 58	.
November	41.26		39.20	.	42 61	. .
December	36.96		34.90	. .	37 73	. . .
Year	44.45		43.85	..	44.93	.

In dollars per long ton

Monthly Crude Copper Production

	1920 October(a)	1920 November	1920 December	1921 January
Alaska shipments	4,984,219	12,802,696	6,631,700	5,241,634
Arizona Copper	2,800,000	2,800,000	2,650,000	2,300,000
Calumet & Arizona	3,802,000	3,486,000	3,300,000	2,438,000
Cons. Ariz. Smelting	865,000	750,000	476,000	
Inspiration	7,000,000	5,350,000	5,000,000	5,000,000
Magma	750,814	671,752	600,000	600,000
Miami	4,582,293	4,505,232	4,373,123	4,439,000
New Cornelia	3,450,000	2,670,000	2,688,456	2,170,000
Old Dominion	2,912,000	2,563,000	2,655,000	2,822,000
Phelps Dodge	5,309,000	5,492,000	5,850,000	6,339,000
Shattuck Arizona	206,772	6,063	.....	
Ray	3,990,800	3,975,000	2,975,000	2,983,000
United Verde	5,858,000	4,030,000	3,260 000	3,500,000
United Verde Extension	3,864,756	2,642,812	3,204,258	3,219,912
Calumet & Hecla	7,945,502	7,326,763	7,507,712	7,234,300
Other Lake Superior	6,000,000	6,000,000	6,000,000	6,000,000
Anaconda	11,000,000	11,100,000	10,500,000	9 700,000
East Butte	1,626,980	1,658,860	1,538,760	1,500,000
Nevada Cons	3,850,000	3,950,000	3,000,000	3,000,000
Chino	3,933,435	4,000,000	2,999,000	2,999,751
Utah Copper	8,000,000	9,120,000	7,500,000	7,500,000
Eastern Smelters	1,600,000	1,600,000	1,600,000	1,500,000
Others, estimated	10,900,000	10,200,000	11,400,000	10,000,000
Total United States	105,231,571	106 700 178	95,709,009	90,586,597
Imports: Ore and concentrates, etc	9,626,502	7,143,610	6,331,559	
Imports in blister, etc	24,559,763	31,148,088	34,619,919	
Grand total	139 417 836	145,291,876	136,660,487	.
British Columbia:				
Granby Cons	2,293,500	2,465,585	2,665,018	2,530 038
Mexico				
Boleo	617,200	771,680	1,014,160	969,920
Cananea	3,500,000	3,500,000	3,700,000	2 530,038
Phelps Dodge Mexican properties	1,817,000	2,666,000	2,468,000	2,362,000
Other foreign:				
Cerro de Pasco	4,698,000	3,612,000	4,258,000	4,086,000
Chile	9,420,000	8,859,984	.	
Katanga	2,697,696	3,174,624		
Backus & Johnston	1,740,000	1,548,000	1,604,000	1,760,000

Comparative Annual Copper Production

	1919	1920	1921
January	135,733,511	121,903,744	90,586 597
February	111,649,512	117,450,000	
March	102,040,460	120,309,316	
April	98,808,998	116,078,871	
May	92,652,975	114,964,207	
June	95,856,570	116,107,856	
July	100,369,247	109,729,510	
August	107 994,040	116,460,654	
September	108,703,075	(a) 104,919,262	
October	115,143,143	(a) 105,231,571	
November	117,289,735	106,700 178	
December	102,997,633	95,709,009	

(a) Revised

COMPANY REPORTS

St. Joseph Lead Co. Reports Large Earnings

Lead; Missouri

The annual report of the St. Joseph Lead Co. states that in the year 1920 dividends to the amount of $2,889,436 in cash were paid to stockholders and a stock dividend of 140,946.6 shares was distributed ($1,409,466).

As the earnings for the fiscal year, after allowances for depreciation, depletion, and reserve for Federal taxes were $2.563,690 after an addition of $78,823 due to the separation of the accounts of the St. Joseph Lead Co. and the Doe Run Lead Co., the company's surplus on Dec. 31, 1920, was $1,656,390 less than on Dec. 31, 1919.

The mines produced 2,133,327 tons of ore, yielding 119,429 tons of lead concentrates and producing 78,497 tons of pig lead.

During the year the company purchased and now holds in its treasury, or in the sinking fund, $230,000 additional bonds of the Mississippi River & Bonne Terre Ry. Holdings of Government securities on Dec. 31, 1920, were Third 4¼ per cent U. S. Liberty Loan. $1,500,000; U. S. certificates of indebtedness 5¾ per cent, $1,450,000.

Federal income and excess profits taxes amounting to $105,700 were paid in 1920 on account of 1919 income.

Income account as taken from the consolidated general balance sheet, Dec. 31, 1920, follows:

	1920	1919
Net income after providing for depreciation of plant	$4,813,512	$2,295,256
Depletion	1,202,086	1,116,816
Federal taxes	600,000	117,844
Balance	3,011,426	1,060,596
Cash dividends	2,889,436	1,550,478
Surplus	$121,990	$489,882 (a)

(a) Deficit.

The surplus account stood at $11,098,952 on Dec. 31, 1920, compared with $12,755,342 Dec. 31, 1919.

The International Nickel Co.

The International Nickel Co. has issued the following statement covering its condition on Dec. 31, 1920:

ASSETS	
Property	$48,093,797 90
Investments	1,085,971 43
Inventories	11,764,482 86
Accounts and bills receivable	1,208,213 96
Loans on call	2,015,000 00
Cash	1,757,997 14
Total	$65,925,463 29

LIABILITIES	
Preferred stock	$8,912,600 00
Common stock	41,834,600 00
Accounts payable and tax reserves	1,786,674 06
Preferred dividend No. 61 payable Feb. 1, 1921	133,689 00
Accident and insurance funds	396,860 50
Exchange reserve	250,000 00
Surplus April 1, 1920	10,391,233 38
Profit and loss (balance as per statement)	2,219,806 35
Total	$65,925,463 29

CONSOLIDATED GENERAL PROFIT AND LOSS STATEMENT

Nine Months Ending Dec. 31, 1920

Earnings		$4,415,774 20
Other income		920,164 81
Total income		$5,335,939 01
Administration and general expense	$495,217 76	
Reserved for U. S. and foreign taxes (estimated)	534,840 63	1,030,058 39
Net income		$4,305,880 62
Depreciation and mineral exhaustion		1,685,007 27
Profits		$2,620,873 35

DIVIDENDS

Preferred No. 59. Paid Aug. 2, 1920	$133,689 00	
Preferred No. 60. Paid Nov. 1, 1920	133,689 00	
Preferred No. 61. Payable Feb. 1, 1921	133,689 00	401,067 00
Balance		$2,219,806 35

Davis-Daly Copper Co.

A report of the Davis-Daly Copper Co. for the three months ended Dec. 31, 1920, states that, unlike many copper mining companies, production has not been curtailed.

Receipts and disbursements follow:

RECEIPTS

	Ore Returns	Miscellaneous Revenues
October	$50,282 62	$3,115 07
November	75,099 82	2,480.15
December	54,772.13	8,810 52
	$180,154.57	$14,405 74

Total receipts, $194,560.31.

DISBURSEMENTS

	Development	Mining Cost	Equipment	Butte Gen. Exp.	Boston Expense
October	$16,742.65	$61,014 60	$4,375.34	$15,545.07	$4,764 68
November	10,077.30	49,800 07	3,325.50	11,303.65	3,888 89
December	13,158.98	42,454.16	2,337.93	15,593.72	a14,504 91
	$39,978.93	$153,268.83	$10,038.77	$42,442.44	$23,158 48

Total disbursements, as above, $268,887.45. (a) Including U. S. income tax.

New Jersey Zinc Co.

The New Jersey Zinc Co. has issued the following statement of operations for the last quarter of and the year 1920:

Income (including dividends from subsidiary companies), after deductions for expenses, taxes, maintenance, repairs and renewals, betterments, depreciation and contingencies		$881,557 42
Deduct interest on first mortgage bonds		40,000 00
Net income		$841,557.42
Dividend: 2 per cent payable Feb. 10, 1921		840,000 00
Surplus for the quarter		$1,557.42
Net income:		
First quarter		$2,628,127.47
Second quarter		2,756,576.98
Third quarter		1,711,873 69
Fourth quarter		841,557.42
		$7,938,135 56
Less.		
Dividends declared	$5,600,000 00	
Accrued interest on stock subscriptions	13,092 18	
Reserve for adjustments of inventories and Federal taxes	341,179.92	5,954,272 10
Surplus for the year		$1,983,863 46

Mining Dividends for February, 1921

The following is a partial list of dividends paid by American mining and metallurgical companies during February, 1921:

Companies in the United States	Situation	Per Share	Totals
Chief Consolidated, l. s.	Utah	$0 05Q	$44,211
Granite Gold, g.	Col.	.03K	52,500
Internat. Nickel	U. S. and Canada	1 50Q	133,689
Miami Copper*	Ariz.	50Q	373,557
New Jersey Zinc	N. J.	2 00Q	840,000
United Verde Extension	Ariz.	50Q	525,000
Companies in Canada and Mexico			
Amparo Mining, g. s.	Mex.	0 03Q	$30,000
Hollinger Consol. Gold	Canada	.05M	246,000

Q, Quarterly. K, Irregular. M, Monthly.

*Miami Copper Co.'s dividend No. 34 was paid on Feb. 15, 1921, and not in January, as previously announced.

The feature of February's dividend record among mining companies was the omission of the $1 quarterly dividend paid by the Anaconda Copper Mining Co. since May, 1919, when it was reduced from $2 to $1. Other companies omitting dividends due at this time were Greene Cananea Copper, American Zinc, Lead & Smelting, Ltd., and Mohawk Mining. The New Jersey Zinc, the Chief Consolidated, and the Amparo Mining companies reduced the amount of their disbursements; but Granite Gold Mining pays for the first time since March, 1918.

The Rand Mines, Ltd., paid $2 per share on "American" shares, Feb. 25; and on Dec. 31, 1920, the North Star Mines disbursed $75,000 to its 250,000 shares outstanding. Frontino & Bolivia Gold paid a semi-annual dividend of 1s., amounting to £7,000, on Jan. 13.

MINING STOCKS

Week Ended February 26, 1921

Stock	Exch.	High	Low	Last	Last Div.	
			COPPER			
Adventure	Boston	....	....	*60		
Ahmeek	Boston	50	48	48½	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	⅝	½	½		
Allouez	Boston	22	22	22	Mar. '19	1.00
Anaconda	New York	38⅞	38	38½	Nov. '20, Q	1.00
Arcadian Consol	Boston	2⅞	2½	2⅞		
Ariz. Com'l	Boston	8¾	8½	8½	Oct. '18,	.50
Big Ledge	N. Y. Curb	⅜	5/16	⅜		
Bingham Mines	Boston	....	....	8½	Sept. '19, Q	.25
Calumet & Arizona	Boston	50	47	47⅛	Dec. '20, Q	1.00
Calumet & Hecla	Boston	252	235½	238	June '20, Q	5.00
Canada Copper	N. Y. Curb	....	....	*13		
Centennial	Boston	9½	9½	9½	Dec. '18, SA	1.00
Cerro de Pasco	New York	28½	27½	27½	Dec. '20, Q	1.00
Chile Copper	New York	11⅞	11⅛	11⅝		
Chino	New York	22⅜	21½	21½	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*35½	*33½	*34		
Con. Arizona	N. Y. Curb	....	....	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	....	....	2⅛		
Copper Range	Boston	35½	34	34½	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*38	*34	*34		
Davis-Daly	Boston	6½	6¼	6½	Mar. '20, Q	.25
East Butte	Boston	9¼	9	9	Dec. '19, A	.50
First National	Boston Curb	*95	*85	*90	Feb. '19, SA	.15
Franklin	Boston	....	....	2⅝		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol.	New York	22	22	22	May '19, Q	1.25
Greene-Cananea	New York	22⅛	22	22⅛	Nov. '20, Q	.50
Hancock	Boston	2½	2½	2½		
Howe Sound	N. Y. Curb	....	....	3	Jan. '21, Q	.05
Inspiration Consol.	New York	35	34¼	35	Oct. '20, Q	1.00
Iron Cap	Boston Curb	7¼	6½	6½	Sept. '20, K	.25
Isle Royale	Boston	20	19¼	20	Sept. '19, SA	.50
Kennecott	New York	18¼	17⅝	18⅛	Dec. '20, Q	.50
Keweenaw	Boston	1½	1½	1½		
Lake Copper	Boston	3⅛	3	3		
La Salle	Boston	1¾	1¾	1¾		
Magma Chief	N. Y. Curb	...	...	*21		
Magma Copper	N. Y. Curb	24⅝	23½	23½	Jan. '19, Q	.50
Majestic	Boston Curb	*15	*11	*15		
Mason Valley	Boston	1¾	1¾	1¾		
Mass Consolidated	Boston	2¼	2¼	2¼	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	4	3¾	4		
Miami Copper	New York	18½	18⅜	18½	Feb. '21, Q	.50
Michigan	Boston	2¾	2¾	2¾		
Mohawk	Boston	48½	47	48	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5¼	5¼	5¼		
Nevada Consol.	New York	11½	10⅞	11⅛	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	15¾	14	14¾	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....	....	*5		
North Butte	Boston	12½	11½	11½	Oct. '18, Q	.25
North Lake	Boston	....	....	*45		
Ohio Copper	N. Y. Curb	....	....	3/16		
Old Dominion	Boston	20½	19½	19½	Dec. '18, Q	1.00
Osceola	Boston	27½	27	27	June '20, Q	.50
Phelps Dodge	Open Mar.	....	†165	....	Jan. '21, Q	2.50
Quincy	Boston	39	39	39	Mar. '20, Q	1.00
Ray Consolidated	New York	13½	12¾	13½	Dec. '20, Q	.25
Ray Hercules	Boston Curb	*63	*63	*63		
St. Mary's Min. Ld.	Boston	34	32⅛	32⅛	June '20, K	2.00
Seneca Copper	Boston	17½	16½	16½		
Shannon	Boston	1⅛	1⅛	1⅛	Nov. '17, Q	.25
Shattuck Arizona	New York	6¼	6¼	6¼	June '20, Q	.25
South Lake	Boston	....	....	1		
Superior Copper	Boston	4⅛	4	4	Apr. '17,	1.00
Superior & Boston	Boston	2¼	2	2⅛		
Tenn. C. & C. cfs.	New York	8½	8¼	8½	May '18, I	1.00
Toulumne	Boston	*58	*56	*56	May '13,	10
United Verde Ex.	Boston Curb	29	27	28	Feb. '21, Q	.50
Utah Consol.	Boston	4	4	4	Sept '18,	.25
Utah Copper	New York	52	48¼	50	Dec '20, Q	1.50
Utah M. & T.	Boston	2	1¼	1⅞	Dec '17,	.30
Victoria	Boston	1¾	1¾	1¾		
Winona	Boston	*75	*60	*75		
Wolverine	Boston	14	13½	13½		
			NICKEL-COPPER			
Internat. Nickel	New York	15¾	15¼	15¾	Mar. '19,	.50
Internat. Nickel, pf	New York	80	80	80	Feb. '21, Q	1.50
			LEAD			
National Lead	New York	....	....	71¾	Dec '20, Q	1.50
National Lead, pfd.	New York	103½	103	103	Dec '20, Q	1.75
St. Joseph Lead	New York	12	11¾	12	Dec '20, QX	.50
Stewart Mining	Boston Curb	....	....	*6	Dec '15,	.05
			ZINC			
Am. Z. L. & S.	New York	9	9	9	May '20,	1.00
Am. Z. L. & S., pfd	New York	28½	28	28	Nov. '20, Q	1.50
Butte C. & Z.	New York	5½	4¾	4¾	June '18,	.50
Butte & Superior	New York	13	12¼	12¾	Sept. '20,	1.25
Callahan Zn-Ld	New York	6	5½	6	Dec. '20, Q	.50
New Jersey Zn	N. Y. Curb	142	141	142	Feb. '21, Q	2.00
Success	N. Y. Curb	*3	*2	*2	July '16,	.03
Yellow Pine	Los Angeles	....	....	*59	Sept '20, Q	.03

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

Stock	Exch.	High	Low	Last	Last Div.	
			GOLD			
Alaska Gold	New York	1½	1	1½		
Alaska Juneau	New York	1½	1⅜	1½		
Carson Hill	N. Y. Curb.	....	....	22¾		
Cresson Consol. G.	N. Y. Curb	....	....	1⅝	June '20, Q	$0.10
Dome Extension	Toronto	....	....	*45		
Dome Mines	New York	16¼	14½	15½	Jan. '21, Q	.25
Golden Cycle	Colo. Sprgs.	‡.	...	*73	Dec. '20, Q	.02
Goldfield Consol.	N. Y. Curb	*9	*7½	*8½	Dec. '19,	.05
Hollinger Consol.	Toronto	6.61	6.54	6.60	Feb. '21, M	.05
Homestake Mining	New York	....	....	50	Sept. '19,	.50
Kirkland Lake	Toronto	*51	*50	*50		
Lake Shore	Toronto	1.17	1.17	1.17	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	1.98	1.98	1.98	Jan. '21, K	.05
Porcupine Crown	Toronto	*23	*22¾	*23	July '17,	.03
Portland	Colo. Sprgs.	‡..	..	*60	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*6	*4½	*5½	May '19,	.05
Silver Pick	N. Y. Curb	*8	*5½	*5½		
Teck Hughes	Toronto	*10½	*10¼	*10½		
Tom Reed	Los Angeles	1.28	1.25	1.26	Dec. '19,	.02
United Eastern	N. Y. Curb	2 7/16	2⅜	2 7/16	Jan. '21, Q	.15
Vindicator Consol.	Colo. Sprgs.	†...	....	*18	Jan. '20 Q	.01
West Dome Consol.	Toronto	*9½	*8	*8		
White Caps Mining	N. Y. Curb	*8	*7	*7½		
Yukon Gold	N. Y. Curb	*100	*100	*100	June '18,	.02½
			SILVER			
Arizona Silver	Boston Curb	*21	*19	*20	Apr. '20, M	.03
Batopilas Mining	New York	⅞	⅞	⅞	Dec. '07, I	.12½
Beaver Consol.	Toronto	*39	*38	*38	May '20, K	.03
Coniagas	Toronto	....	....	2.05	Nov. '20, Q	.12½
Crown Reserve	Toronto	....	....	*17	Jan. '17,	.05
Kerr Lake	Boston	2⅞	2⅝	2⅝	Jan. '21, Q	.12½
La Rose	Toronto	*27½	*25½	*25½	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*30	*30	*30	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.11	1.11	1.11	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	8¼	7⅞	8	Jan. '21, QX	.50
Ontario Silver	New York	....	....	4¾	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	1	11/16	1	Jan. '12,	.10
Peterson Lake	Toronto	...	....	*7¾	Jan. '17,	.01½
Temiskaming	Toronto	....	....	*27	Jan. '20, K	.04
Trethewey	Toronto	*17	*17	*17	Jan. '19,	.05
			GOLD AND SILVER			
Atlanta	N. Y. Curb	*2	*1	*2		
Barnes-King	Butte	‡....	....	1.11	Aug. '20, Q	.05
Boston & Montana	Boston	....	....	*63		
Cashboy	N. Y. Curb	*7	*6	*7		
El Salvador	N. Y. Curb	5/16	5/16	5/16		
Jim Butler	N. Y. Curb	*17	*14	*15	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*10	*8	*8½	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	¼		
MacNamara M. & M.	N. Y. Curb	*17	*15	*16	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1⅝	1½	1 9/16	Jan. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1¼	1 1/16	1 1/16		
Tonopah-Extension	N. Y. Curb	1½	1⅜	1½	Jan. '21, Q	.05
Tonopah Mining	N. Y. Curb	1⅜	1¼	1 5/16	Oct. '20, SA	.05
West End Consol.	N. Y. Curb	1 1/16	1	1 1/32	Dec. '19, SA	.05
			SILVER-LEAD			
Caledonia	N.Y. Curb	*11	*9½	*11	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	1.15	1.15	1.15	Dec. '20,	.15
Chief Consolidated	Boston Curb	2⅝	2⅝	2⅝	Feb. '21, Q	.05
Consol. M. & S.	Montreal	19½	18	18	Oct. '20, Q	.62½
Daly Mining	Salt Lake	....	....	2.50	July '20, Q	.10
Daly-West	Boston	4	4	4	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	....	....	2⅛	Dec. '20, K	.25
Electric Point	Spokane	*5	*5	*5	May '20, SA	.03
Federal M. & S.	New York	....	....	8	Jan. '09,	1.50
Federal M. & S., pfd.	New York	26½	25½	26½	Dec. '20, Q	1.75
Florence Silver	Spokane	*16	*16	*16	Apr. '19,	.01½
Grand Central	Salt Lake	....	....	*37½	June '20, K	.03
Hecla Mining	N. Y. Curb	4½	4⅜	4½	Dec. '20, QX	.15
Iron Blossom	N. Y. Curb	3/16	3/16	3/16	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	....	....	3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*10	*7	*8		
Prince Consol.	N. Y. Curb	⅛	¼	3/16	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*7½	*7	*7	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*7½	*6	*6		
South Hecla	Salt Lake	....	...	*66	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	3/16	3/16	3/16	Oct. '17,	.05
Tamarack-Custer	Spokane	2.00	1.95	2.00	Jan. '21, K	.04
Tintic Standard	Salt Lake	3.35	3.25	3.30	June '20, Q	.10
Utah Apex	Boston	2½	2½	2½	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*3	*2	*3	Nov. '17,	.01
			QUICKSILVER			
New Idria	Boston	....	....	*95	Jan. '19,	.25
			VANADIUM			
Vanadium Corp.	New York	37¾	32	35¾	Jan. '21, Q	1.00
			ASBESTOS			
Asbestos Corp.	Montreal	....	....	80½	Jan. '21, QX	3.50
Asbestos Corp., pfd.	Montreal	90	90	90	Jan. '21, QX	3.75
			MINING, SMELTING AND REFINING			
Amer. Sm. & Ref.	New York	42¼	42¼	41¾	Dec. '20, Q	1.00
Amer. Sm. & Ref. pf.	New York	82½	82½	82½	Dec '20, Q	1.75
Am. Sm. pf. A	New York	65	65	65½	Jan. '21, Q	1.50
U. S. Sm. R. & M.	New York	33¾	32½	32¾	Jan. '21, Q	.50
U.S.Sm.R.& M. pf.	Boston	43½	42½	43	Jan. '21, Q	.87½

INDUSTRIAL NOTES

New Auto-Transformer Starter Easily Tended by One Man

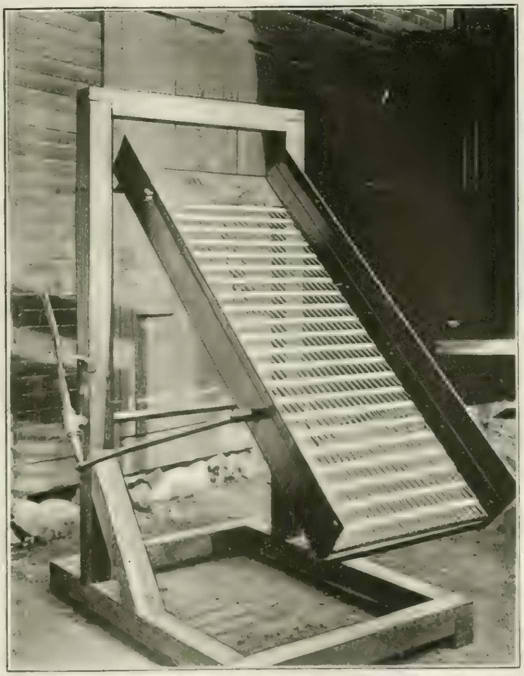
For the starting of standard squirrel-cage motors operating mine pumps, fans, conveyors, tipple machinery, crushers, etc., an auto-transformer starter has been developed by the engineering department of the Cutler-Hammer Manufacturing Co., of Milwaukee, Wis. The simple steel construction—using no wood or castings whatsoever — the absence of flexible moving leads, and the ease of inspection of the contacts and adjustment of the relays, enable this device to give continuous and satisfactory service at a low upkeep cost. The starter consists of two auto-transformers, commutating mechanism, low-voltage release and duplex overload relay, all inclosed in a sheet-metal case with the operating lever outside. The case is strongly reinforced with angle iron, and has a hinged cover. The transformers and case are carried directly on the supporting brackets and may be readily mounted on the wall, switchboard, or any post or pedestal. Interlocks prevent moving the operating lever directly to the running position. If released in the first or starting position, the lever is returned to neutral by a spring. It may be locked in the neutral position to prevent unauthorized operation. The oil-immersed commutating mechanism is placed at the bottom of the case below the transformers and may be exposed for inspection by the removal of the oil pan, a simple one-man job. An ample head of oil is maintained above the contacts and a double horizontal break is provided in each line. Breaking the circuit horizontally confines the arcs between the copper contacts and prevents burning of parts not designed for that service. The stationary contacts are drop-forged pieces of copper carried on non-stubbing fingers easily adjusted and renewed. The moving contacts or segments are short copper strips, which are made reversible so as to provide double the normal amount of service.

These starters are made in various sizes for the operation of two- or three phase induction motors rated between 5 and 100 hp., on standard commercial voltages between 110 and 2,200 and at frequencies of 60, 50, 40, 33, and 25 cycles per second.

Wullstein Gravitation Screen

Construction Produces Mobile Bed and High Efficiency

An interesting new type of stationary screen is being put on the market by the International Gravitation Screen Co. of Salt Lake City, Utah. It is of the inclined type, adjustable for slope. The screen consists of a series of overlapping "combs." Each comb consists of a steel retaining bar in which teeth of steel wire are firmly attached. The teeth are in pairs, each one being shaped like a hairpin. After being placed in the retaining bar the prongs are bent, one down and the other up. The bending is slight. Looked at from the edge of the comb the ends of the teeth follow what appears to be a staggered path. The result of this bending is to leave an opening, which is narrowest at the point of attachment and widest at the free end of the steel prong. The ends of the prongs, being free, allow of vibration and spring. The combs are held in place by two side boards and can be readily replaced. Our illustration shows the finer-meshed pattern ready for work.



FINE GRADE WULLSTEIN GRAVITATION SCREEN

The material to be screened is fed over a flat sole piece in a thin sheet and runs down the sloping surface of the screen. It is exceedingly mobile, there being a pronounced up and down motion in the vertical plane as well as a side-to-side motion in a horizontal plane. The screen does not blind. This is due to the fact that the screen openings are widest at the ends of the prongs and the movement of the particle prevents any from lodging between the prongs. The capacity is large, both on account of the large effective screen area opening and because of the mobile character of the bed. A high capacity and efficiency are claimed for the screen. The principle of the screen is also being applied to the grizzly for very coarse screening, although it appears to be suitable for comparatively fine screening down to 16 or 20 mesh at least.

The Motor Truck Serves the People Cheaply and Efficiently

In discussing the motor truck as a competitor of the railroads, the *Mining Congress Journal* for October, 1920, points out that "The public highways are maintained by the people who use them, either by direct taxation or by license fees paid by the users of automobiles and trucks, and that these same highways were maintained at public expense long before railroads were dreamed of. When motor-truck freight transportation over any considerable distance is at all possible in competition with railroad transportation it is proof that the railway service is so clumsily handled as to need such competition in order that it shall be made to meet more efficiently the public requirements. There was a time when the farmer carried his grain in a sack over his shoulder miles across the country upon the best highway available to have it ground into flour. Later the ox cart, then the mule team, and later still the motor truck were the means through which a marvelous advance in civilization was accomplished. All of these have used the public highways, and the railroad as such can command business only to the extent that its service is vastly cheaper than that which can be otherwise furnished. Motor-truck transportation for short hauls and for city delivery has a distinct advantage over railroad transportation between the same points. That such competition shall interfere with railroad traffic for any great distances is a libel upon railroad management."

Newspapers and Periodicals in Japan

A list of newspapers, trade papers, and magazines in circulation in the principal cities of Japan has been compiled by the Far Eastern Division of U. S. Department of Commerce, Washington, D. C. The nature of the publication, its circulation, subscription price, rates of advertising, and other available information is given. (Request file number FE-11029.)

Chain Hoists Handle Materials in the Oil Field

Relative Advantages of Various Types Discussed by the Vice-President of the Wright Manufacturing Co.

One of the most interesting and extensive problems of the oil industry is the handling of materials in the field, and the requirements of the work have been an inspiration to the manufacturers of lifting devices in general and of chain hoists in particular.

In the economical handling of various materials that must be lifted and moved from place to place, cranes and chain hoists play an important part. There is probably no organization in the oil industry that does not employ them. The chief advantages of these machines lie in their great power and self-locking features. Light and compact, for short lifts, they are unsurpassed by any device yet designed. They are made in sizes up to thirty tons' capacity.

WRIGHT CHAIN HOIST

For the handling of heavy materials and work involving high lifts, cranes are frequently employed, although the number in use is rather small. A common method is that of erecting beams with trolleys or runners to which chain hoists are attached, such as are shown in the accompanying photograph.

The proper selection of a chain hoist involves, according to H. F. Wright, vice-president of the Wright Manufacturing Co., Lisbon, Ohio, an understanding of principles that are frequently overlooked. There are three separate and distinct types of chain hoists on the market, the differential pulley block, the screw hoist, and the high-speed hoist. Each of these is made for a particular class of work. The differential pulley block was the first to be used, and as it costs only one third as much as its modern rival, is still found occasionally where considerable lifting is done.

In addition to price, two other factors must be considered when a new hoist is to be purchased: speed, or the number of feet of hand chain that must be overhauled to raise the load a given distance; and force, or the pull in pounds required on the hand chain to raise the weight. As ordinarily made, the number of feet of hand chain that must be overhauled to lift a given load is about the same with the pulley block and high-speed hoist. And as the differential pulley block is the cheaper hoist, it evidently is to the question of force, or the effort exerted on the hand chain, to which one must look to establish the superiority of high-speed hoists.

What are the facts? With a one-half ton high-speed hoist, a pull of 60 lb. only must be exerted as against a pull of 120 lb. with the differential pulley block; with the one-ton high-speed hoist, a pull of 80 lb. only must be exerted as against a pull of 218 lb. with the differential block; and with the two-ton high-speed hoist, a pull of 120 lb. is exerted as against 306 lb. with the pulley block. Thus, it is evident, the problem reduces to one of labor versus price. From two to three times as much effort must be exerted to lift a load with the differential pulley block as with the high-speed hoist.

In practically all cases, and specially in the oil fields, the high-speed hoist is by far the cheapest to use because it prevents unnecessary waste of human effort, the most expensive of any kind of power that it is possible to buy.

The screw hoist is of the worm-and-gear-wheel type and is designed to be used for work where the hoist has to be continually shifted about as in general repair work. It is more efficient than the differential pulley block but only about one half as efficient as the high-speed hoist. With this hoist the pull on the hand chain is cut down at the expense of speed. For example, with a one-ton screw hoist, 60 ft. of chain must be overhauled to raise the load one foot, whereas with the high-speed hoist only 30 ft. need be overhauled to do the same thing. With both hoists, however, the force applied is about the same.

The Manistee Iron Works Co., Manistee, Mich., manufacturers of Roturbo centrifugal pumps, vacuum pumps, rotary jet condensers, and evaporating equipments for salt, sugar, and potash, have opened a Pacific Coast office in the Rialto Building, San Francisco, which will be in charge of L. M. Page, general sales manager for this company for the last five years. The company expects to open branches also at Los Angeles, Cal., Portland, Ore., and Seattle, Wash., which also will be under the supervision of Mr. Page.

TRADE CATALOGS

Hoists—The Allis-Chalmers Manufacturing Co., Chicago, Ill., has issued a new bulletin, No. 1803-A, dealing with the company's line of Corliss steam hoists for mines.

Heaters, Evaporators—Ross Heater & Manufacturing Co., Inc., Buffalo, N. Y., has issued its catalog F, illustrating and describing the various types of heaters, condensers, expansion joints, coolers and "airjector" pumps made by it. The line includes an oil cooler for cooling lubricating oils and quenching oils before reuse.

Ladles—Whiting Corporation Harvey, Ill., (formerly the Whiting Foundry Equipment Co.) has issued catalog No. 156, superseding number 147, of December, 1920. The new catalog, of thirty-one pages, is well illustrated, and specially presents the maker's new-style helical worm geared crane ladle. There is also a new style "teapot spout" ladle having the spout inside the bowl. A copy will be mailed on request.

Cars—The Lake Shore Engine Works, Marquette, Mich., has issued an illustrated pamphlet, entitled "Marquette Cars," which outlines some of the equipment that is manufactured by that company for mining and other industrial use. Several types of cars are featured in the bulletin, but there is also included such equipment as rotary car dumpers, mine cages and skips, crossheads and sheaves.

Locomotive Cranes—The Brown Hoisting Machinery Co., Cleveland, Ohio, has issued its 88-page catalog "K 1921," dealing with its line of locomotive cranes. The 160-odd large photographs eloquently describe the variety of forms and of uses of these cranes, and indicate the extensive patronage enjoyed at home and abroad. Tables and skeleton drawings aid the prospective purchaser to select just the type and size suited to his need.

Cottrell Processes—The Western Precipitation Co. of Los Angeles, Cal., has issued an attractive folder simply describing the various applications of the Cottrell method of electrical precipitation of suspended particles from gases, and giving a selected bibliography on the subject. Many illustrations and diagrams are shown which make clear the method of installation.

Pipe Stocks and Dies—The Armstrong Manufacturing Co., Bridgeport, Conn., has issued catalog No. 16, illustrating and listing the company's full line of genuine Armstrong stocks and dies. The pamphlet calls special attention to the new machines for threading and cutting off pipe. All are built with standard care, the larger sizes having all driving gears inclosed in an oil chamber.

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Volume 111 New York, March 12, 1921 *Number* 11

The Fourth Estate

IN MEDIÆVAL ENGLAND there were three classes, castes, or estates—the barons, the clergy, and the commons. With the invention of printing, books became a powerful factor in life, and with the development of the newspaper this factor strengthened from a leavening influence into an ever-present dynamic force. Burke, statesman and orator, making a speech in the House of Commons, was suddenly conscious of that power as represented by the reporters in the press gallery. "These gentlemen," he interrupted his speech to say, "represent a distinct class and power in the empire. They constitute a Fourth Estate."

Since that time the power and responsibility of the Fourth Estate has grown so that its influence is probably predominant. Certainly modern life, government, commerce, and industry would be impossible without the press, though it would be conceivable, for example, without the barons or even without the clergy.

The one thing which we all need in common is the newspaper; it is the one medium through which, in the most advanced countries of the world, millions of men and women daily merge their thoughts into common channels. It is the prime essential to intelligent common understanding, the *sine qua non* of democracy, the link that binds great nations and causes together.

Such are the more or less trite and acknowledged functions of the press in general. It is fitting that engineers should apply these definitions to the engineering press. It is especially necessary for the members, committees, and officers of technical societies to keep in mind the necessity and the indispensability of the technical press, and to realize the dignified nature of this medium for the development of a common harmonious thought and understanding. Any Burke of the engineering world must needs pause in his address to engineers and to the nation long enough to recognize the independent status and the power of the Fourth Estate, and the necessity for its support.

It has been said that the technical press could exist without the engineering societies, which is evidently true; and it has been added that the engineering societies could not exist without the technical press. The latter is perhaps only partly true; but, at any rate, it is clear that the technical societies could not have grown to the numbers and power which they have attained except with the support, publicity, and constructive criticism which the press has afforded them.

Those societies which deem themselves self-sufficient and their officers who are not analytical, will reply: we can have our own journals, our own mediums of publicity; we do not have to recognize the need of an independent press. Think again: has that principle worked as between governments and the press, as between great industries and the press? The journal of a technical society is an organ, a subsidized publication, bound by the policy of the board of management. It is not the medium for independent editorial comment, a disseminator of general news, or a forum for unbiased public opinion: for sometimes that public opinion and that honest editorial comment would criticise policies of the society; and that, of course, would never do. The administration at Washington during the war issued a daily official organ, under the editorship of one Creel; but Congress tomahawked it at the first opportunity, and there was nowhere in evidence any voice of protest.

In any attitude of the technical societies which does not recognize the necessary function of the independent technical press, and which does not support it, these societies are blind, not only to the advancement of the causes which they represent, but also to their own welfare. Engineers know that the aims and ideals of the societies are as a rule of the highest: they move in any good cause not only from their own earnest conviction but with an ear to the ground for all comment and illuminating criticism. They would like to know as they proceed what the thousands of their own members think of what they are doing. They cannot find that out from their own organizations. Their work is done by committees, and it is a long time between the appointment of committees; and the thousands of the rank and file have only once in a great while an opportunity for the expression of an opinion, and that only on a single categorical question, such as: "Shall the American Society of Civil Engineers join the Federated American Engineering Societies? Answer Yes or No, and be quick about it."

The technical societies cannot find out from their own official organs what the *vox populi* is saying. Therefore, just as Mr. Harding cannot and will not try to run the Government intelligently without the light which the press affords him, just so the technical organizations, especially as they launch out into work of general or public import, cannot keep properly oriented, even as to the opinions and wishes of their members, without the independent technical journals.

The Demagogue

THE House of Representatives is full of all sorts of people, many of them ignorant, many catching at any straw for notoriety. Such a one is Mason, of Illinois, in whose record we recall the episode of his having made a speech during the war at a public meeting in Washington, which apparently was [illegible] to expound the beauties of Bolshevism and Pacifism. It is Mr. Mason who recently offered resolutions in Congress calling for recognition of the independent republics of Korea and Ireland.

Quite recently, on the floor of the House, Mr. Mason attacked the copper producers, particularly Mr. John D. Ryan, and also Mr. B. M. Baruch, charging them with having stolen from the Government in copper deals during the war. Mason was promptly rebuked by his own colleagues, who recalled the action of the copper producers in selling the metal early in the war to the Government at 16⅔c. per pound, when the prevailing price was 26c. This agreement was made with Mr. Baruch, representing the War Industries Board.

Several members of the Senate also brought out the facts, Senator Thomas narrating that he and Senator Smoot had gone to Mr. Baruch to protest against his buying copper at that figure, because this depression of price, if maintained, would have forced many small companies to the wall. Senator Myers, of Montana, remarking that Mr. Ryan had done his best to keep him out of the Senate, testified to his convictions as to the patriotism of Mr. Ryan and the great value of his services to the country during the war.

The copper producers of America worked during the war at the orders of the Government, and were quick to respond to its desires, even though the last request made, that the producers keep up war production after the armistice was signed, resulted in that surplus of copper stocks which has ever since hung like a pall over the industry. These Government requests were transmitted by Mr. Baruch as chief of the War Industries Board.

There is no question that the Government program left the industry in an unfavorable and crippled condition, when it dropped it with its heavy accumulated stocks. We have heard nowhere, however, any complaint against the Government, or of any claim for damages. It is all in the hazards of the war. Nevertheless, the men who stood behind the Government with all their resources and their untiring personal service should not have to suffer the unnecessary hazard of irresponsible slander.

Why Magnesite Producers Shut Down

WHEN IT WAS ANNOUNCED at the beginning of the year that producers of magnesite in the State of Washington had shut down, the importation of this commodity from Austria was generally accepted as the cause. That is, somebody said this was the reason, and no one denied the statement. Those engaged in mining this mineral have been agitating for a protective tariff, and here, apparently, was ready proof of what Austrian competitors could do to put this war-bred industry, with its great investment and machinery of preparation and distribution, on the rocks.

To what extent the Washington companies will be able to operate in the face of such competition is a debatable point. It is also debatable whether under any circumstances a protective tariff on magnesite be advisable. But it seems unlikely that it is importation of Austrian magnesite that has caused the suspension of operations in Washington. This is pointed out on p. 464 by R. C. Stone, of the U. S. Geological Survey. Imports in 1920 were only about 18 per cent of the magnesite consumed for all purposes, according to Mr. Stone, as compared with 14 per cent in 1919. Also, imports in December last were less than a quarter of those of November, and in neither of these months did any come from Austria. Mr. Stone suggests that the real reason for the shutdown is lack of orders, owing to conditions in the steel trade, the principal consumer of magnesite. Unless imports increase or Washington producers resume, the steel industry will probably find itself short of refractory material very soon, Mr. Stone believes. We are glad to publish Mr. Stone's convincing conclusions, for at a time when tariff legislation is pending it is proper that the truth be told, as far as it is discernible.

Pittman Act Distortions

APPARENTLY the latest tirade launched against the Pittman Act appears in a recent leading editorial of the *Commercial and Financial Chronicle*. The statements made leave no doubt in anyone's mind as to the attitude of that paper. The operation of the Pittman Act is characterized as "a piece of extravagance and profligacy," a "monstrous wrong to the people of the country," and an "iniquitous law." These caustic remarks would not be so bad were arguments advanced to substantiate them, but absolutely no facts are presented that in any manner prove the *Chronicle's* contentions. One acquainted with the history and operation of the Pittman Act can find much fault and serious criticism with the presentation of the editorial comment noted. Misstatement follows misstatement, so that the reader unfamiliar with this silver legislation may unwittingly be induced to agree with the conclusions reached.

It appears to us that this attempt of the *Chronicle* to discredit the Pittman Act is merely exposing either its own ignorance of the silver situation or its unwillingness to present all the appertaining facts, for the article carefully fails to point out that the Government, and hence the taxpayer, is not losing one cent by the silver purchases under the Pittman Act. The silver was sold to the British government for one dollar an ounce and is being replaced for one dollar an ounce. We reluctantly refer to this point, as it has frequently been stressed in these columns, but it has evidently been overlooked in this patently ignorant attack. It is not the American taxpayer who is feeling the effect of the Pittman Act but his British neighbor, who bought about 207,000,000 ounces of silver in the first place at one dollar an ounce and through the intermediary of the United States Government, which had a large stock on hand and which is now transferring the money it received in the transaction to the American silver producer.

If it had not been for the enormous amount of American silver that was shipped to India in 1918-1919 there is little doubt that the silver market would be in much better condition today. India's large silver repast of that period, judging by the recent selling for Indian account, has evidently not been digested or assimilated. The present unusual spectacle of selling from India would surely have been deferred a bit longer.

The *Chronicle* states that should silver purchases continue, at present market prices, "the loss to the Government and the clear bonus to the silver producers would reach the prodigious sum of $70,000,000." A prodigious statement. A moment's reflection will show that it would be purely a *paper loss*, and not a loss at all, for, should the Government make its future silver purchases at the market price, it would be making an actual profit of $70,000,000 at the expense of the silver producers. Is that the purpose of the purchases? If so, why not have the Government withdraw its buying entirely at the present time so as to "bear" the market, and then to buy gingerly without disturbing the low level of the market? Fortunately such is not the purpose of government, which should function not for its own particular profit but with equal consideration to everyone. The Pittman Act merely gives due and equitable treatment to the silver producers, and the flimsy pretexts, hasty assumptions, and gross distortions of those unfamiliar with its history and its purpose will not change it.

We wonder if it is generally known what a boon the Pittman Act has been of late in keeping the wheels turning in some of our copper and lead mines where silver is recovered as an important and valuable byproduct. Were it not for the support given by dollar silver to the low-priced copper and lead produced, many valuable mining properties would be shut down in Montana and Idaho mining districts and hundreds of miners added to the already swelled list of unemployed in the mining industry. This statement is not introduced as an argument to continue the act, but merely to point out one of its beneficial results through stabilization. The Pittman Act can stand on its own merits and the splendid service it rendered in helping win the war (tribute was recently bestowed upon it by a prominent British official), and needs no extraneous support.

Attacks against the Pittman Act may be expected at any time, particularly as it may appear to the uninformed that the Government, and hence the public, is being mulcted of a large sum of money in making silver repurchases. It would help much, however, if before venting their spleen, critics took care to present all the facts in the case, so that the reader may also draw his own conclusions.

Improved Utilization of Non-Metallic Minerals

IT IS PROVERBIAL that the pork-packing industries utilize everything up to, and some aver even including, the squeal. In striking contrast with this are some of the non-metallic mining industries, where the waste is very greatly in excess of the useful products. A paper entitled "Byproduct Expansion in the Non-Metallic Mineral Industries," read at the recent New York meeting of the A. I. M. E., brings this subject into the foreground. It is asserted that in the process of slate quarrying the waste is 80 to 95 per cent of gross production, and in various other non-metallic mining industries the percentage of waste approaches these figures.

Of course it must be remembered that much of this waste is just plain ordinary dirt and barren rock, which are in a sense cheap because the world is made of them, but, on the other hand, it is believed that a considerable part of the discarded material may be fitted into our complex industrial life if its proper niche can be found. It is to find the niches and corners into which non-metallic byproducts will properly fit that the U. S. Bureau of Mines is devoting an important part of its present activities.

Copper bars are all much alike, whether their source was native metal or sulphide, and gold bricks (if genuine) vary little in character, whether derived from placer or quartz vein, but many non-metallics are like people: they have about them a sort of individuality or personality which persists and remains a positive factor throughout their entire lives. Thus, a mica may be stained or transparent, a graphite may be flake or amorphous, and a slate may be clear or ribboned, soft vein or hard vein, but, whatever their peculiarities, they must for the most part retain these characteristics in the finished products. They are not thrown into furnaces and molded or stamped into series of identical forms, but they are cut, polished, trimmed, or otherwise fashioned, then turned loose in the world, carrying with them all their inherent qualities, and upon such qualities they must stand or fall.

This variation in physical properties, giving rise to types and classes in the same mineral species, opens up a wide field for choice on the part of consumers, and the important point toward which this introductory pathway has been leading is that the overwhelming plurality of choice commonly tends toward the higher and purer grades, with a consequent tendency to "pick the eyes" out of deposits, (a process largely completed in some feldspar mines) and to discard whatever of the lower grades the consumer refuses to use. This is a natural tendency, and for certain purposes, no doubt, the higher grades are essential, but for many uses it may be demonstrated that what are regarded as lower types can be used with advantage. This tendency unduly to limit and hedge in specifications demands correction if several of the non-metallic industries are to remain on a solid footing.

As an illustration, in the Pennsylvania soft vein slate district "clear stock" constitutes only about 10 per cent of what is commonly regarded as the commercial slate, or, say, 1 per cent of the gross tonnage mined. If, therefore, the majority of consumers specify clear stock, such a hardship is laid on producers that the very existence of their industry is threatened. A tendency to accept only the selected stock has been noted on the part of slate blackboard purchasers, and it is quite possible that specifications will be raised to a point where no slate blackboards will be produced. The claim, therefore, that for many uses the banded or "ribboned" slate is of equal quality with "clear stock," except possibly in appearance, is a subject for serious consideration by dealers and consumers.

Another striking example is to be found in the feldspar industry, for the continued and insistent demand for No. 1 spar by ceramists has threatened a shortage of such supplies, and is leading to a condition where the use of lower grades becomes imperative. It is noted that larger proportions of No. 2 spar have lately been used, thus making it possible for the miner to operate more advantageously, to increase his output and profits, and reduce the volume of his waste heap.

Reduced to its basic factors, the question for the consumer is "Shall I insist now and all the time on first-grade material, irrespective of price elevation, the threatened exhaustion of deposits, or the hardship such action may work on producers, with consequent possible reduction in supply, or shall I make a determined effort to use whatever share of lower-grade raw material may be utilized without detriment to my products?" A proper answer [illegible] is awaited not only with interest [illegible] a certain degree of trepidation by several groups of non-metallic miners, whose operations [illegible] of success as accompanies [illegible] in this field.

WHAT OTHERS THINK

Assisting Deflation

After reading columns of learned mush that appears in almost every issue of almost every periodical, your sane, sensible editorial "Assisting Deflation," which appears in the Feb. 19 issue of the *Engineering and Mining Journal*, on the keynote of the root evil of the times, is most refreshing and reassuring. I begin to feel now that perhaps, in the course of time, others will arrive at your point of view. Then things will begin to happen, and for the better. "Deflation of money-psychology" deserves to become a classic.

You have had the sense and, what is more, the courage to put into words what I have felt for a long time (and I believe that thousands have felt)—the protest against publishing in the *Transactions* the interminable "drools" of men who have nothing to say and an unquenchable desire to say it.

I believe that you are putting the right kind of oil on "crime waves" and other waves that are almost as demoralizing, and I am writing to express the wish that you will keep it up. FRANK L. NASON.

West Haven, Conn.

A Correction Concerning Engineering Society Publications

Your editorial on "Assisting Deflation" is one that was very much needed. The National Research Council and some other organizations might take it to heart, as well as the two mining engineering societies. But in justice to the two latter, I wish to point out that there is a mistake in the next to the last paragraph.

The Mining and Metallurgical Society of America does not force upon its members any bound volumes. If the members wish them, they pay extra; and if they do not wish them they do not pay.

The American Institute of Mining and Metallurgical Engineers specifically states in a footnote: "If the *Transactions* are wanted in paper covers, deduct $2 from this bill."

I do not see how the engineer can consistently call on the Government or the industries to cut down their overhead, while his own engineering society and Engineering Foundation expenditures are both soaring, with the moon as the limit. DONALD M. LIDDELL.

New York City.

Chloridizing Roasting of Copper Ore

I have read with great interest the article in the *Engineering and Mining Journal* of March 5 on chloridizing roasting of pyrite cinders as carried out in Scandinavia. Although an American process, it would appear that the method has been further advanced in Europe. Its consideration in this country depends on locality and the nature of the ores. The process might possibly open a field for selective flotation of pyrite ore impregnated with chalcopyrite. Contrary to the case of lead and zinc ores, the selective flotation of copper ores has never found practical application.

It is known that chalcopyrite will float before pyrite. If a feed containing, say, 1.5 per cent Cu and 10 per cent S is taken, the highest concentration in regard to copper would probably be around 6.5 per cent, provided a fairly good extraction is obtained. Now, suppose that in a unit of one ton this product can be divided up by selective flotation and tabling the flotation concentrate from the last cells, to contain

1,000 lb. of concentrates of 10 per cent Cu
800 lb. pyrite of 3.5 per cent Cu and 43 per cent S
200 lb. gangue.

If a ready market is at hand for the pyrite and resulting purple ore, it is evident that the method can be worked to great advantage.

The extremely good copper extraction from a flotation concentrate, secured by a chloridizing roast, is interesting. It can find no practical application in this country, however. It will be cheaper to extract the copper by smelting, because the sulphur content will be too low to have any market value. Furthermore, the purple ore will probably contain from 20 to 25 per cent gangue, and this in turn would render this product practically worthless. It is probable that the clogging of the material to be leached in the tanks can be prevented by saturating the roasted ore with dilute solution just before it is put in the leaching vats. This would simplify the leaching. The advantages of this process should not be overlooked, as the cost of extraction is relatively low. VIGGO CARLSEN.

Brooklyn, N. Y.

The Tainton-Pring Electrolytic Zinc Process

Referring to the article entitled "Electrolytic Zinc" in your issue of Feb. 19, dealing with the discussion of Mr. Laist's paper presented at the recent New York meeting of the A. I. M. E., I should like to add a few words and correct one or two minor inaccuracies.

The new electrolytic zinc process referred to is the invention of Mr. U. C. Tainton and Dr. N. C. Pring. Mr. Tainton has been since 1914 connected with the metallurgical staff of the Rand Mines, Ltd., at Johannesburg, but more directly concerned in the last few years with the development of his invention at a small plant in London, and recently at a plant of commercial size at Martinez, Cal. Dr. Pring is professor of chemistry at the University of Manchester. The patent rights in the Tainton-Pring process are controlled by the Central Mining & Investment Corporation, Ltd., of London, whose interests in this country I am at the present time representing.

The plant at Martinez was erected by, and is the property of, Mr. Charles Butters, but in January, 1920, was taken over on lease by the English owners of the process, who extended and modified it considerably, and placed it under the supervision of Mr. Tainton.

It may be pointed out, in connection with Mr. Smith's interesting testimony, that the success of the process, commercially and metallurgically, has been definitely established at the Californian plant, and that all the important details as regards construction and design of plant have been practically worked out and standardized.

New York, N. Y. F. L. BOSQUI.

[We regret the misreporting of Dr. Pring's name, which was caused by our going to press before the close of the meeting, thereby making impossible the verification of all names. Also, Mr. Smith has called to our attention the fact that on page 342, column 2, line 9, "39 per cent ZnO" should read "39 per cent Zn."—EDITOR.]

Postponement of Assessment Work

It so happened that on the very day that I had prepared an effusion on the evils of the law extending the period for the performance of annual labor on mining claims I received the Jan. 15 issue of the *Engineering and Mining Journal* containing the editorial "Postponing Assessment Work." As it covered every point that I had in mind, I submitted to your appropriation of my thunder, but in view of the criticism of your attitude by A. T. Roos, in the issue of Feb. 5, I wish to add my testimony in the case.

Because of the peculiar nature of the work on which I have been engaged for some years, I see far more of the prospector and small claim owner than is possible for the average engineer. I probably see more honest-to-goodness prospectors in one year than most of my colleagues see in ten. For the real prospector I have the greatest respect. For the "claim pegger" I have none. As a class the latter and not the former were the ones who benefited by this law. There may be exceptions to this statement, but they are very much the exception and a long way from being the rule.

Less than a week ago I was in the field with a real prospector. To be sure, every volcanic that we encountered was a "pawfry," and we found several "barium dikes" in our day's work, but he knows ore and where to look for it. He has found and developed a number of good claims at one time or another and makes a good living by selling at a reasonable price when he has something worth while. He is holding about ten claims now. He had the work on all of them done long before the close of 1920, and has already done some of his 1921 work.

We need more of his kind. He, as well as every other real prospector with whom I have discussed the subject, was outspoken in his condemnation of the new law. He summed it up very well about as follows: "Look at ——. He and his brother have nearly two hundred claims within a radius of ten miles of here. They have held them since the first of 1916 without doing a lick of work on them, and now they get six months more. There are some likely looking claims among them, but they won't develop them and they won't set anything like a reasonable price on them. They are simply holding on in the hopes that some of us fellows who are trying to do the right thing will strike it and give them a chance to sell out at a fancy figure." I am acquainted with the men to whom he referred and know that they have so many claims that they can't keep track of them and don't know one from the other.

It is quite true, as Mr. Roos says, that conditions in the mining industry are deplorable, but this very thing has tended to make labor abundant and reasonable, and it would help, in small measure at least, to alleviate these deplorable conditions to give some of this labor employment on annual assessment work.

Explosives *are* high, as he says, but bear in mind that the claim owner is not required to spend any more money on his annual labor than he expected and in a sense agreed to spend when he acquired the claim. The difference is that, in return for the same money, he will not get, say, ten feet of work but eight or perhaps only six. These are of the vicissitudes of business, and I am very sure there are few of us but have been obliged, at some time or other, to choose between sacrificing something which we were holding or submitting to financial inconvenience. And the joker is, as you pointed out, that the law was not passed until those who sincerely intended to hold their claims and were deserving of consideration, if anyone was, had performed their work and were beyond its benefits. The beneficiaries were those who did not think enough of their claims to submit to the slight financial inconvenience or those who never had any intention of performing the required labor when they made their locations.

Our mining laws are exceedingly liberal, and, to avoid working a hardship to even a few, they have been liberally—too liberally—applied. Without any special exemption laws a man can, by locating on Jan. 1 of any year, hold a claim two years without doing a thing but post his notice and record it. There was good reason for exemption of assessment work in 1917 and 1918, but there was little in 1919 and none in 1920. The present policy is a serious handicap to development work and is a matter which should be taken up by one of the professional organizations with the purpose of preventing long-time segregation of valuable mineral land by persons who have no intention of developing it. Such are "gamblers in mining claims" of the worst kind, because they expect all of the odds themselves and are not willing to give the other fellow even a respectable run for his money. Their only idea is to get something for nothing, selling at a figure that is out of all proportion to any effort or expense that they may have incurred. LEROY A. PALMER.

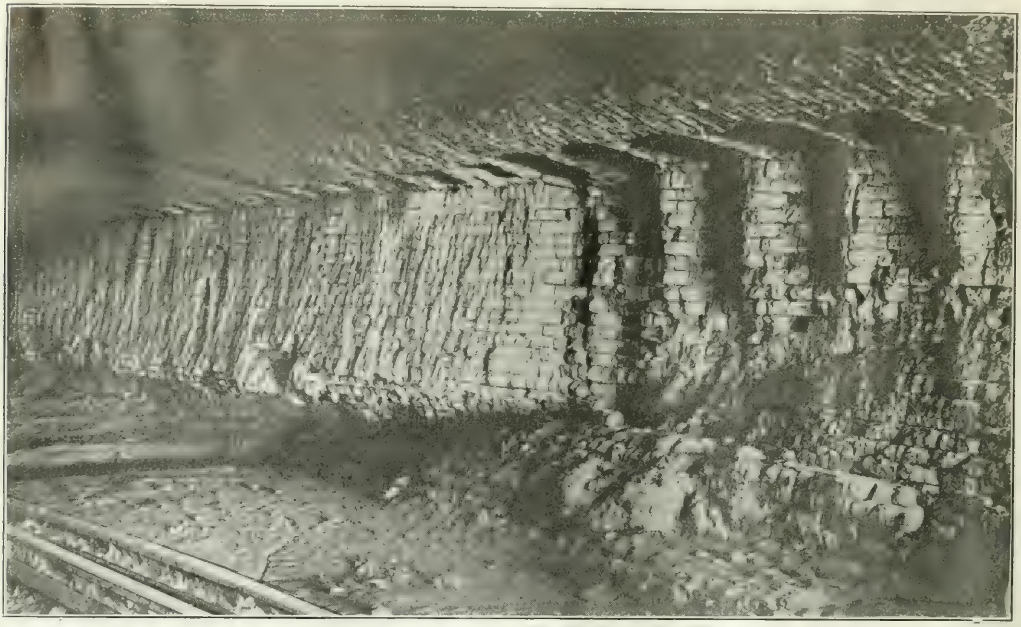
San Francisco.

Note by the Editor: The abuse to which Mr. Palmer refers, and concerning which he suggests that the matter be taken up by one of the professional organizations, was part of the mining law problem originally taken up by the Mining and Metallurgical Society of America, whose committee was later merged into a Bureau of Mines committee, consisting of W. R. Ingalls, chairman, with Walter Douglas, J. Parke Channing, J. R. Finlay, John Hays Hammond, L. D. Ricketts, Horace Winchell, and James R. Jones. This committee has nearly ready a draft of the bill which is intended to cover this particular situation and other reforms necessary in the mining law.

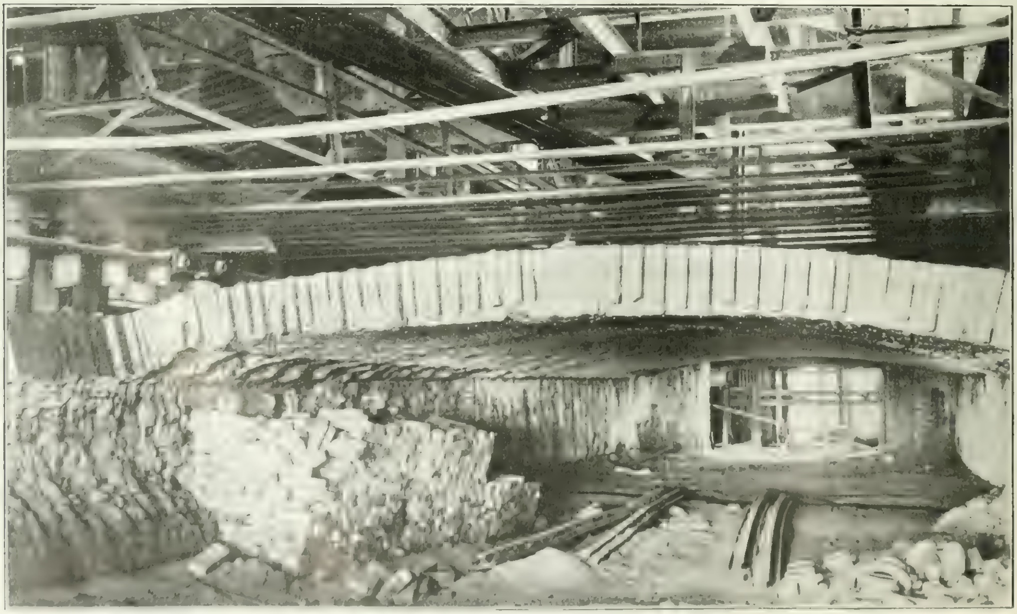
Mining in Colorado

In my article "Colorado" in your Annual Review number (Jan. 22, 1921) I am made to say with reference to the Ouray district (p. 168, line [illegible]) [illegible] at present any important producing [illegible]. This [illegible] typist's error, a line of my draft having [illegible] in copying. The sentence should have read [illegible] the exception of the Atlas and Mountain [illegible] at present any important producing [illegible]

Denver, Col. [illegible] E. COLLINS



Interior Views of a Reverberatory Furnace in the Copper Queen Smelter, Douglas, Ariz., Shut Down for Repair



The Importance of Foreign Trade in Copper and Other Non-Ferrous Metals*

Gold and Silver Mainly Subservient to Government Regulations—War Volume of Zinc and Lead Exports Not Likely To Be Repeated—Foreign Demand for Copper Only Awaits Financial Readjustment

BY FELIX EDGAR WORMSER

OF THE FIVE domestic metal industries producing copper, lead, zinc, gold, and silver, foreign trade is normally of direct importance to only two—copper and silver. The lead, zinc, and gold industries function quite independently of export stimulus. Foreign commerce undoubtedly plays a most important rôle in the production and marketing of agricultural staples such as wheat and cotton, and foreign trade to the copper and silver industries is scarcely less important. The extent of the effect of this factor on a domestic metal industry may be judged by the serious depression and loss which the post-war dullness in export trade caused the copper industry.

Three chief differences exist between agricultural and mineral commodities that influence their international movements. Farm products are of a perishable nature, whereas the metals are of a permanent nature. Furthermore, food and clothing are of much greater importance to life. Each year there is poured upon the world a supply of new metals which augment existing supplies, enlarging the possibility of using available quantities of scrap metal and transforming it into essential shapes. These facts do not apply to agricultural products, the perishable nature of which precludes use after any but a measurable period. If a nation be faced with the alternative of choosing between the importation of foodstuffs and of metals, the former would undoubtedly be selected. Moreover, though a country may modify its agricultural activities it cannot change its mineral resources, and so must seek its supply of metals from existing deposits, whether domestic or foreign.

Although the statement has been made that foreign trade is important to only two of the five metals under discussion, this should perhaps be qualified through a recognition of the fact that the Great War seriously altered the foreign and domestic demand for the metals and that the present period of economic readjustment has largely distorted the normal movements of some of them. Consequently, statistical records made in the first few post-war years, 1919, 1920, 1921, furnish an unreliable criterion of future developments.

Considering first the importance of exportation of gold upon the gold production of the country, the conclusion may be drawn that gold, being dependent upon financial requirements, moves chiefly in response to the settlement of adverse trade balances with gold standard countries, and that the use of gold in the arts, or commercially, is not influential in affecting its price. Silver performs a duty similar to that of gold in discharging indebtedness to silver-standard countries or countries on a gold exchange standard, such as India. The movements of both these precious metals are now mainly subservient to governmental regulations, though normally free and according to banking requirements.

Restrictions on the external movements of gold are more prevalent than for silver, and there is small likelihood of the removal of these gold embargoes in the near future, as nations cling tenaciously to their gold reserves. With the exception of the United States, many countries have prohibited the outward movements of gold, and the export of silver can take place only under government license. The United States permits the free exportation of silver, but through a legislative enactment, the Pittman Act, the Treasury Department is required to purchase up to 207,000,000 oz. of silver mined and refined in the United States at $1 per ounce, an amount of silver equal to that sold for the same price during the war. This has virtually prevented the export of domestic silver, as the market for foreign silver is much below $1. All of the domestic production for the next four years will probably be directed into the vaults of the Treasury, unless, of course, an unlikely rise of silver in the world market to over $1 per ounce should occur.

Thus, present export trade in gold and silver is unimportant to these respective metal-producing industries. Gold always commands $20.67 per ounce regardless of export trade, and domestic silver will find its way into the vaults of the Treasury for several years to come unless the Pittman Act should be repealed. Normally about 50 per cent of the domestic silver production is exported—mainly to Asiatic countries—and there is hardly an industry more dependent upon export conditions. Silver's phenomenal rise in 1918 and 1919 was due almost wholly to the demand for the metal for the settlement of commercial balances with India and China.

Export trade is of varying importance for the other three metals in the group—lead, zinc, and copper. During the war foreign demand caused extraordinarily high prices and greatly stimulated production. Normally, however, export trade is of much importance to only one of these metallic commodities, copper. The situation in each metal will be considered separately.

Although the United States produces over a third of the world's lead, and about as much as its two chief competitors combined, exports of lead made from domestic ores from the United States for the four years prior to the war were negligible. However, considerable quantities of lead from foreign ore were exported, the production from foreign ore and imports almost balancing. Most of the imported lead comes from Mexico to be refined in this country, and [illegible] for consumption may be exported [illegible] of the "drawback," or a freedom from [illegible] applying. The following table brings out the pre-war position of the lead industry, its [illegible] the [illegible]

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*Published in the *Annals* of the American Academy of Political and Social Science, March, 1921 of war, and the results of two years of readjustment, 1919 and 1920:

LEAD PRODUCTION AND MOVEMENTS
(In Short Tons)

	Production from Domestic Ores	Production from Foreign Ores and Base Bullion	Imported Lead (Ore, Bullion, Refined)	Exports	
				From Domestic Ores	From Foreign Ores (a)
1910 to 1913, inc	411,700	82,000	84,800	..	80,700
1914	534,500	29,300	28,300	58,700	21,550
1915	537,000	43,000	51,400	88,300	38,600
1916	596,200	18,900	35,300	100,500	9,900
1917	579,400	62,300	78,250	53,700	37,700
1918	556,900	100,300	98,600	41,800	59,400
1919	427,800	58,000	71,400	10,000	42,900
1920	471,700	54,000	91,200	3,000	22,500

(a) Excludes lead in manufactures exported with benefit of drawback amounting to 10,500 tons prior to the war, an average of 5,000 tons during the war, and about 2,000 in 1919.

Although exports of lead from domestic ores were negligible prior to the war, the war demand made it profitable to export large tonnages. Thus in 1914, 58,700 and in 1916 a peak of 100,500 tons was exported, but domestic lead movements have since decreased. These figures do not take into consideration the export of manufactures, ammunition, and articles in which the lead content is an appreciable item. However, the domestic trade felt the indirect effect of the lead consumption in other industries during the war.

Little justification exists for hope of a change in the export situation to a pre-war basis. In 1920 importation of cheap pig lead was threatened time and again, and eventually foreign pig lead in large quantities actually did come into the country (27,300 tons in ten months). The difficulty which the United States must overcome in competing in the well-established international lead market, coupled with exchange difficulties, effectually prevents a profitable development of the outward movement of lead. Domestic production and consumption are expected to balance as before the war. The American industry, emphasizing its inability to compete in other markets, is protected under the Underwood tariff by a 25 per cent duty upon the metal in various semi-finished and finished forms and ¾c. per lb. on lead contained in imported ores. This is a greater protection than that enjoyed by the copper and zinc industries; in fact, greater than that accorded any other important metal. Australia, Spain, Germany, and Mexico furnish strong competition for export trade in lead, and have been able to produce the metal at a cost equal to if not lower than that in the United States. Now they, with the exception of Mexico, can also benefit by exchange rates.

The zinc trade of the United States closely parallels that of lead. In pre-war years exports of zinc from domestic ores were small; from 1910 to 1913 inclusive they averaged about 6,300 tons annually, or little over 2 per cent of the domestic production, as the following table illustrates:

ZINC PRODUCTION AND MOVEMENTS
(In Short Tons)

	Production		Imports (a)	Exports	
	From Domestic Ores	From Foreign Ores		From Domestic Ores	From Foreign Ores
1910 to 1913, inc	296,300	14,000	[illegible]	6,300	7,100
1914	343,400	9,600	[illegible]	64,800	5,600
1915	458,100	31,400	[illegible]	118,600	12,800
1916	564,300	104,000	[illegible]	163,100	43,200
1917	584,600	85,000	[illegible]	153,800	64,700
1918	492,400	25,500	[illegible]	80,200	20,100
1919	452,300	13,500	[illegible]	129,500	12,300
1920	[illegible]	14,000	[illegible]	86,000	28,500

[illegible] exported with [illegible]

The war demands for zinc, however, were so insistent for a large supply of this useful metal that domestic exports increased to 163,100 tons in 1916 and to 153,800 tons in 1917, and although there was a sharp drop to 80,200 tons in 1918, a rise took place the following year to 129,500 tons, chiefly on account of the idleness of one of the world's great zinc producers in Australia. The record for 1920 appears well in the aggregate, 86,000 tons, but when it is considered that during the last five months of 1920 exports had tapered off to a rate of about 500 tons monthly, it is likely that a reversion to a pre-war scale will take place quickly.

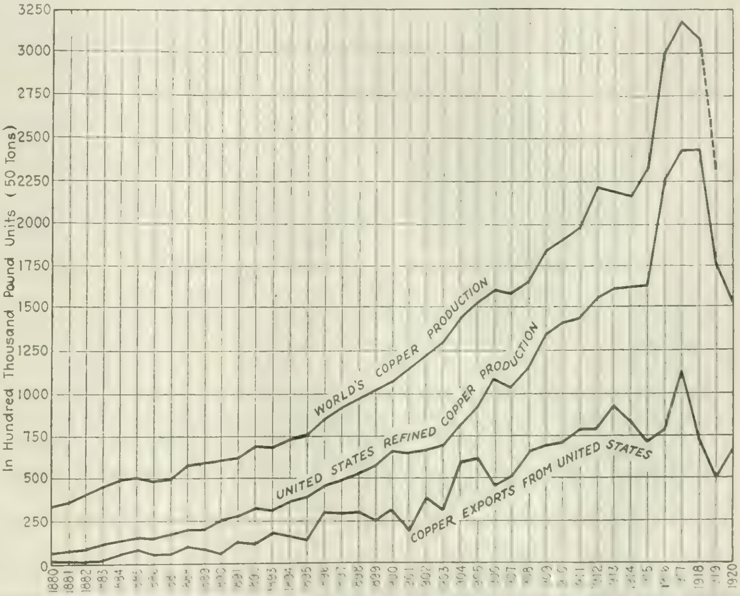
As in the lead industry, much zinc material is imported to be manufactured and later exported, the net result of the operation being to avoid the payment of duty. Similarly, the domestic zinc consumption is normally a little below domestic production, and the industry is quite flexible and able to meet sudden demands put upon it. The zinc trade in the United States enjoyed unprecedented prosperity during the war, when remarkably high prices were reached and unusually large exports were made, but it is doubtful if a considerable proportion of this foreign trade can be held, and highly probable that the condition of the industry will revert closely to the pre-war status, not only because of the difficulties that beset export trade in general—chiefly financial considerations—but owing to the lower costs in other zinc-producing countries.

Australia, Germany, and Belgium are rapidly regaining their strength, eager to furnish competition in international markets. The paralysis of the Australian zinc industry, due to prolonged labor troubles, has passed, and already this strong competitor is influencing the international market. Germany, Belgium, Great Britain, France, and Australia have well-established zinc-smelting industries, and they will do everything to facilitate a return to former conditions. The zinc trade in the United States has a slightly better opportunity than the lead trade to expand its exports, judging from past records, but it faces a difficult problem—one that can be solved only as the general solution to the problem of export trade is found and domestic costs are lowered. Competition was at a minimum during the war, and its full force has not been felt by the American industry for many years. The tariff on zinc is 15 per cent on ores, slabs, blocks, and pigs—less protection than the lead industry enjoys and yet not sufficient to prevent the frequent talk of, and actual importation of, zinc for consumption in the United States.

Germany, by the terms of the peace treaty and the probable loss of Silesian deposits and smelting plants, will not be able to hold second place in the zinc industry. The supply of German ore will be cut down two-thirds, and considering that Australian concentrates formerly shipped to Germany are being diverted elsewhere, the most logical source of importation of concentrates is the United States or Mexico. At all events, the best opportunity facing the American zinc export trade lies in supplying the Central Powers, but what measure of success will reward attempts to enter this field—Germany was formerly the second largest consumer of zinc in the world—will depend almost entirely on the attitude that the Germans adopt toward the restoration of their industry and the facilities granted that almost bankrupt country by financial interests.

No concerted attempt is being made by the zinc trade to attack the problem systematically through an export association similar to that of the copper producers, and the industry is not any too well organized to know how it stands with other countries, particularly in respect to costs and the technology of production. It has been frequently pointed out that there existed for years an unhealthy secretiveness in the industry and an unwillingness to co-operate in lowering costs. Such an attitude will not help the industry in expanding its foreign trade, thereby benefiting itself and the country. Perhaps also because no organized attempt has been made by the American zinc trade to develop foreign markets, export trade in normal years was relatively unimportant. The obstacles to foreign zinc trade loom large, but would doubtless repay study in the endeavor to surmount them.

There remains for discussion one other metal of the group, the most important from the standpoint of production, utility, and export trade of all the non-ferrous metals — copper. Its position has grown stronger and more important with the development of the world's electrical industry, concurrently with the giant strides that have been made in the progress of using more and more electrical power each year. The accompanying curves illustrate graphically the great increase in the world's production of copper during the twentieth century, a production that almost trebled the pre-war rate during the war. The United States has had a remarkably rapid growth in copper production, as the curve indicates, and during the five years before the war accounted for well over 60 per cent of the world's refined-copper production. This, however, includes the imports of crude copper from Canada, Mexico, and South American countries, shipped to this country to be refined. However, the copper production of the United States itself has for many years been the largest in the world, and there is little probability of this leadership being lost. Compared with the relatively stationary production of other countries, the growth of United States copper production has been phenomenal.



COPPER PRODUCTION OF THE WORLD AND OF THE UNITED STATES, AND UNITED STATES EXPORTS

COPPER PRODUCTION AND MOVEMENTS
(In Short Tons)

	Smelter Production from Domestic Ores	Import	Export
1910 to 1913, inc	580,500	187,300	[illegible]
1914	575,000	153,000	[illegible]
1915	694,000	158,000	[illegible]
1916	964,000	[illegible]	[illegible]
1917	943,000	278,000	[illegible]
1918	954,500	288,000	[illegible]
1919	655,500	214,500	258,000
1920	617,500	244,000	[illegible]

It is striking that the nation's agricultural and mineral wealth in each of four important commodities, corn, cotton, petroleum, and copper, is greater than that of any other country and that in each product foreign trade has developed through the superabundance of our own natural resources and an effectiveness of labor which resulted in trade with other countries willing and anxious to consume this American produce.

As copper is an indispensable metal in modern life, our export trade in that metal has been a natural development of the effort of other countries to procure an adequate supply. With the vast resources available, it has been easy for the American copper industry to respond to any demand put upon it, whether a normal yearly growth in consumption or an acute war appeal. Furthermore, the heavy investment of American capital in South American copper mines, and the concentration of the refining of South American, Canadian and Mexican copper on the Atlantic and Pacific seaboards have helped to bring the world's copper market into the hands of the United States producers, whereas during the greater part of the nineteenth century the world's copper market was controlled by Great Britain.

An accompanying set of curves indicates the world's production of refined copper; the production of refined copper in the United States, and the copper exports of the United States. In pre-war years, as the curves show, well over half the refined copper produced in the United States was exported. In 1917, an important war year in which every effort was being made to speed production, the ratio of exports was lower—about 45 per cent; in 1919, 29.1; and in 1920, about 34 per cent. The decline was sufficiently pronounced to disturb the industry seriously, as the domestic consumption was in no condition to take up production on a war scale.

Immediately after the armistice, Nov. 11, 1918, the copper producers were advised by the Government to maintain production at the war rate, on the ground that an armistice did not imply a complete and ultimate cessation of hostilities. Acting upon this advice, production was maintained at 100 per cent of capacity to the end of the year and a short period after the Government had reliquished its interest in the copper industry's activities. It was virtually impossible to curtail output as quickly as might have been desired. A [illegible] of demand ensued, which, coupled with the reduction of the excess ore produced at the end of 1918—about four months' work—soon supplied the industry with heavy surplus stocks that have consistently plagued the producers and which await a foreign trade revival to be eliminated.

THE WORK OF THE COPPER EXPORT ASSOCIATION

The pre-war method of exporting copper depended primarily on individual transactions. The largest copper producers usually had representatives in foreign countries whose duty it was to take care of their foreign business. Similarly, agents in this country of foreign consumers looked after their European clients' copper requirements. Competition in foreign trade was keen. The war and Federal legislation have changed all this. Soon after the passage of the Webb-Pomerene Act in 1918, permitting combinations of enterprises to engage collectively in foreign trade, the copper producers of the United States, realizing the advantages accruing to them under this legislation, took steps to organize a Copper Export Association. This corporation has functioned since December, 1918, and has produced the machinery necessary to facilitate export trade in any volume. Practically all the copper producers in the United States are members. Together they account for about 80 to 85 per cent of production. Each member of the Copper Export Association participates in the business of the corporation on a production basis; that is, the larger a member company's production the greater the share of the association's business apportioned to it.

The Copper Export Association has had to confine its operations chiefly to the Allied countries, where financial arrangements could be more readily concluded. Political considerations prevented entering the German field with the credit arrangements possible for France, England, Italy, and Japan. However, the association has sold copper to Germany on a cash basis.

The financial arrangements cover an extension of credit to European consumers, the plan to last two years. Each consumer has a definite credit extended to him, the amount depending on individual circumstances and the financial standing of the purchaser. In addition to the financial and commercial standing of the copper purchaser acting as a warrant for payment, arrangements have been consummated whereby a group of banks of the highest standing guarantees the payment of the drafts at maturity. The Copper Export Association participates actively in the foreign market and makes its prices conform to market conditions.

With its foreign representatives, the association keeps closely in touch with the requirements of European purchasers, and through the medium of copper stocks in warehouses at important seaports such as Liverpool, Rotterdam, Bordeaux, Hamburg, Bremen, Havre, and Antwerp is enabled to fill each order promptly. The association is also enabled to supply each consumer with the particular brand of copper he may desire. Although there is practically no substantial difference between the various brands of electrolytic copper shipped abroad, manufacturers frequently express preference for one particular kind. No attempt is made to increase export sales other than through the personal contact established by foreign representatives. An important feature of the method of handling export trade through an export association is that individual competition of copper producers that are members of the association, in a foreign market, disappears and only in the home market is competition keen. As with a well-balanced team, the personal welfare of the individual is subordinated to the common good.

Although theoretically one of the compelling arguments in favor of export combinations is the reduction in overhead costs and the elimination of a duplication of effort, the point has not been attained where this result has been fully felt, owing mainly to the decline in the volume of export trade. Maximum efficiency in an export combination is attained only when the volume of exports is on the scale for which the association was organized.

One circumstance which has affected the Copper Export Association's volume of trade has been the decline in the exchanges. After a contract between the European consumer and the association has been made, and payment arranged according to the credit terms outlined, settlement must be made in United States dollars. When exchange is increasing the foreign copper purchaser can advantageously discharge his obligation at a future date, but when exchange declines a larger payment in pounds sterling or francs, as may be, is exacted. The purchaser takes sole responsibility for the fluctuations in exchange, and hence a certain amount of speculation is introduced in purchases.

Some criticism of the Copper Export Association has been made abroad on the ground that it is attempting to control prices arbitrarily, and the conclusion reached that its attempt is doomed to failure. Such a criticism neglects to take into consideration the fact that copper can be obtained in the United States in rather large quantities outside of the association and that European purchasers do not have to avail themselves of the facilities offered by this organization. Criticisms of the sales policy adopted have also been made, but as in such matters a wide divergence of opinion is natural, this criticism is not of material force. Thus, American producers were criticised for holding their copper at 19c. per lb. in 1920 without making sales and then subsequently having to unload large quantities on the market at 13 and 14c. In explanation it may be said that producers were influenced largely by the impression that a decrease in price would not result in pronounced increase in sales. Furthermore the heavy sales of copper made earlier in the year were sufficient in volume to take care of practically the entire year's business, so that there was not as great incentive later on to enter actively into the market only to slash prices. There was also the consideration due purchasers of copper at the higher prices and the protection of their interests which fair trading demanded. As later events indicated, this policy was essentially sound. It is unfortunate that ill-advised criticism should have been directed against the association. To function properly the Copper Export Association requires the good will of foreign consumers, and concessions must be made by both parties if, as in all trading, a mutually satisfactory bargain is to be struck.

AN ANALYSIS OF COPPER EXPORTS

In analyzing the normal foreign trade in copper and the more important copper manufactures, Europe is found to be the largest consumer, taking about 95 per cent of export shipments. Germany and The Netherlands were ostensibly the best customers, together accounting for over half the European purchases of American copper. Sales to France, Italy, England, Austria-Hungary, and Denmark were also important, and although individually not comparable to the volume of Germany's purchases, materially swelled the aggregate amount. The following table is intended to exhibit the heavy European copper purchases from United States producers.

EXPORTS OF METALLIC COPPER FROM THE UNITED STATES IN POUNDS

(A) Exports in per Cent of United States Production

Year	To England	(A)	To France	(A)	To Germany	(A)	To Netherlands	(A)	To Italy	(A)	Total Exports	(A)
1910	98,000,000	6.8	116,000,000	8.1	176,000,000	12.2	222,000,000	15.5	34,000,000	2.4	708,000,000	49.8
1911	108,000,000	7.5	135,000,000	9.4	190,000,000	13.3	231,000,000	16.0	38,000,000	2.7	787,000,000	55.0
1912	95,000,000	6.1	131,000,000	8.4	252,000,000	16.2	153,000,000	9.7	47,000,000	3.0	775,000,000	49.5
1913	34,000,000	2.1	160,000,000	9.9	307,000,000	19.0	179,000,000	11.1	41,000,000	2.6	926,000,000	52.4
1914	198,000,000	12.9	150,000,000	9.8	177,000,000	11.5	126,000,000	8.2	67,000,000	4.4	840,000,000	54.8
1915	201,000,000	12.3	236,000,000	14.5	....	....	4,000,000	0.2	107,000,000	6.6	682,000,000	41.8
1916	173,000,000	7.7	318,000,000	14.1	....	....	....	....	98,000,000	4.3	784,000,000	34.8
1917	373,000,000	15.3	366,000,000	15.1	....	....	....	....	153,000,000	6.3	1,126,000,000	46.5
1918	252,000,000	10.4	265,000,000	10.9	....	....	....	....	122,000,000	5.0	744,000,000	30.7
1919	106,000,000	5.9	89,000,000	5.1	....	....	....	....	65,000,000	3.7	516,000,000	29.3
1920	101,500,000	6.5	120,000,000	7.6	85,000,000	5.4	34,000,000	2.3	770,000	0.5	610,000,000	37.8

In pre-war years Austria-Hungary imported about 35,000,000 lb. United States copper, and Belgium 7,000,000 lb., annually.

It is now generally conceded that the heavy pre-war purchases of The Netherlands were for German consumption, Dutch companies merely acting as brokers. Denmark's purchases were made with a similar design. Thus, to obtain the true significance of German copper importations, those of The Netherlands, Denmark, Belgium, and possibly Austria-Hungary should be considered. A warrantable estimate of American copper imports into Germany would be 500,000,000 to 550,000,000 lb. per annum; yet in 1920 only about 120,000,000 lb. of copper was purchased by that country. The logical effect of this drop in sales, to a copper industry tuned to the greater rate of purchases, is apparent. A large proportion of German copper consumption was for the munition industry, but the chief reason of the large copper imports was a highly developed electrical industry which combed the world's markets for its export electrical trade and used great amounts of raw copper in electrical manufactures. Germany is at the heart of the copper export situation, and any real stability to the export market is not expected until conditions in that country permit buying copper at approximately the pre-war rate.

The economic influences (particularly fluctuating exchange rates) which depress copper trade with other nations are stressed to a much greater degree in trade with Germany. Political and industrial uncertainties prohibit stabilizing the copper export trade with Germany to the same extent as with other European countries. The fixing of the indemnity, and the proper functioning of German industrial life under definite reparations, will do much to bring Germany back to pre-war importance in the copper trade.

Although the prosperity of the American copper producers is dependent largely upon the foreign demand for the metal, and the industry is bound to be depressed by an absence of such a demand in customary volume, the future outlook for copper is exceptionally bright. The world is living in an electrical age, and expansion in the use of electrical apparatus of all kinds, the utilization of the vast water-power resources in the United States and abroad, and a consequent decrease in dependence upon coal as a fuel will do much to further the demand for this cheap and efficient conductor of electricity. Some competition there will be from aluminum, another excellent conductor, but the general use of aluminum is commercially feasible only when the price of that metal is less than twice the price of copper. Hand in hand with the development of electrical power must proceed the necessary financing of various hydro-electric and electrification projects, to which liberal financial assistance must be given by nations in a position to relieve the acute financial embarrassments of European countries. Foreign trade in copper thus depends upon events that must progress together. It is folly to take a disinterested attitude of detachment from the financial affairs of Europe.

The export trade generally in all non-ferrous metals produced in America, and in copper particularly, does not depend upon some advantage gained during the war, nor on the financial and industrial helplessness of other nations, but upon the bountiful mineral resources of the United States, the efficient way they are mined and reduced, and the prestige of American leadership in the world's production of most of these metals. Foreign trade has been but a logical outcome of the commercial advantage that our abundant natural resources have given us.

The problem of the copper industry is not one in which the loss of export trade, in part or in whole, is at stake, but, rather, how the present obstacles that hinder foreign trade may be overcome quickly. Exchange difficulties are the root of the trouble.

Some manufacturers have circumvented the disadvantage of present exchange relationships by resorting to direct barter. Trading American-made steam locomotives for Rumanian oil was an example. It is also understood that shipments of copper were made to Germany to be fashioned into exportable manufactures and then turned back into the hands of the shipper financing the operation. Such methods as these are but temporary expedients that will be gradually subordinated to the more convenient arrangements existing prior to the war.

It is to the credit of the copper producers that they have presented an almost unified front to the problem of export trade and have an organization authorized by recent legislation to solve it. The copper producers have been quick to see their predicament and to take the best procedure to remedy it.

The lead and zinc producers have already become timorous and are beginning to clamor for a higher protective tariff. This does not augur well for the ability of either of these industries to enter the international market. Raising the tariff on imports will probably provoke retaliatory measures by Europe and make it more difficult to compete. The gradual awakening of the zinc industry, the internal co-operation of the domestic zinc producers through the medium of their own organization, the American Zinc Institute, in an effort to compare and lower costs, will do much to help the industry in both local and foreign markets. But underneath all efforts to establish export trade stand the economic conditions which hamper its development.

For the non-ferrous metal trade the lack of exports at any time will not be a lasting calamity, for, apart from the standpoint of conservation of our mineral resources, our irreplaceable deposits of copper, lead, zinc, and other metals will be conserved for posterity, if in the meantime domestic wants can be adequately supplied.

Why Washington Magnesite Mines Shut Down

Imports Only 18 Per Cent of Consumption in 1920—Lack of Orders Probably a Reflection of Conditions in Steel Trade

BY R. W. STONE*

Written for Engineering and Mining Journal.

ACCORDING to recent press reports the magnesite industry of Washington is practically at a standstill. On Dec. 31, 1920, the three companies operating near Valley and Chewelah, Stevens County, sixty miles north of Spokane, laid off a force of from 400 to 500 men. It is understood that the mines and plants of the Northwest Magnesite Co. and of the Western Materials Co. are completely closed and that the American Mineral Production Co. has practically stopped mining, but is running a small kiln specially designed for calcining magnesite for the plastic trade. The statement has been published that Austria is now so nearly supplying the demand of the large Eastern consumers that the orders for Washington magnesite are negligible, and that the shut-down will undoubtedly last until a protective tariff is secured.

In view of these statements about large importations of magnesite from Europe killing the market for domestic magnesite, it seems not inappropriate to call attention to figures of the Bureau of Foreign and Domestic Commerce and of the U. S. Geological Survey.

Prior to the world war the annual consumption of crude magnesite in the United States was approximately 300,000 short tons. Magnesite is imported in two forms, crude and calcined. Two tons of crude are required to make one ton of calcined. To have all figures on the same basis the quantity of calcined magnesite imported has been converted to the equivalent in the crude form and from long to short tons in the following table:

CRUDE MAGNESITE CONSUMED IN THE UNITED STATES, 1910-1920.
In Short Tons

	Domestic Production	Imports	Total
1910	12,443	322,652	335,095
1911	9,375	270,098	279,473
1912	10,512	268,309	278,821
1913	9,632	347,428	357,060
1914	11,293	256,988	268,281
1915	30,499	102,913	133,412
1916	154,974	93,85	248,859
1917	316,838	38,208	355,046
1918	231,605	43,530	275,135
1919	156,226	25,321	181,547
1920	278,000	63,110	341,110

This table shows that the imports in 1920 were only about 18 per cent of the magnesite consumed for all purposes, as compared with 14 per cent in 1919.

Magnesite is produced in only two states in this country, California and Washington. The output in California in 1920 was approximately 70,000 tons, and in Washington 210,000 tons. The principal and most essential use of magnesite is in metallurgy as a refractory material for lining furnaces.

The accompanying diagram illustrates clearly the relation of imports and production for the last ten years and would indicate that the steel industry will be short of refractory material in the next few months unless there is a large increase in importation or the Washington companies resume operations.

The closing of magnesite plants in Washington at the end of December can hardly be ascribed to heavy imports in that month, because the records of the Bureau of Foreign and Domestic Commerce show that imports in December were less than one-quarter those of November. There were no importations direct from Austria in November and December. The shipments from Italy may have originated in Czecho-Slovakia. Imports in November and December were as follows:

MAGNESITE IMPORTED IN NOVEMBER AND DECEMBER 1920
In Short Tons

Source	November	December
Germany	119	481
Netherlands	213	211
Greece	4,000	
Italy	2,954	
French Africa	745	1,051
England	15	
Scotland	8	
Canada	298	136
Totals	8,352	1,879

Imports of magnesite computed on a crude basis in short tons in 1920 by quarters were as follows: First quarter, 19,294 tons; second quarter, 8,434; third, 18,874; and fourth, 16,508; total, 63,110.

In view of the present freight rate of about $20 a ton on magnesite from the Pacific to the Atantic coast, it does not seem likely that the domestic material can long compete with foreign material in the principal market, which is east of Indiana. The question is raised, however, whether there is sufficient importation at present to warrant the action taken by the producers.

I think the cessation of the magnesite mining in Washington can be explained by other reasons than heavy imports. The Western Materials Co. is obliged to haul its product by truck from mine to railroad over several miles of mountain road which may be practically impassable on account of snow or mud during several winter months. The American Mineral Production Co. and the Northwest Magnesite Co. have direct rail or aerial tramway connections.

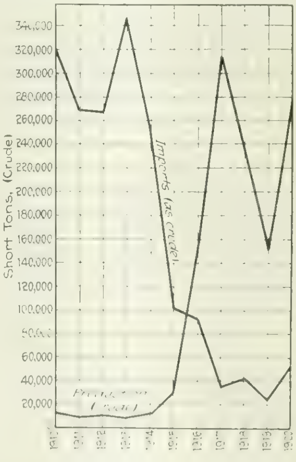


DIAGRAM SHOWING PRODUCTION AND IMPORTS OF CRUDE MAGNESITE, 1910-1920

In looking for an explanation of the closing of the Washington magnesite mines, why not assume that the producers of magnesite for refractory purposes have been forced to close for lack of orders? It is well known that many steel plants are idle, and that those which are operating are not running at full blast. It seems much more plausible, therefore, to explain the present idleness of the Washington magnesite mines by the condition of the steel industry.

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The Montreal Meeting of the Canadian Institute Of Mining and Metallurgy

Several Papers and Moving Pictures of More Than Ordinary Interest Presented at Twenty-Third Annual Convention—Entertainment Features Maintain Records Of Past Gatherings—Attendance Large and Enthusiastic

BY EDWARD H. ROBIE

Written for *Engineering and Mining Journal*

BUSINESS AND PLEASURE do not usually mix to advantage, but the Canadian Institute of Mining and Metallurgy seems to have solved the problem. The twenty-third annual gathering, which was held last week in Montreal, was notable for the good fellowship and general enjoyment of the social features as well as for the variety and interest of the technical papers presented. The very successful meetings of the Canadian Institute seem to be becoming pretty generally known, for the attendance was a considerably larger proportion of the membership than was the case at the New York meeting of the American Institute, held in February. Of course, Montreal has obvious advantages as a convention city, and there was a tendency toward the smacking of lips rather than the gnashing of teeth when the plans for Ottawa had to be abandoned on short notice owing to the prevalence of smallpox in that city.

FEATURES OF FIRST DAY'S MEETING

The sessions opened on Wednesday morning, March 2, in the "Ladies' Ordinary" room of the Windsor Hotel, with Parlor "A" and Room "4" reserved for committee meetings. The presidential address and reports on the mineral statistics of the various provinces for 1920 occupied the forenoon. The afternoon was devoted to general Institute business, and the evening to a technical session, with motion pictures of the operations of the Mond Nickel Co., in the Sudbury district of Ontario, showing the mining and the smelting of the ore.

Thursday morning brought forth some discussion as to the advisability of allowing company membership in the Institute, and arguments were offered for and against "blue sky" legislation. At 1 o'clock a luncheon was served in the Oak and Blue rooms. In the afternoon, coal and petroleum papers monopolized the program. A separate program of automobile drives, teas, and theater parties had been provided for the few ladies who had registered.

Thursday evening was the occasion of the annual smoker, which was second only to the banquet among the social features. Some Snappy Syncopaters from McGill University were assisted by cello and vocal soloists in providing the musical fare. The gastronomic features of the occasion were taken care of by item No. 9 of the program — "Beer — Sandwiches — More Beer." The dramatic feature of the evening was a burlesque depicting the granting of government licenses permitting engineers to practice in Ontario. The license board included two long-bearded politicians and an engineering representative who always dissented from the decisions of the other two, but who, of course, was always overruled. In addition, a stenographer was present, Miss ———[1] whose opinions as to who should be granted licenses were always confirmed. Applications were read from some of the leading mining engineers present, and they were called to the stand, but the examination soon separated the sheep from the goats, and it was evident that some did not even understand the principles of calci-mining.

FRIDAY'S SESSIONS

The success of the smoker caused the technical session scheduled for Friday morning to be delayed about an hour. A paper on welfare work was discussed, and the remaining time devoted to iron and steel. In the afternoon various non-metallic minerals were taken up, and the field for manganese steel castings in the mining industry was discussed. Inspection trips were arranged for those of the members who wished to see the plants of the Thomas Davidson Manufacturing Co., Ltd., and the Dominion Engineering Works, Ltd.

The annual dinner on Friday night was held in the banquet hall of the Montreal Club, on St. James St. In these days, most banquets are mere slight punctures, but this was a real blow-out and lived up to the best traditions of the old C. M. I. Many distinguished guests were present. C. V. Corless, the president-elect, outlined the aims and activities of the Institute; General Arthur Currie dealt with the reparations question and the problem of taking care of returned soldiers; and J. M. R. Fairbairn, chief engineer of the C. P. R., and O. E. S. Whiteside made short addresses. Several engineers from the United States also spoke: E. Ludlow, the new president of the A. I. M. E.; Colonel A. S. Dwight, who explained the function of the Federated American Engineering Societies; H. F. Bain, the new Director of the U. S. Bureau of Mines; Prof. A. C. Lane, of Tufts College; and E. P. Mathewson. The spirit of the speakers was distinctly Anglo-American and would have confounded the adherents of the disreputable anti-British yellow press. Any reference to the distinguished guests and members present would be woefully incomplete without mention of Neil ("Foghorn") MacDonald, who, as usual, was called upon to sing the C. I. M. M. anthem, "Drill, Ye Tarriers, Drill." "Foghorn" is possibly the most popular member of the Institute, and has been referred to as having the widest personal acquaintanceship in the British Empire. Some time we are going to devote one of our page biographies to mention of his exploits, provided some of his friends will be kind enough to send the necessary information.

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[1] [illegible]

President Whiteside's Opening Address

In opening the meeting on Wednesday morning, Mr. Whiteside, the retiring president, emphasized that the policy of the Institute must be developed with national rather than selfish interests in view, to achieve the greatest success. He dwelt on the disadvantage of having the Montreal headquarters so far from the mining districts of Nova Scotia and the West, and emphasized the importance, therefore, of expanding branch organizations. These should establish friendly relations with the various provincial governments, but should be careful to act as counselor rather than critic.

Mr. Whiteside then took up the coal problem. The coal resources of Canada are greater than those of any other country except the United States, but it is all in the far East and West, and as a result, central Canada has been importing about twenty million tons annually. The task of molding public opinion on this subject, he said, was worthy of the Institute's highest endeavors. The same subject was touched on by the new president, C. V. Corless, at the banquet. Mr. Corless took advantage of the occasion to compliment F. W. Gray, editor of the *Canadian Mining Journal*, for his fight for the more active development of the Canadian coal resources.

Value of Canadian Mineral Production in 1920 Greatest in History

John McLeish, Chief of the Division of Mineral Resources and Statistics, presented a bulletin giving preliminary production figures for 1920. Owing to high prices and, in many cases, increased production also, the value of the mineral products was the greatest in the history of the country—about $218,000,000. Of the principal metals, lead and silver decreased both in quantity and value, and of the non-metals, petroleum, natural gas, and pyrites were the only ones to show a decrease in quantity. Quartz was the only non-metal to show a decrease in value of production.

Mr. McLeish's talk was followed by some discussion by Mr. Gray, Dr. Miller, Mr. Denis, and others as to the wisdom of the new government regulation that the collection of mineral statistics be henceforth intrusted to the Dominion Statistical Bureau instead of the work being done, as formerly, by the Department of Mines. The general opinion was that the transfer of this work was a mistake, and that it was a case of carrying centralization too far. Statistics are only of value if comparative, it was pointed out, and the continuity of the work was likely to be interrupted by the change.

T. W. Gibson, Deputy Minister of Mines for Ontario, lauded the work of Mr. McLeish and regretted that his duties had been shifted to other hands. In discussing the Ontario mineral production for the last year, he spoke of the bad condition of the nickel and silver market, and explained the impossibility of predicting the future of silver with the Chinese and Indian demand so little understood. Gold, he said, was the bright spot in the metal-mining industry at present. The value given in his report for 1920, $11,665,735, should really be augmented by 10 or 12 per cent, as the gold producers market their product in New York and get the benefit of depreciated Canadian exchange rates. Of the non-metallic minerals, Mr. Gibson called special attention to the natural-gas supply, which is undergoing rapid decline.

Mr. Théo. C. Denis, Superintendent of Mines for Quebec, outlined the position of that province as the pre-eminent world producer of asbestos, both as to quantity and quality. About 95 per cent of the product, however, is exported in the raw state, and there is some agitation in favor of having it manufactured within the province.

No reports were available from British Columbia, Nova Scotia, or Alberta. The coal production of Alberta in 1920, however, was stated to be about 6,900,000 tons, an increase of almost 50 per cent over that of the previous year. Coal production in Nova Scotia, according to Mr. Gray, amounted to about 5,600,000 tons. The mining of gold and iron has practically ceased in that province, there now being only one producer of the precious metal. A salt deposit has reached the producing stage, and has some possibilities as a source of some of the more valuable halides.

Institute's Internal Affairs Discussed

The business meeting of the Institute was held on Wednesday afternoon. A memorial resolution was first offered for the late Professor Gwillem. Secretary Mackenzie then explained the transference of the place of the annual meeting from Ottawa to Montreal, and the Council meeting of Oct. 26 was ratified and confirmed. The medal given by Colonel R. W. Leonard for the best paper presented before the Institute in 1919 was awarded to E. E. Campbell for his manuscript on the Hidden Creek deposits, and for 1920 to J. C. Nicholls for the description of the International Nickel Co.'s operations.

There was much discussion as to amending the constitution regarding the membership and authority of an Executive Council, and some fear seemed to be felt that a coterie of Montreal men would gain control. The plan to increase the size of the *Bulletin* to that of the A. I. M. E. publication was brought up. The chief reason for the change was that it would be easier to secure advertising. The project was referred to the Committee on Publications, with power to act.

Some interesting charts were then put on the screen by Secretary Mackenzie. The first showed how many of the councilors had been present at the monthly meetings during the year. The average was 5.7 out of 30. The second showed the income and expenses of the Institute for 1920, and the estimated balance sheet for 1921. This should be of interest to A. I. M. E. members, who have recently received requests for a contribution of $10 to make up a deficit.

The Canadian Institute received $31,700 in 1920 and showed a surplus of $4,629 for the year, although it was later said that this did not include certain items for depreciation, and that the actual surplus was only $12. Without raising the dues, the Institute expects to have a surplus of $2,000 for 1921. A third chart showed how the members paid their dues, by months. Apparently only about 75 per cent of the dues have been paid in the last three years, and the arrears last year amounted to $4,400. A fourth chart depicted the comparative growth of the A. I. M. E. and the C. I. M. M., and indicated the same trends in the growth of both societies, with the ratio of the membership of the older society to that of the younger gradually decreasing, as would naturally be the case.

COPPER LEACHING AND PRECIPITATION PRACTICE IN NORTH AND SOUTH AMERICA OUTLINED

The evening session on Wednesday included the reading of two interesting papers, one by Frank E. Lathe, of the British America Nickel Corporation, on the principles of copper leaching and precipitation practice, and the other by W. E. Simpson, embodying suggestions for the better development of the mineral resources of northern Ontario.

Mr. Lathe explained leaching practice as carried on by several representative plants, particulars of which are given in the following table:

PRINCIPAL LEACHING PLANTS IN AMERICA

Company	Tons Daily Capacity	Material Treated	Preliminary Treatment	Solvent	Precipitant
Anaconda	2,000	Sand tailings	Roasting	Sulphuric acid	Scrap iron
Calumet & Hecla	4,000	Tailings	Crushing to 28 mesh and desliming	Ammonium carbonate	Heat
Chile Exploration	15,000	Ore	Crushing to ½ inch	Sulphuric acid	Electrolysis
Kennecott	700	Tailings	Partial desliming	Ammonium hydrate	Heat
New Cornelia	5,000	Ore	Crushing to ½ inch	Sulphuric acid	Electrolysis and scrap iron
Utah Copper	2,000	Ore	Crushing to ½ inch	Sulphuric acid	Scrap iron

Heap leaching is also being practiced by some companies and considerable experimental work is being carried on.

Crushing must be sufficiently fine to set free the copper mineral, and thus make a good extraction; to shorten the leaching time; and to prevent the solution of an unnecessary amount of gangue, thus taking up an unnecessarily long time, and fouling the solution. Too fine crushing will cost too much; will make too much dust; will make leaching difficult without agitation; is liable to cause channeling; and will make the final washing more difficult. Symons disk crushers are generally used for the coarser grinding, supplemented, in some cases, by rolls. No desliming is required before acid leaching if the ore is not crushed finer than one-half inch.

Roasting is sometimes necessary to make all of the copper water soluble, and is not to be considered an unusually expensive process. The gangue may also be rendered less soluble. In other words, copper sulphides are almost insoluble in ordinary leaching solutions, whereas those of iron are often fairly soluble. In a general way the opposite is true of the oxides, and roasting therefore brings about two desirable ends and also makes percolation easier by agglomerating the finer particles. Some impurities may be volatilized. Free access of air is necessary in roasting, and careful temperature control by means of pyrometers must be maintained. Salt and other additive agents are sometimes used, as at Anaconda until recently, to dissolve the silver. This addition of salt at Anaconda, however, has been discontinued on account of the expense.

ADVANTAGES AND DISADVANTAGES OF SULPHURIC ACID

As a solvent, sulphuric acid is most popular and is used in about 75 per cent of all plants, because it is cheap; can often be made from waste gases locally; is easily regenerated by electrolysis; makes copper of high purity; and is easily handled. Some objections to its use are that it does not dissolve metallic copper; dissolves only half the copper from cuprite; attacks carbonates in the gangue; and has some action on the oxides and silicates of iron and aluminum, thereby fouling the solutions.

The greater utility of ammonium compounds rests in the fact that they have none of the above-mentioned disadvantages of acid and may be perfectly recovered by distillation. However, they are expensive; cannot be regenerated by electrolysis; are volatile; and do not make a sufficiently pure copper. Therefore the properties of each determine their fields of use. Sulphurous acid has possibilities. Ferric salts are good solvents for metallic or oxidized copper and chalcocite and do not attack the gangue, but reduced ferric salts are hard to oxidize, and precipitation by electrolysis is impossible.

The leaching tanks must be carefully charged where the material is not of uniform size. The rectangular tanks used are usually 10 to 15 ft. deep, and filled by a conveyor belt. Leaching practice varies considerably, and no common leaching cycle can be given. At Chuquicamata, percolation is downward except for the first solution, but at Ajo it is altogether upward. The latter extracts the copper more rapidly and reduces channeling, but results in ten times as much water-soluble copper in the tailings. Downward percolation also lessens the amount of slimes carried over into the solution tanks and requires less power. Continuous percolation is more necessary on high- than on low-grade ore. The percentage of acid soluble [illegible] is dissolved should not be under 85.

The leaching tanks are usually made of reinforced concrete, with a lining of either lead or mastic asphalt, sometimes with an inner lining of wood as a protection against wear. Smaller tanks are [illegible] of wood with lead linings.

If precipitation is to be by iron, the acid is not recovered and fouling of solutions only causes trouble by increasing the acid consumption. The acid in the final solution should be low, to prevent an undue consumption of iron.

Consumption of acid depends upon conditions. At Anaconda it is about 60 lb. of 60-deg. Bé. acid per ton of tailings. At Ajo, where the gangue is more soluble, about 90 lb.; at Chuquicamata, combined sulphuric acid is found in the ore, so that only 4 to 5 lb. per ton is needed.

Ferric iron causes more trouble in electrolytic precipitation than any other impurity and is commonly reduced to the ferrous condition. At Ajo, this is done by sulphur dioxide. At Chuquicamata, chlorides also cause difficulty and are precipitated as cuprous chloride by agitating the solution with fine cement copper, which, at the same time, reduces much of the ferric iron present. The impurities cause no end of trouble in the electrolytic deposition of the copper, which is possibly the most difficult part of the whole process. Chlorine up to 0.5 g. per liter has no great effect on the current efficiency, and nitric acid may run up to 15 g. per liter if ferric iron is low and the electrolyte is not too warm. The solutions are not usually heated, and in Chile are artificially cooled.

The anodes used for precipitation have been made of graphite, antimonial lead, ferro-silicon, and fused magnetite. Graphite requires only low voltage, and the amount of acid regenerated is very high, but the liberated oxygen attacks it badly, as do ferric salts. However, it deserves much further experimentation. Lead anodes are not satisfactory where much chlorine or nitric acid is present, but they are a great success at Ajo. Fused magnetite was used in the experimental work in Chile, but the war cut off the supply, and since then, ferro-silicon has been used, which is better in its mechanical and electrical properties and cheaper, but inferior chemically. There, sulphuric, nitric, and hydrochloric acids are in the solution.

Precipitation may be by electrolysis or on scrap iron, depending upon the relative cost of current and scrap iron. The current efficiency in a new plant is usually low for the first year, owing to inexperienced workmen. With trained men it should be 80 to 85 per cent. The amount of copper deposited per kw.-hr. should be 0.7 to 0.9 lb. At Ajo, where the current density is as low as 7.5 amp. per sq.ft., the voltage is just over two; in Chile, with anodes of greater resistivity and nearly double the current density, it is about 2.8.

Scrap-iron precipitation usually is more adapted to smaller plants. Old tin cans can be used. Sponge iron, reduced from iron ores at a low pressure, offers attractive possibilities. It is ideal for precipitation but difficult to make. Modified tube mills seem to be superior to launders for precipitation purposes. Nearly two pounds of iron per pound of copper is ordinarily required, and the cement copper will average about 30 to 35 per cent impurities.

In ammonia leaching, steel tanks are used. No fouling of solutions occurs. About one pound of ammonia per ton is lost at Lake Linden, and half that at Kennecott, with an elaborate patented system of steam washing. The recovery in the two plants using ammonia is about 80 per cent.

Mr. Lathe summarized the characteristics of an ore suitable for leaching by the methods described, as follows: (1) The copper minerals, except possibly in the case of heavy sulphides, must be soluble in sulphuric acid or ammonia or capable of being made so by a cheap method. Conversely, the gangue must not. (2) Gold or silver should not be present in appreciable quantities unless made soluble by a chloridizing roast or leach. The most promising extension of leaching in the near future would seem to be in the treatment of large bodies of partially oxidized ores.

In discussing Mr. Lathe's informative paper, E. P. Mathewson spoke of Greenawalt's experiments at a plant at Martinez, Cal., with high current densities, and said that the precipitation tanks might be made about one-fifth of the size now found necessary. Respecting precipitant, Mr. Corless spoke of the practice which obtained at a plant in Russia, of granulating pig iron from open-hearth furnaces for this purpose. The granules formed were up to ½ in. in diameter. Dr. Stansfield mentioned the manufacture of sponge iron for precipitation purposes, this being made by the reduction of iron ores by heating with peat or other fuel. Mr. Mathewson stated that sponge iron made by carbon reduction had proved too expensive at Anaconda.

SUGGESTIONS FOR DEVELOPING NORTHERN ONTARIO MINING COUNTRY

The second paper of the evening was read by W. E. Simpson, general manager of the Miller-Independence mine, at Boston Creek. Mr. Simpson emphasized the importance of doing hard work in the development of properties and criticized the policy of some individuals and companies which were inclined merely to hold their lands while neighboring properties were being developed, thereby profiting without doing anything themselves. In this connection Mr. Simpson pointed out the advantages of the leasehold title system, in which a certain amount of work could be made obligatory under penalty of losing the lease. It was his conviction that something of this kind would be preferable to the present system in northern Ontario, where thousands of acres were lying idle.

The tax levy of 5c. per acre was also criticized as being more of an irritant than a revenue producer, and a tax graduated according to the owner's valuation of his property was suggested instead; this to be refunded where active development had been done.

Mr. Simpson then spoke about the impossibility of the small operator and prospector in remote regions being able to secure a mill run of his ore. He described the practice in West Australia, where small government custom mills had been established in remote sections not served by private mills. There are now twenty-nine such mills, producing well over a million dollars' worth of gold annually, and the plan should also be applicable on a smaller scale, he said, to northern Ontario.

Inefficient transportation is another factor which retards development. Macadamized roads in the northland cost about $20,000 a mile to build. Transportation over ordinary bush highways will average well over $1 per ton-mile. As a solution of this difficulty, the construction of a light railroad was described; this was made of 20-lb. rails spiked 4 ft. 8½ in. apart to round logs cut to serve as ties from the trees felled in clearing the right-of-way. Such a road, which had been facetiously named the "muskeg express," cost about $6,000 for a two-mile stretch. The building of roads of this kind might well be encouraged by the government, which could secure the right-of-way and arrange the title.

FREEHOLD TENURE DEFENDED BY T. W. GIBSON

In the discussion, T. W. Gibson pointed out that the greatest mining country in the world had been developed on a freehold tenure basis without making development obligatory. Prospectors, he said, claim that even the present terms of obtaining mining lands in Ontario are onerous. He did not attempt to defend all parts of the present Ontario mining law, however, saying, "I did not make the law." The principal value of the 5c. per acre tax, he said, was not in getting revenue but in getting back undeveloped lands for the province so that they could be allotted to others. A 25c. tax he thought would mean the confiscation of almost all undeveloped lands, and the province was getting enough as it was. He doubted the efficacy of a law making a certain amount of work on a claim necessary. Mr. Gibson then described the work of the government in training prospectors in the fundamentals and practical aspects of geology, mineralogy, and mineral spotting. These classes are being held in various mining districts, with skilled teachers in charge, and the attendance has reached as many as eighty.

In subsequent discussion by Messrs. Dresser, Neilly, Cole, and others the tendency of small government custom mills to keep prospectors in one place was emphasized. Usually they wish to skip along to the newest discoveries, and an outlet for their development ore would make them more inclined to stay where they were. Mr. Cole stated that his experience as mining engineer for the government railway had shown him that the demand for such custom mills was widespread. The power question, however, was highly important, and the high cost of power sometimes not realized. A cost of $400 per horsepower-year for a small steam plant with wood fuel was a conservative figure. Mr. Corless suggested that Mr. Cole would be a valuable man to recommend sites for mills such as had been discussed.

THE PETROLIFEROUS AREA OF NORTHWESTERN CANADA DESCRIBED

What was probably the most important paper presented at the meeting was read by Mr. J. Ness, of the geological department of the Imperial Oil Co., Ltd., on Thursday afternoon, and covered in considerable detail the geology of the possible oil regions of northwestern Canada. Commendation was freely expressed for the liberality of the oil company in releasing information of such value. Mr. Ness first described the Cretaceous area of the plains of Saskatchewan and Alberta; then the Cretaceous area of the foothills; and lastly the Devonian of the Mackenzie River valley. Owing to the character of Mr. Ness's paper, an abstract is hardly possible, but early publication in the *Bulletin* of the C. I. M. M. is assured. The remoteness of the region was emphasized, and the attendant difficulty of transporting supplies to some of the more promising regions discussed. The oil-well recently brought in on the Mackenzie River is 1,470 miles from Edmonton, and the rivers are open only three and one-half months in the year.

A paper read by E. M. Kindle entitled "Salient Features of the Geography and Geology of the Mackenzie River Oil Region" supplemented that of Mr. Ness. The Mackenzie River oil well is forty miles north of the mouth of Great Bear River, and about 100 miles south of the Arctic Circle. It is about sixty miles further north than the Klondike gold field, which is separated from the oil well by 350 miles of unexplored mountains.

To reach the new well two routes are available. One may leave the railway at Peace River Crossing or at McMurray. The former route involves a change of steamers and a four-mile portage at the Chutes on the Peace River in addition to a sixteen-mile portage on the Slave River. By the latter route a change of steamers is made at Fitzgerald, on the Slave River. Either involves a river trip of 1,500 miles or more. Three steamboat lines are operated by fur companies. The coming year it is planned to institute a hydroplane service, which can be begun about June first, or a month before the ice is out of Great Slave Lake. The flying route will be up the Peace River from Peace River Crossing to the Pine; then up the Pine and down the Nelson and Liard to the Mackenzie at Simpson. Dirigibles are also being considered.

THE NORTHLAND SUMMER

The climate is not really as cold as one might expect, considering that the latitude is that of southern Greenland. Hardy garden vegetables will grow, and raspberries were obtainable by Aug. 7 on Bear Mountain, forty miles from the oil well. The first frost comes about the first of September. The almost continuous sunshine of the summer months causes rapid growing.

The Peace River canyon is said to compare very favorably in scenic beauty with the more famous canyons of the continent. The river has many sharp turns and has cut its valley 700 to 800 ft. through the sandstone and shales. For several miles the walls of the canyon rise almost perpendicularly, but, further down, the valley is broad and nearly level. Heavy spruce timber is found throughout the region.

On the Athabasca River route the cliffs of tar sands may be seen for more than 100 miles rising abruptly from the river banks. These tar sands are impregnated with thick bituminous material to such an extent that they can be molded like clay, and in some instances tar may be squeezed out by the pressure of the hand. Along much of the Mackenzie River the oil product of the Devonian rocks is protected by relatively impervious shales, so that it cannot escape into the sponge-like sandstone. The Devonian rocks include four fairly well-defined types of lithology. These are, starting at the top of the section, sandstones and shales, bluish argillaceous shales, black bituminous shales, and limestones. In view of the vast extent of the Devonian beds along the Mackenzie, and the presence of oil as proved in the one well drilled, there is justification for optimism as to the future oil development of the region.

Four or five reels of motion pictures were shown following Mr. Kindle's paper. They told "The Story of Petroleum," and were prepared by the U. S. Bureau of Mines, co-operating with the Sinclair Consolidated Oil Corporation. The story covered all phases of the subject, from prospecting to refining, and the films were of absorbing interest. The photography was excellent, and the mysteries of the animated cartoon were employed to show how a well is "shot," how the pipe lines are kept clean with the "go-devil," and how fractional distillation is performed.

Some of the other interesting papers which were presented at the meeting will be reviewed in a later issue.

BY THE WAY

On the Stage

In "The Bad Man," at the Comedy Theater, which (though this is no dramatic column and we paid good money for our seats) is one of the most thoroughly entertaining plays we have seen in a long time, the villain seeks to prove the existence of oil lands by scraping up a sample of the country soil and carrying it back to Wall Street in his bag. We doubt if such evidence would convince even the lambiest lamb. Doubtless in the present case the sample was carefully gathered from the spot where the flivver customarily stood, but even so he should certainly have obtained a few samples of "structure" too.

In another show, the name of which we have forgotten, the hero finally has reached the point where, on bended knee he asks the lady for her hand. "But you are a millionaire," she says. "Ah! No, dearest, I am but recently graduated as a mining engineer and am on my way now to begin my career in a position paying only $6,000 a year. If you can endure my poverty let us begin life together."

Making Hooch From Coal

G. A. E. Martin, the sage of Adona, Ark., is devilish deep at times, in this way resembling the Pacific Ocean. Those not on the inside may not at once fathom the meaning of all that is in the following letter that we have received from Mr. Martin, but they have no one to blame but themselves. The letter follows:

> By a delicate simple process I have discovered a method to eliminate the gasses and alkalies from coal when a pure blueish white crystalized metal, H about 3.50, S.G.6.428, is left, proving that pure carbon is in its elementary state such metal; that has the property of, in the presence of sufficient oxygen, hydrogen and alkalies with heat, when smothered as when well covered with earth and shale, of making what we know as natural coal-beds. Hence in nature we have stone-coal. Said metal in such molecular solution on cooling crystalizes in the form of the so called coal-plant, hence the erroneous suposition that our coal beds are necessarily a naturally transformed vegetable growth. That such metal properly in solution with alkalies (it has an acid reaction) has a greater attraction for oxygen at ordinary temperature than any other product, and is the substance of vegetable and animal growth. It, when heated very slightly as in vegetable growth, has the property of rising to obtain oxygen and makes a cork-screw-to-the-right course. Hence the course of vines and the commonness of right-handed people; a continued supply of such solution to the blood of animals, as is effected by normal assimilation of the normal foods carboniferous, is necessary to enable such animals to extract oxygen from their breath while breathing. Hence when animals are sick and cannot so supply their blood with oxygen, they have abnormal blood-pressure and heart-failure.
>
> I have learned to make such a solution suitable to animal blood, which is a beautiful bright purple fluid. This should be given in any depletion of the digestive system, and is readily absorbed by the blood, a very great and innocent germacide, and will insure sufficient oxygen by the natural process of breathing. It is indirectly a great stimulant and it is practical to give it with any of the many fevers in them it does away with the necesity of the common heart stimulants and is more efficient and keeps fevers from running so high, it may, and should be given with any other needed medicine the action of which it aids. This medicine can be made at a cost of 10c. a gallon and should sell at $4.00 per gallon. To make the discoveries explained above, I have been very busy much of my time for the last 30 years that I have kept myself financially very poor and for this reason I am alone unable to promote this enterprise (which should be one of the most successful). Hence I write you to ask if you would care to furnish the capital necessary to patent same in every civilized country in the world and control this medical and plant fertilizer discovery on reasonable partner-shares?
>
> These Central Arkansas mountains and ridges are almost wholly composed of this carbon-alkali combination, much of it crystalized as the famous Arkansas crystals, in such proportions, that when ground to promote solution it is nothing less than that the necessary elements to compose the richest of soil for vegetable growth—hence in its self the very best fertilizer for vegetable growth. All this I can verify to any chemist, if he, by his own experience will test samples of such material by my method, which though very delicate, is very simple. And I would be only too glad to explain minutely details only to those competently interested for business reasons.
>
> If you are not interested but are acquainted with one that is, will you kindly pass this proposition to him?
>
> Yours, very truly, G. A. E. MARTIN,
> Adona, Arkansas.
>
> P. S. I have a piece of this metal practicly pure in its virgin state, was found near here where nature placed it in black perpendicular shale that will weigh almost 180 gr. It has such magical and varied chemical reactions it should be worth $100 per grain for research work alone.

Every time we read this we get a new meaning out of it. Mr. Martin is a physician and druggist, and those desiring that he prescribe for them can get him at Adona.

Tha Mine Smell

BY D. E. A. CHARLTON

There's tha salt o' tha sea to tha sailor,
To tha woodsman tha smell o' tha pine,
But to miners like we there's nothin' can be
As gran' as tha smell from tha mine.
If thee's askin' for me to describe it,
Then thee's asked for a 'ard thing to do,
For I naws it so well that I 'ardly can tell
O' w'ot she's made up o' to you.

W'en thee stan's at tha bloody shaf' collar,
An' tha h'upcast is suckin' tha h'air
From h'each manway an' drif', an' h'all o' tha shif'
Is workin' an' sweatin' daown there,
Then thee'll naw w'y it's 'ard to describe un,
An' thee'll naw w'ot that smell means to me.
For I tell ee, m'son, there's no h'other one
No matter w'ere h'else I may be.

Firs' o' h'all there's tha h'odor o' h'earth clods,
Freshly turned as a plot on tha farm.
An' I naws bloody well they's givin' 'er 'ell
Daown there, an' thee's naught to fear 'arm.
Then there's steam with it's fizzin' an' fussin',
An' a wee sniff o' h'oil burnin' slow
On tha 'eads o' tha pump, an' then from tha sump
Comes a smell o' tha water below.

Mixin' in with these 'ere many h'odors,
There's tha powder-gas commin' h'up strong
From tha drif's on tha sub (a breath from tha pub
Thee may say that it's like, but thee's wrong).
Then there's cannels, an' carbide, an' Peerless,
All o' they smells tha same at tha top.
It's 'ard to define jus' tha smell o' tha mine
It's mixin', tha h'odors thee's got.

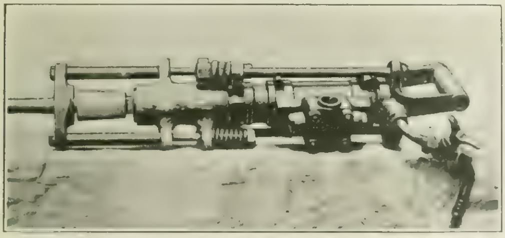
Although, dam-me, m'son, there's no diff'rence,
An' it matters not w'ere thee may be,
(I naws I am soun') any 'ole in tha groun'—
A mine—smells tha same, jus' thee see.
So, tha salt o' tha sea to tha sailor,
To tha woodsman tha smell o' tha pine,
But to miners like we there's nothin' can be
As gran' as tha smell from tha mine.

HANDY KNOWLEDGE

Shanks for Hammer Drill Steel

The technical advisers of the Chamber of Mines in Johannesburg, South Africa, have for some time been seeking to standardize and improve rock-drill practice at the Witwatersrand mines, and committees have been appointed for that purpose. The advisers also investigate all new local applications for patents.

Much loss and inefficiency have been caused by bad design and the neglect of proper maintenance of rock-drill steel shanks, more particularly those for use in hammer drills. Research along this line has been undertaken by the advisers. If the top of the shank is not kept smooth and true, the hammer or tappet of the drill does not strike the steel a true blow, and breakage of both shank and piston results. If, again, the area of the top of the steel is too small to withstand the stresses set up by the blow, as may be caused by excessive chamfer or too large a water hole, breakage is caused.



DEVICE WITH SPRING ATTACHMENT TO FACILITATE USE OF DETACHABLE SHANK

Bad tempering due to faulty work in the mine drill shops is a most frequent cause of breakage. Again, a bad fit or excessive wear on the sides of the shank also causes excessive wear on the chuck lining.

Evidently the remedy for these evils lies in providing exactly the right conditions for tempering by means of exact control of heating and quenching temperatures, and, second, by improving and standardizing design to give adequate wearing and stress-resisting surfaces. Such control is best obtained at some central works equipped with pyrometers and having the services of experts, but the great bulk of drill steel to be handled renders this impossible. It seemed that the best solution lay in the direction of making the shank detachable. In the jackhammer shown in the accompanying illustration the shank of the drill steel is tapered at such an angle that the steel seizes in the shank while at work sufficiently to hold firmly, but not so firmly that it cannot be detached by a blow. The most suitable taper is approximately 6 per cent.

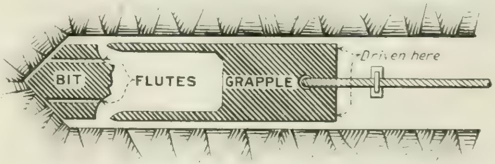
In the photo it will be noted that a sort of forehead is used, with a spring attachment to minimize jar. When it is necessary to change steel, the front of the shank is driven against this by turning on air when the steel is not against the rock. The steel then flies off from the shank, which is always retained in its place in the front head of the machine. A new taper drill is then inserted, and drilling is resumed. It will be noted that the square shank head is of large and ample section. The adoption of this device is due largely to the efforts of F. A. Roberts, technical adviser of the Chamber of Mines.

Recovering a Broken Drill Bit

By R. Franklin Mundorff

Written for *Engineering and Mining Journal*

When a rope-drill bit breaks in a 5¾-in. hole 70 ft. deep in granite, its recovery is a difficult problem. This, however, recently occurred in a quarry at Columbia, S. C., and after several attempts at retrieving the broken bit, which was a piece of steel about five inches long, had failed, a device to recover it was forged from malleable iron. It consisted of a flat plate with two long prongs, as shown in the illustration. The arrangement was lowered by a rope and pressure used to force it down. The two prongs were bent around the broken bit, and drawing it to the surface was an easy matter.



DEVICE USED FOR RECOVERING BROKEN ROPE-DRILL BIT

ROPE DRILL BIT RECOVERED BY [illegible]

"Hypoing" Silver Ores

By Leroy A. Palmer

Written for *Engineering and Mining Journal*

The following qualitative test, locally known as "hypoing," is in vogue among the silver miners of the Calico mining district, in San Bernardino County, Cal.: A calcium sulphide solution is used, which is made up by mixing quicklime and flowers of sulphur in the proportion of one pound of sulphur to two of lime and boiling for four to five hours in half a gallon of water. To make the test, a test tube is filled a quarter full of pulverized ore and well filled with a saturated solution of hyposulphite of soda. After shaking well, the solution is allowed to stand until clear, when a drop of the calcium solution is added and the silver thrown down as a brownish-black precipitate of silver sulphide. The test is useful with free-milling ores, chlorides, bromides and native silver, if the latter is in fine grains.

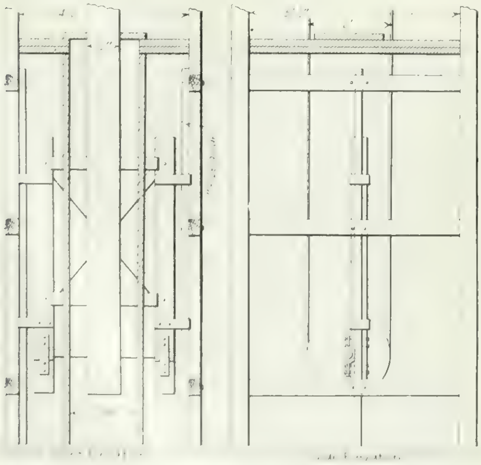
The miners at Calico have become very expert in applying this test. On an ore of not more than 100 oz. per ton they can estimate the silver content within 10 per cent by the color of the precipitate. Above 100 oz. an accurate quantitative estimate is not possible.

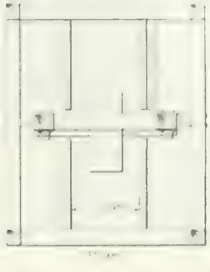
Crosshead Tightener for Dry Elevator

By Hugh B. Lee

Written for *Engineering and Mining Journal*

At the plant of the Porcupine-Crown Mines Ltd., Timmins, Ont., the ore is hoisted in 14 cu.ft. cars and trammed from the shafthouse to the mill, about fifty yards distant, where the cars are dumped upon a bar grizzly having 1½ to 2 in. openings. The undersize from this grizzly passes through a steel-lined wooden chute to the boot of a belt elevator, which also handles the discharge of the Buchanan crusher that crushes the grizzly oversize. The flow of rock from the chute mentioned is controlled by means of a gate operated by the crusher man. Forgetfulness on his part would at times permit this chute to fill up, when, in releasing the accumulated ore, he frequently overtaxed the capacity of the elevator. This sometimes resulted in blocking the elevator and tearing or breaking the belt. Considerable time was lost, and the life of the belt was shortened.





CROSSHEAD TIGHTENER

To overcome this condition the crosshead shown in the figure was installed. The tightener posts, which carry the bearings of the boot pulley shaft, are 6 by 6 in. with 4 by 6 in. crosspieces and 3 by 6 in. braces. The weight of the tightener is supported by the elevator belt, and the tightener is held in place by the two vertical pipe guides at either side of the housing. The 2-in. plank partitions, which inclose the pulley and belt, prevent accumulation of rock beneath the posts of the tightener and also protect the bearings. The elevator belt is 10 in. in width, and carries 9 by 9 in. buckets. It travels at a speed of 225 ft. per min.

In operation, the tightener rides freely, and is very responsive to changed conditions in the boot. Whenever there is an excess of feed, it rises, and then gradually lowers as the accumulation is removed. The installation of the tightener has not only done away with the annoyance and delays formerly experienced, but the device has practically doubled the life of the elevator belt.

Dynamite in Lead Blast Furnaces

At a Colorado smelting plant, the crusts of dross in the lead furnaces are broken by dynamite, according to an article in a recent issue of *Mining and Metallurgy*. The bomb used in the blasting operation is a piece of pipe, 1½ in. in diameter and 7 in. long, threaded at each end. One-half of a cartridge of dynamite (measuring ⅞ x 4 in.) is placed inside of this pipe and the remaining space is filled with powdered asbestos. The caps are then screwed on and white lead is applied to make an air-tight joint. By means of a long rod of ⅜-in. iron attached to one of these caps, the bomb is thrust through the lead well into the crucible and up near the crust of dross, and the workmen leave the vicinity.

After 1½ to 5 minutes the dynamite is detonated by the temperature of the lead bath in which it has been placed. As a rule one detonation will completely break up the crust. Occasionally, a second shot is necessary. If the first shot does not break up the crust, some of the bullion is thrown out on to the furnace floor through the lead well. This is easily recovered after cooling.

Cleaning Muck Out of Mine Cars

By Roy H. Poston

Written for *Engineering and Mining Journal*

In a mine in the southeast Missouri lead district a man whose duty it is to clean the packed muck out of mine cars had the blacksmith put a wedge-shaped point on a discarded starter drill. He then borrowed a jackhammer from the drill repair man. To cut loose the packed material from the mine car bottom with this machine is the work of but a few seconds, instead of minutes as by use of pick or hammer and moil.

The car-cleaning station is close to the drill repair shop, and the air connection is therefore convenient. By using a jackhammer "in for repairs" no machine is taken out of regular service.

Fluorspar Production and Imports Increased in 1920*

Many Domestic Consumers Have Large Stocks on Hand—Producers Seeking Tariff Protection From Foreign Competition

THE PRODUCTION OF FLUORSPAR in 1920, compared with that for 1919, is shown in the following table prepared by the U. S. Bureau of Mines and the U. S. Geological Survey:

	1919 (Actual)			1920 (Estimate)		
State	Quantity (Short Tons)	Value	Average Value per Ton	Quantity (Short Tons)	Value	Average Value per Ton
Colorado	9,687	$150,739	$15.56	14,000	$279,000	$19.93
New Mexico	2,346	37,643	16.05	7,700	136,000	17.66
Illinois	92,729	2,430,361	26.21	121,000	2,970,000	24.55
Kentucky	32,386	883,171	27.27	42,000	1,134,000	27.00
Nevada, New Hampshire, Utah, Arizona	1,142	23,660	20.72	1,300	25,000	19.23
Total	138,290	$3,525,574	$25.49	186,000	$4,544,000	$24.43

The imports of fluorspar into the United States during 1920 amounted to 24,610 short tons, valued at $265,624; in 1919 they were 6,943 short tons, valued at $107,631. The value at the foreign ports of shipment assigned to the imports for 1920 averaged $10.79 a ton; for 1919 it was $15.50 a ton. The imports for 1920 were greater than in any year since 1913, when they were 22,682 short tons.

Small quantities of fluorspar have been imported into the United States from Canada prior to 1919, the largest being in 1918, when 913 tons was reported, practically all of which was obtained from Ontario. During 1920 the imports increased to 7,068 tons, a considerable portion of which were fluorspar concentrates from the Rock Candy mill in the Similkameen district, British Columbia, which were shipped to steel plants at Gary, Ind. Small quantities of fluorspar were received from Germany, British South Africa, and Australia during 1920.

The increase in the imports of fluorspar in 1920 can probably be attributed to the difficulty in securing supplies from American mines, due to the insufficient car supply and labor troubles, and to the easing up of the ocean freight situation. Most of the English spar is consumed at steel works in the Lehigh and Susquehanna valleys of Pennsylvania, at which points the foreign material can be delivered at a slight advantage in price on account of a saving in railway freight charges.

According to a consumer in the Lehigh Valley who uses a large quantity of fluorspar imported from England, the foreign spar purchased in 1919 averaged 75 per cent calcium fluoride and 4 per cent silica, and the cost, delivered at its works, was about $7 a ton less than the cost, delivered, of the domestic spar, which averaged 85 per cent calcium fluoride and 6 per cent silica. This consumer states that the better grades of domestic fluorspar are more efficient than the imported material and that on a fairly even price basis the better grades of domestic spar are preferred.

At the close of 1920 little new business was being booked, although some of the larger producers were still running to capacity on old contracts. For most of the smaller mines the market was stagnant. Though in general an optimistic view is held, especially in the West, there are several disturbing features. One is that the imports for 1920 were large and increasing toward the end of the year. Though Canadian competition has been small, it will probably increase. To equalize the price of imported and domestic spar, the principal fluorspar producers recently presented a petition to the Ways and Means Committee of the House of Representatives to increase the import tariff from the present rate of $1.50 to $5 per long ton.

Another factor of some importance in the early part of 1921 will be the fact that many steel producers have accumulated large stocks of fluorspar which will be used up slowly until the present industrial depression ends. It is also possible that many consumers will withhold contracts with the expectation of lower prices. However, no tendency toward price reductions on gravel spar have been noted.

There seems to be a tendency, particularly among Western producers, to specialize on high-grade fluorspar such as used in the acid, glass, and enamel-ware industries. This is due, no doubt, to the apparent scarcity of spar of these grades during 1920 and to the fact that the item of freight cost is relatively lower on material of high grade. It should be remembered that the consumption of fluorspar of these grades is small in comparison with that of gravel spar, and any considerable increase in the production of these grades would result in an oversupply, with a consequent reduction in price.

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*U. S. Bureau of Mines, *Reports of Investigations*.

Fluorspar Industry Active in Germany

The largest fluorspar fields in Germany are situated in the Hartz, Upper Palatinate, Thuringian Forest, and Black Forest. The best quality is produced in the Upper Palatinate. The fluorspar found in the Upper Palatinate contains generally from 95 to 98 per cent of fluoride of calcium and relatively little silicic acid in the marketable product.

Most of the fluorspar in Germany is consumed at present by the iron industry, according to *Commerce Reports*. In this kind of utilization broken materials suffice. Other consumers are the glass industry and the chemical and enamel industries. These utilize fluorspar in a milled form, and together they use much less than the iron industry alone. According to a rough estimate made before the war, it is calculated that the quantities supplied, respectively, to the individual industries are approximately as follows: Iron and metal smelting industry, 79 to 84 per cent; glass industry, 10 to 15 per cent; chemical industry, 5 per cent; enamel industry, 5 per cent, and the optical industry, about 5 per cent.

Today the cheapness of extraction and milling, due to the condition of German exchange, constitutes a great encouragement for the export trade. Under these circumstances the Germans are in a position to export with profit, despite the enormous wages, freights and cost of packing. Germany is able to offer cheaper prices than any other country.

The utilization of fluorspar in the iron industry has made steady progress in consequence of the shortage of coal since the armistice, as fluorspar increases the fluidity of the fusible material and thus effects an economy of fuel, although at the cost of the quality of the resulting product. Consequently, it is probable that post war statistics will show an increase of the consumption of fluorspar by the iron industry at the expense of that of the glass and possibly other consuming industries.

THE PETROLEUM INDUSTRY

Relation of Topography to the Oil Fields Of the Texas Gulf Coastal Region

By Albert G. Wolf

Written for *Engineering and Mining Journal*

IT HAS BEEN freely predicted that the present known oil resources of the United States will be exhausted in twenty years if our rate of production continues to increase as it has during the last decade. Even though this estimate may be over-conservative, we must grant that ultimate exhaustion of our known resources is inevitable, and, therefore, any work that will surely lead to the discovery of new oil fields should be undertaken without delay. Various ways of prolonging the life of the oil industry have been suggested, the most obvious being the discovery of more oil fields. One such work, so large that only the United States Government can successfully undertake it, is a complete topographic survey of the Texas and Louisiana Gulf Coastal plain.

Gulf Coastal Oil Production All From Salt Domes

Practically all of the oil, sulphur, and salt produced in the Gulf Coast region of Texas and Louisiana are found in salt domes. Not all the salt domes so far discovered have proved to be commercially productive in even one of these minerals, but the majority of them have. Though all of the salt domes do not appear on the surface as topographic domes, the greater number of them, whether productive or not, do appear as such.

The importance of salt-dome oil fields is shown by the fact that between 6 per cent and 6.5 per cent of the petroleum production of the United States in 1920 came from them, the total Gulf Coastal production being about 27,000,000 bbl. out of a total production by the United States of 443,400,000 bbl. (figures based upon statistics obtainable at the time of writing). In 1919 the coastal fields produced 20,500,000 bbl., the United States 377,719,000 bbl. and the world 558,692,519 bbl. (*Mineral Industry*, Vol. 28, 1919). Expressed in percentages, the coastal production during 1919 was 5.43 per cent of the United States' production and 3.67 per cent of the world's. It is self-evident, then, that any work that will lead to the discovery of more surface domes will result in the discovery of more salt domes, and will be an important preliminary step in adding to our known oil resources.

Though the oil production is of paramount importance in this discussion, it is not out of place to point out that the coastal domes play an extremely important part in the world's sulphur production and also produce a small amount of salt. During 1917 the world produced 1,553,232 metric tons of sulphur, the United States 1,138,416 metric tons, and of this United States' production the coastal fields produced more than 99 per cent. In 1918 the production of the United States was 1,287,103 metric tons (1,353,525 long tons, according to the U. S. Geological Survey), of which the coastal domes contributed more than 99 per cent. (*Mineral Industry*, Vol. 28). Further statistics are not available.

To show more clearly the percentage of producing to non-producing domes, and the percentage of salt domes that appear as topographic domes, the following table of known salt domes lying within seventy-five miles of the Gulf coast and between the Sabine River and the Colorado River (of Texas) has been prepared. One of the domes in this list, Markham, lies just west of the Colorado River, outside of the area specified, but is included because it is a proved salt-dome oil field. The salt core at another, Goose Creek, has never been found. but as all other oil in the Texas coastal region has been found on or immediately around salt domes, and as thin strata of salt have been found, which may be outlying portions of or redeposits from the main core, it appears fair to treat this area as a salt-dome field. There is no surface dome here, and if a salt dome exists, it is either very deep, even deeper than that at Markham, or out under San Jacinto Bay.

At Big Hill, Jefferson County, a prominent surface dome, drilling on the dome has not been done to sufficient depth to prove or disprove the existence of a salt core, at least the results have not been made public if so, but as limestone and gypsum in quantity, together with anhydrite in some cases, invariably form the "cap rock" of the dome salt-cores, it appears fair to include this in the list of salt domes. Furthermore, as this area has never proved productive, to leave it out would increase the percentage of productive salt domes; hence it must be included to be fair in the final deductions.

Near Orange a little oil is being produced (30 bbl. a day at the present time, according to *The Oil Weekly*), but as I am not sure that the salt core has been struck here I will not include it as a producing salt-dome structure.

KNOWN SALT DOMES

Name	County	Surface Configuration and Elevation Above Surrounding Area	Barrels Oil Production, 1920, and Total to Oct. 1, 1920
Barbers Hill . .	Chambers. .	Distinct dome 45 ft	136,367 287,487
Batson	Hardin	Flat. .	484,036 30,207,855
Big Hill	Jefferson. . .	Distinct dome, 30 ft	Nil
Big Hill	Matagorda	Distinct dome, 36 ft	Nil
Blue Ridge	Fort Bend	Distinct dome, 30 or 40 ft. .	200,000 (est.) 173,087 No data
Bryan Heights. . (Freeport)	Brazoria. . .	Distinct dome, about 20 ft	Nil Nil
Damon Mound	Brazoria	Distinct dome 83 ft	1,259,375 1,598,742
Davis Hill	Liberty. . .	Dome, partly eroded .	Nil
Dayton (North).	Liberty. .	Dome	100,000 (est.)
Dayton (South)	Liberty. . .	Dome	526,921
Goose Creek. . . .	Harris	Flat, part submerged	5,666,384 28,978,122
High Island	Galveston	Distinct dome.	Nil
Hockley	Harris	Monocline or portion of eroded dome	. Nil (traces found)

Name	County	Surface Configuration and Elevation Above Surrounding Area	Barrels Oil Production, 1920, and Total to Oct. 1, 1920
Hoskins Mound.	Brazoria...	Distinct dome, 30 ft..........	Nil (?) 100,000 est.
Hull...........	Liberty....	Low dome, 15 ft............	4,468,612 4,565,278
Humble........	Harris.....	Slight dome of considerable extent................	3,692,108 83,574,361
Markham......	Matagorda.	Flat....................	75,774 2,500,000
Pierce Junction.	Harris.....	Slight dome, 10 ft...........	Nil (traces found)
Saratoga.......	Hardin....	Two slight elevations........	913,728 20,169,721
Sour Lake......	Hardin....	Flat....................	2,073,483 58,372,681
Spindle Top....	Jefferson...	Dome, 10 ft................	323,995 46,975,144
Stratton Ridge..	Brazoria...	Dome, 10 to 15 ft............	Nil (traces found)
West Columbia.	Brazoria...	Dome, partly eroded........	10,563,748 15,077,619

From the above list the following tabulation is derived:

		Per Cent
Known salt domes..................	23	
Oil producers in quantity..............	14	60.87
Producers of appreciable quantities of oil in the past.......	2	8.70
	16	69.57
Non-oil producers to date..............................	7	30.43

Of 16 oil producers 12, or 75 per cent, are surface domes, and 4, or 25 per cent, are flat.

Salt domes productive and visible on the surface, 69.57 × .75 = 52 per cent.

In at least three of the non-productive dome structures small quantities of oil have been found, and these cannot be classified as barren. On three others, sufficient prospecting has not been done to prove them so.

Regarding the salt domes classified here as surface domes, a word of explanation is necessary to those unacquainted with the Gulf Coast region. The highest of these domes, Damon Mound, is about 83 ft. above the level of the surrounding country, and the lesser ones are only eight or ten feet in height, not sufficient to be visible to the untrained eye but sufficiently high to make them quite prominent on a contour map of one-foot contour interval.

The high percentage of productive salt domes, together with the high percentage of salt domes that appear as surface domes, and the difficulty, in many cases, of seeing these slight elevations with the unaided eye, make it evident that the first requisite in the search for new fields in the Texas coastal region is a good topographic map. Such a map does not exist at present. No topographic survey of this region has been made by the State of Texas, and the U. S. Geological Survey has completed only a few quadrangles, most of Harris County, to be specific, and as yet has not published all of these quadrangles. A few other small areas have been surveyed by operating oil companies, almost all of these areas, however, covering productive domes.

This topographic survey is a big and a hard undertaking, not alone because of the extent of the region involved, but because of the nature of the country. Much of the surface is covered with dense timber, in many places forming veritable jungles, or with swamps, or a combination of both. However, a survey first of the accessible areas would show all the surface domes in a considerable part of the coastal plain. This could be followed by meanderings of all the stream banks, roads, trails, and railroad right-of-ways, which would aid greatly in detailed examinations of specific tracts now too densely overgrown to permit stadia work. Undoubtedly such a survey would lead to the discovery of many more salt-dome oil fields in this portion of the state.

It is probably too much to expect that 50 per cent of all newly discovered surface domes will prove to be productive oil fields, but I do believe that 25 per cent of all the distinct surface domes within the area already delimited will prove, upon drilling, to be salt domes, and at least 50 per cent of the salt domes so discovered will develop into oil fields; or, in other words, I consider one productive oil field out of eight distinct (upon survey) surface domes to be a conservative estimate. In making this estimate I am assuming that the selection of the apparent domes will be made by one who is familiar with the country, and who will not mistake residual cut-off deposits by meandering streams, or ancient wave ridges, for surface domes likely to have been formed by a salt-core "intrusion." I place the word "intrusion" here in quotation marks, as it is not within the limits of this article to discuss the theories of salt-dome origin.

Assuming that the above figures are correct, how much better it would be for wildcat oil companies to confine their drilling in the coastal region to the centers of distinct surface domes where the chance of finding a salt dome is probably one in four, rather than engage in promiscuous drilling that is often induced by nothing more reasonable than the possession by some "oily" promoter of leases on a block of 1,000 or 5,000 acres in "rice" or "cotton" country. Confine the drilling to the tops of the distinct surface domes; then the salt core will be found if one exists, and oil too if it occur in either the cap rock or the shallow strata above it. A salt dome once proved will be eagerly purchased by the larger oil companies, whether oil has been found or not. No organization except a big, experienced oil company with great financial resources should attempt to be the first to find oil in the deeper abutting strata of a salt dome, for fifty wells may be required finally to "tap" the oil "pool."

It is hoped these notes will elicit discussion and further information. Possibly there are either errors or omissions in the list of salt domes presented, and some slight changes may be necessary, but the main facts will remain unchanged; that is, the majority of salt-dome structures are oil producing and the majority of these producing domes appear on the surface as topographic domes. Likewise, all the oil produced in this region is from salt-dome structures. Hence the prime requisite in the search for more oil fields here is a good topographic map.

Canadian Oil Regulations Amended

SPECIAL CORRESPONDENCE

The Canadian government has issued an Order-in-Council making some important amendments to the new oil regulations governing the Mackenzie district. The regulations provided that companies acquiring permits or leases must be incorporated under Part 1 of the Companies Act, which provides that shares or capital stock must be without a nominal or par value. After this regulation was approved it was discovered that companies had been incorporated and had issued stock with a nominal value under prior regulations.

One clause of the order enacts that "[illegible] of any other country, the laws, customs or regulations of which deny similar or like privileges to citizens or incorporations of the British Empire shall not by stock ownership, stock holding or stock control own any interest in any permit or lease acquired under the provisions of these regulations."

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Immigrants and Immigration Are Discussed at A. I. M. E. Local Monthly Meeting

The monthly meeting of the New York section of the A. I. M. E. was held on March 2 at 50 Church St., with Vice-chairman Robert Linton presiding. The subject of the evening was "Immigration and Immigrants as Affecting the United States," and four speakers took part in the discussion. The chairman introduced the first speaker, Frederick A. Wallis, U. S. Commissioner of Immigration at Ellis Island, with the statement that Americans often forget how many of our people are immigrants or but one generation removed, and said that even the older lines are all descended from immigrants.

Mr. Wallis spoke at some length on the conditions he found at Ellis Island and on the immigrant-bringing ships, declaring that they are worse, if that be possible, on the ships today than they ever were at the station. Mr. Wallis finds that the immigrant is indispensable to this country, and that the actual problem is to insure his high quality. This can be done by careful, rigorous, medical selection abroad, the only humane and businesslike method. We need expect at the most not over one and one-quarter million newcomers annually, and we shall not net that many. If these are selected, distributed intelligently and treated humanely from the time they arrive onward they will prove no burden but will be a help and strength. Our real danger lies in superficial medical inspection, hordes of criminal stowaways, deserting seamen and the like, but not the declared immigrant. The "literacy" test he holds to be worthless as a protection.

Dr. Albert Shiels, managing director of Interracial Council, discussed errors we constantly make in the personal treatment of the immigrant. Too often he is reproached because he cannot speak English and is not an Anglo-Saxon. Freedom, said the speaker, appeals to others besides the Anglo-Saxon, and usually our ignorance of other languages prevents us from explaining all the subtleties of the "American Idea" to those who long to become intelligent citizens. We should speak to them in their own language, put basic business truths into simple plain English for their benefit, leave to them their own regulatory ideals, and, above all, extend personal help to them in every way.

Prof. S. McC. Lindsay, of Columbia University, discussed very briefly the existing and contemplated immigration legislation. He finds many good laws on the statute books, but they are poorly enforced. The pending bill was also a step in the right direction, but the "literacy" test he condemned unsparingly.

Sidney Rolle, of the U. S. Metals Refining Co., Chrome, N. J., had but little time available. He stated that his company had tried to prefer the native-born workers, but experience showed that they were not as efficient in some of the major operations as were the immigrants from Hungary and southwestern Europe. Mr. Rolle maintained that the latter were essential to the country's industrial life, and thought the best guide in dealing with them is the Golden Rule. Pending legislation is aimed directly at these classes we so need.

Connecticut Legislature Will Consider Registration of Engineers

The bill recently introduced in the Connecticut Legislature by Representative Ford, the object of which is to compel the registration of professional engineers in all branches of engineering work, has attracted the interest of the professional engineers of Connecticut. Its provisions include civil, mining, mechanical, and electrical engineers; also land surveyors and other persons exercising an engineer's functions.

The bill is similar to laws already enacted in many states, and most recently in New York. A bill embodying the same regulations is now before the Massachusetts Assembly. Connecticut professional engineers are prohibited from practicing in states that now register engineers unless they are registered in those states. If the pending bill is enacted at Hartford, Connecticut engineers may, through reciprocity clauses, practice in other states.

The Connecticut bill is in accord with the suggestions for uniform laws in the registration of professional engineers, as drawn up by Engineering Council.

Aid From the O. C. Marsh Fund Available

A fund established in 1898 by the late Prof. O. C. Marsh has now grown to $20,000, and an income of $1,500 is available this year to the National Academy of Sciences for grants in accordance with the original purpose of the bequest. The Academy has approved the recommendations of its Committee on the Marsh Fund ". . . . that grants in the first instance should be used for the support of paleontological and geological research . . . ." Applications should be forwarded to the National Academy of Sciences, Washington, D. C., before April 5.

Conference Urges Publicity for Engineers

Problem of Educating the Public in Technical Matters Discussed at A. A. E. Meeting

Engineers, technical journal publishers and editors, college professors, magazine writers and daily newspaper men met on the common ground of educating the public, at the publicity conference of the American Association of Engineers held in Chicago on Feb. 25. The conference emphasized three main points: (1) Co-relation of the various avenues of publicity; (2) possible co-operation of the various agencies, and (3) details of how to go about the task.

Dr. F. H. Newell, after stating the wrongs inflicted on the engineer in public service because of a lack of appreciation of his work, indicated that the engineer mostly deserved the attacks because he had not told the people what he is doing in terms that they can understand.

R. W. Krum, engineer of materials and tests, Iowa State Highway Commission, spoke of the success of the Iowa plan whereby the small-town newspaper editor was cultivated by the local engineer, the latter being furnished news from a central bureau. W. W. De Berard, Western editor, *Engineering News-Record*, emphasized the same idea of local contact in his plan for a national bureau of publicity.

A description of a course of engineering journalism at Iowa State College by H. E. Pride, led several editors to say they would work for similar courses elsewhere.

Harvey V. Deuell, city editor, *Chicago Tribune*, emphasized the fact that real news cannot be kept out of the newspapers. Too often, however, an engineer's writing is heavy because he wants the bones of his structure to show, whereas the public is only interested in the outline, general appearance and interpretation.

F. M. Feiker, vice-president McGraw-Hill Co., Inc., pledged the help of the technical press.

The Committee on Elimination of Waste in Industry, established by American Engineering Council and organized last January, has its work well under way. First reports in each industry were made on Feb. 21; preliminary reports were made to the planning board on March 1, and it is expected that the fuel industries work will be completed by April 1, according to vice-chairman L. W. Wallace. Other industries now under study, and from which field reports have been received, are transportation, clothing, shoes, printing, textiles, and the metal trades.

MEN YOU SHOULD KNOW ABOUT

Arthur W. Jenks, consulting mining engineer, of Berkeley, Cal., is making examinations in Idaho.

J. Morgan Clements, mining engineer, has gone to Hinan, near Canton, China, on professional business.

E. Percy Smith, mining engineer, of Allendale, N. J., has moved his office to 35 Wall St., New York City.

George H. Garrey, mining geologist, of Philadelphia, Pa., is in British Columbia doing geologic work.

Jerome R. Buchanan, manager of the Homestead-Iron Dyke Mines Co., Inc., Homestead, Ore., is at Pasadena, Cal., on a brief vacation.

C. Minot Weld, consulting mining engineer, of New York City, is in West Virginia on professional business for two weeks.

Ming-Yi Chang, metallurgical engineer, of 414 West 118th St., New York City, has returned from a recent professional trip.

Donald M. Liddell, metallurgist, of the firm of Weld, Liddell & Lazenby, was in Washington on professional business the last week.

W. R. Van Slyke, of Eveleth, Minn., superintendent of fee interests on the Mesabi Range, was in New York City the early part of the week.

Andrew W. Newberry will return to New York City about March 28 from the west coast of Nicaragua, after an absence of nearly four months.

E. O. Daue has returned to Easton, Pa., from a recent trip to Nicaragua and Central America, where he spent several months in examination work for New York interests.

Lloyd D. Cooper and **J. H. Stovel**, of the E. J. Longyear Co., Minneapolis, Minn., were in New York City recently.

William W. Odell, superintendent of the U. S. Bureau of Mines experiment station at Urbana, Ill., is now in charge of lignite investigations being made by the Bureau.

R. H. Sargent, of the U. S. Geological Survey, who has been doing commercial work in Bolivia, has again taken up his duties with the Alaska division of the Survey.

Edward Thornton, recently with the American Smelting & Refining Co., at Tucson, has been appointed general manager for the Arizona United Mining Co., at Johnson, Ariz.

Earl J. Weimer, mining engineer, recently with the Federal Lead Co., at Flat River, Mo., has accepted a position as mining engineer at the Union Colliery Co.'s Kathleen mine, Dowell, Ill.

H. R. Robbins, mill superintendent, has returned to Fierro, N. M., from Minneapolis, Minn., where he has been for several weeks supervising ore tests for the Hanover Bessemer Iron & Copper Co.

Herbert N. Witt, geologist, of Carson, Nev., has been appointed geologist to the North End group of mines on the Comstock lode, Virginia City, Nev., operated by the Consolidated Virginia Mining Co.

G. B. Richardson, geologist in charge of petroleum statistics for the U. S. Geological Survey, is paying a personal visit to the principal producing companies in Louisiana, Texas, Oklahoma, and Kansas.

J. C. Dick, chief of the subdivision on natural resources of the office of the U. S. Commissioner of Internal Revenue, retires on March 31 to resume his profession of consulting mining engineer at Salt Lake City, Utah.

J. B. Mertie, Jr., sailed from Valparaiso, Chile, Feb. 28, for the United States. Mr. Mertie, who is on the staff of the U. S. Geological Survey, has been engaged in commercial work in South America for the last nine months.

Fidel A. Reyes, trade commissioner of the Philippine government, and **V. Manabo**, superintendent of navigation and lighthouses of the Philippines, visited the Mesabi iron range recently to inspect the iron mines in anticipation of the development of the Philippine iron ore resources.

W. Armstrong Price has resigned his position with the West Virginia Geological Survey and is now geologist on the staff of the Transcontinental Petroleum Co. **Lloyd C. Gibson**, geologist, formerly with the Seneca Hill Oil Co. of West Virginia, is with Mr. Price, whose headquarters are at Tampico.

Frederick G. Clapp, petroleum geologist, of New York City, is giving twelve lectures on oil geology before the Geological Department of Harvard College, Cambridge, Mass., beginning March 8. Mr. Clapp is chief geologist of the Petroleum Corporation of America and president of the Pan-American Exploration Co.

Philip Wiseman, president of United Eastern Mining Co., of Oatman, Ariz., was recently elected a vice-president of the California Chamber of Mines and Oil. Mr. Wiseman has given much time to mining affairs, having started in with the Colorado Smelting & Mining Co., Butte, Mont. Subsequently he was general manager of the Shannon Copper Co. and also of the Ray Copper Co.

W. A. Carlyle sailed for London on the "Imperator" on March 12. Mr. Carlyle was managing director of the British America Nickel Corporation, with headquarters at Ottawa, until that property was closed down on Feb. 26. It is reported that he will resume consulting practice at 62 London Wall, London, E. C. 2, and that the British America Nickel interests in Canada will be in charge of **D. Vogt** in his absence. Mr. Vogt has been connected with refining interests in Norway.

Mining engineers and geologists recently visiting New York City included **R. P. Howell**, Devon, Pa.; **A. P. Grossman**, Melrose, Mass.; **A. A. Holland**, Ottawa, Canada; **W. W. Bennett**, Ottawa, W. Va.; **T. Poole Maynard**, Atlanta, Ga.; **Paul F. Pape**, Chino Copper Co., Hurley, N. M.

SOCIETY MEETINGS ANNOUNCED

The American Electrochemical Society meets at Atlantic City on April 21 to 23.

The National Society of Industrial Engineers meets at Milwaukee, Wis., on April 27 to 29.

The Iron and Steel Institute, London, will hold its annual meeting May 5 and 6 at the house of the Institution of Civil Engineers, Great George St., London, S.W. 1. Dr. J. E. Stead, president, will preside.

The Geological Society of America will hold its next annual meeting Dec. 28-30, 1921, at Amherst, Mass., by invitation of the authorities and the geologists of Amherst College. The affiliated societies are the Mineralogical Society of America, the Society of Economic Geologists, and the Paleontological Society.

American Society of Mechanical Engineers holds meetings locally in the near future as follows: On April 11 the Hartford, Conn., Section, meeting at the City Club there, will discuss "The Corrosion of Metal Surfaces" at a joint meeting with the Connecticut Valley Section of the American Chemical Society; on April 15 the Meriden, Conn., Section will be addressed (illustrations) by H. A. Winne, of the General Electric Co., on "Electric Furnaces"; on April 22 the Birmingham, Ala., Section meets with the Atlanta, Ga., and New Orleans, La., sections, at Battle House, Mobile, Ala.; on April 28 and 29 the Mid-Continent Section meets with the chemical engineering societies at Tulsa, Okla.

The International Mining Convention's third annual session will be held at Portland, Ore., April 5 to 9, inclusive, in the Municipal Auditorium. The program includes a discussion of gold and silver mining, led by W. J. Loring; a symposium on the future of copper; and forecasts of the market conditions for lead and zinc. The mineral tariffs also will be discussed. Coal, coal distillation, and phosphate also will receive attention. Among the special features will be British Columbia Day and Alaska Day, a competition in mineral determinations by inspectors and U. S. Bureau of Mines cinema exhibitions. A mines and mining exhibition will be in charge of John E. Miller, 417 Oregon Building, Portland, Ore. Henry M. Parks, director of the Oregon Bureau of Mines, is chairman of the executive committee of the convention.

THE MINING NEWS

LEADING EVENTS

WEEKLY RÉSUMÉ

Two conventions marked the last week: that of the Canadian Institute of Mining & Metallurgy, at Montreal, and the Northwest Mining Convention, held at Spokane. Both were well attended. In Utah the State Supreme Court has upheld the ruling of the Public Utilities Commission that all consumers taking power from the Utah Power & Light Co. must pay the regular rate regardless of special contract arrangement. C. K. Quinn of Duluth, is reported to have bought the large Atikokan iron property, 130 miles west of Port Arthur, Ontario. The Minnesota Legislature has passed a bill providing for a tax on iron-ore royalties. In the Lordsburg district, New Mexico, the Calumet & Arizona Mining Co. has organized a co-operative mercantile store at its Eighty-five mine.

In Washington the Timberlake subcommittee voted to report the McFadden Gold Bonus bill favorably to the full committee; final action was not taken, however, owing to the congestion marking the end of the session. The Interstate Commerce Commission's bill to regulate the transportation of explosives was passed. The Senate appropriation for a mining experiment station at Butte was lost.

New Stoping Record Claimed on the Rand

At the Geduld Proprietary Mines, on the Rand, South Africa, a miner, L. H. Ellitson, established what is claimed to be a new world's stoping record when in the month of November, 1920, he broke 215 fathoms of rock, the previous world's record having been 190 fathoms. Three No. 18 Ingersoll-Leyner drills were used, the fathoms per machine shift being 2.56, and 40 tons being broken per machine shift. The stoping width was 63 in. In the three months preceding November the same miner broke 185, 185½ and 190 fathoms, respectively, with the same machine. According to the Union Corporation, Ltd., which operates the Geduld mine in which the record was made, the Leyner stoping in this mine averaged 1.7 fathoms per machine shift for 1920 for thirty-eight machines running.

Iron Ore Royalty Tax Bill Passed

A bill taxing royalties on iron ore in Minnesota was passed by a vote of 103 to 14 in the House of Representatives. This bill is practically the same as a bill that was introduced in the house last year. The word "royalty" as used in the bill is defined as meaning any fees received by owners of land for the right to explore or mine ore.

Mining Men of Pacific Northwest Meet in Convention at Spokane

Oregon, Idaho, Montana, Washington and British Columbia Represented—Need for United Front To Secure Relief for Mining Industry Impressed Upon Delegates

BY HILLIARD W. POWER

Written for *Engineering and Mining Journal*

The annual meeting of the Northwest Mining Association was formally opened Monday, Feb. 28, at the Spokane Hotel, in Spokane, Wash., with an initial attendance of about one hundred delegates from surrounding districts. By the second day the attendance had more than doubled. The interest shown in the convention was especially gratifying to the officials of the Northwest Mining Association, who realized at the outset the difficulties to be met in getting together a representative gathering of mining men from a widely scattered area at a time when discouragement was general all along the line. However, it seemed to be generally realized that a united front was necessary in order to secure improvement in some directions, and that there were many matters which could be profitably discussed and upon which action could be taken to voice the opinions of the Northwest mining industry. The neighboring province of British Columbia, as well as the states of Oregon, Idaho, Montana and Washington, was represented in the gathering.

Exhibits of minerals were large and well placed and included displays from such districts as Ferry County and Chewelah and Colville, Washington; Pend Oreille, Bonners's Ferry, Coeur d'Alenes, in Idaho; East and West Kootenay, British Columbia. In addition there were numerous exhibits from individual properties, most of which are in the prospect stage as yet. H. M. Lancaster, of the St. Lawrence mine, Saltese, Mont., had one of the largest individual displays, and the Bunker Hill & Sullivan Mining & Concentrating Co. was represented by a splendid exhibit, showing the Bunker Hill product in its various stages between crude ore and lead in various manufactured articles. Washington bricks, pottery and other articles manufactured from clay were in evidence, as well as exhibits of machinery and mining supplies.

L. K. Armstrong, chairman of committee of control, presided at the opening session on Monday. Addresses of welcome were made by Charles A. Fleming, mayor of Spokane; Frank A. Ross, on behalf of the Northwest Mining Association and by G. A. Phillips, president of the Spokane Chamber of Commerce. Replies were made by James F. McCarthy, president of the Hecla Mining Co., on behalf of Idaho; W. B. Dennis for Oregon; C. S. Muffly, president of the Montana Metal Mining Association, for Montana, and Colonel Pollen, of Cranbrook, for British Columbia. An informal reception was held in the evening in the parlors of the Spokane hotel, a large number of ladies being present.

A resolutions committee was appointed Tuesday morning, the following being named: Sidney Norman, chairman; N. Thompson and F. A. Starkey, British Columbia; J. F. McCarthy and William Brown, Idaho; F. M. Smith and C. A. Gray, Washington; and R. M. Betts and W. B. Dennis, Oregon.

G. B. DENNIS MADE FIRST HONORARY LIFE PRESIDENT

Tuesday's proceedings were opened with a very interesting ceremony, this being the presentation to Graham B. Dennis, of Spokane, of the first honorary life presidency of the Northwest Mining Association, in recognition of the work Mr. Dennis has accomplished on behalf of the organization since it was formed in 1894. Mr. Dennis, who has been directly or indirectly connected with the mining industry of Washington since 1885, was visibly touched by the appreciation shown and paid a tribute to L. K. Armstrong, Sidney Norman and President Oscar Cain for the lively interest they had shown and the efforts they had put forth at all times to further the interests of the organization.

By Tuesday afternoon, when the session was presided over by F. A. Starkey, Nelson, B. C., the convention was in full swing, the topic being "Safeguarding Investments." Discussion was participated in by Dean Howard, of the State College, Pullman, Wash.; W. B. Dennis, and Prof. H. M. Parks, of the Oregon Bureau of Mines; Ravenel MacBeth, secretary of the Idaho Mining Association; Sidney Norman, of Spokane; Dr. Clapp, Montana Bureau of Mines; Dean Landes, of Washington University; Nicol Thompson, chairman of Vancouver (B. C.) Chamber of Mines, and Francis A. Thomson, dean of the Idaho State College of Mines, Moscow. "Blue Sky Legislation" received its share of attention in the discussion, Federal vs. state legislation in that respect being touched upon.

Wednesday morning's session was presided over by Senator C. S. Muffly, of Montana, and was largely taken up with an address by H. S. Stoolfire, attorney, of Spokane, who went exhaustively into the distribution of the domestic silver output, and strongly urged united action by producers of the United States, Canada and Mexico with a view to controlling the market themselves, instead of leaving it to London.

NUMEROUS RESOLUTIONS PASSED—MCFADDEN GOLD BONUS BILL ENDORSED

The following is a synopsis of resolutions passed, after being presented to and considered by the resolutions committee:

FALLS IN SPOKANE RIVER AT SPOKANE, WASH

Photo by Brown Brothers, New York

1. Petitioning Congress to amend the present law to provide that annual work on mining claims be performed on or before Sept. 1 of each year so that prospectors may perform such work within the period of the best climatic conditions.

2. Pointing out detrimental effect upon the mining industry of the enlarged homestead grazing act, through opening the way for unscrupulous individuals to make entries and thus burden legitimate mining, and urging upon Congress the immediate repeal of the act.

3. Pointing out the hardship worked upon the Northwestern magnesite industry through dumping of cheaply produced magnesite upon the local markets in competition with a domestic product manufactured under high labor costs and with large capital outlay made at a time when such material was essential to the successful carrying on of the war, and urging the United States Senate to take immediate action upon the measure, already concurred in by the House of Representatives, providing for an adequate protective tariff upon Austrian and other foreign magnesite, "to the end that a domestic industry of magnitude and great value be maintained in prosperity to protect other domestic industries in times of both peace and war."

4. Urging Congress to adopt such changes in the present duties upon lead in ores, lead in mattes, drosses and reguluses, lead in bullion or base bullion, lead in pigs or bars, lead in any other form or combination, as to levy a tariff of 2c. per lb., and that an increase in the tariff on zinc and lead ores be provided in conformity with the recommendations made by the American Zinc Institute.

5. Endorsing the McFadden Gold Bonus Bill.

6. Pointing out that rail rate advances since June, 1918, resulted in an undue burden upon metal mining, smelting and refining and urging immediate steps by carriers and ore producers to secure such readjustment of the present ore rates as will permit of the continued operation of metal mines, and at the same time give to the carrier a just and reasonable compensation for the services that are rendered by it.

8. Endorsing and commending the proceedings of the Federal Trade Commission against Minerals Separation, North American Corporation; endorsing and approving the action of American Mining Congress in supporting the Commission's proceeding, and pledging assistance to officers of the Congress in their "efforts to remove what constitutes a serious menace to the mining industry."

9. Accepting invitation to the Portland convention.

10. Commending and thanking the Idaho Mining Association for intelligent work at Washington in impressing upon Congress the necessity for an increase in the present protective tariffs upon lead and zinc; commending work of Jerome J. Day and Ravenel MacBeth, president and secretary, respectively, and offering co-operation.

11. Favoring protection of the investing public, but pointing out the variegated "blue sky" legislation covering over thirty states and urging national standardization along lines that would remove all restrictions on the raising of capital and permit men engaged in legitimate constructive effort to seek capital in any state of the Union untrammeled by destructive and repressive laws retarding development of the mineral resources of the West; condemning "blue sky" measures, including the Kenyon bill that is now before Congress.

12. Asking Washington State Legislature to pass certain "blue sky" legislation, adopted by the State Senate with a certain amendment favorable to the state mining interests.

Burma Corporation's Production in January

The Bawdwin [illegible] Corporation produced [illegible] in January. [illegible] was [illegible] lb. [illegible] approximately [illegible]

Dual Control of Minerals on Vancouver Island To Be Abolished

Canadian Pacific To Survey E. & N. Belt First, Before Releasing Underground Resources

A thorough mineral survey of the Esquimalt & Nanaimo Ry. belt, on Vancouver Island, B. C., an area of over 2,000,000 acres, is to be undertaken immediately by the Canadian Pacific Ry., through its subsidiary corporation, the Consolidated Mining & Smelting Co. of Canada. Engineers will be engaged to inspect all prospects that have not passed out of the hands of the company and geologists will make reconnaissance of the mineralized zones of the district. The intention is to obtain as complete information as possible preliminary to entering into an agreement with the provincial government for eliminating the dual control of minerals within the E. & N. belt.

William Sloan, Minister of Mines, has been working on the problem of bringing the minerals of the belt within the sole jurisdiction of the province since 1918. The progress made has not been as satisfactory as he could have wished because of the reluctance of the company to release underground resources without a more exact knowledge of their economic potentialities. The company, it is said, has been brought to realize that the present situation requiring that title to mineral lands within the area must come both from the province and the company cannot continue. It is assumed that if, as a result of the survey that is to be made, deposits of value to the Consolidated company are found, that concern will undertake their development. The minerals of the entire section then would be turned over for administration solely by and under the laws of the province.

Engineer Mine, Atlin, B. C., Claimed by Goodwin and Associates

Title to the Engineer mine in the Atlin district of British Columbia is again the subject of litigation. Action has been brought by Walter L. Goodwin and associates against the beneficiaries under the will of Captain Alexander, who owned the property and had it under development at the time of his death. The plaintiffs allege that they located the property at the time that surveys were being made for the White Pass & Yukon Ry. and it was because the majority of the locators were engineers that the present mine was named the Engineer. It is alleged that documents relating to early assessment work and surveys for the crown granting of the property were mislaid in the Gold Commissioner's office at Atlin and were not recorded. Subsequently Captain Alexander located and the property has since fallen to relatives of the late Allen Smith, of Philadelphia. Custody of the property has been entrusted to J. A. Fraser, Gold Commissioner, of Atlin, B. C.

Shippers Win Rate Decision in Utah

Need Not Pay 25 Per Cent Increase on Coal and Ore Within State, Commerce Commission Rules

Shippers of ore and coal in the state of Utah will not have to pay the 25 per cent increase in intrastate freight rates asked by the carriers to correspond with the blanket increase granted by the Interstate Commerce Commission that became effective Aug. 26 last. A ruling to this effect was handed down by the Interstate Commission on Feb. 23. It is estimated that this will mean a saving of $1,500,000 annually to the mining companies. The commission found that present interstate rates on coal and ores are not unreasonably preferential, unduly prejudicial or unjustly discriminatory against interstate commerce.

The proposed increase in rates was fought by Utah shippers through the State Public Utilities Commission. The Traffic Service Bureau of Utah, the Commercial Club and the Utah Chapter of the American Mining Congress, together with the aid of many individual operators.

Jesse Knight Retiring as Head of Investment Company

Jesse Knight, whose name is so closely associated with the development of the Tintic mining district in Utah, and especially with the Iron Blossom and Colorado mines, is retiring from his position as head of the Knight Investment Co., being succeeded as president and general manager by his son, O. Raymond Knight. Another son, J. William Knight, is vice-president of the company, and R. E. Allen is treasurer. The companies comprising the Knight Investment Company are: The American-Colombian Corporation, Empire Mines (Utah), Bonneville Mining Co., Colorado Consolidated, Dragon Consolidated, Eureka Hill Railroad, Iron Blossom Consolidated Mining Co., Knight Woolen Mills, Union Grain & Elevator Co., Springville-Mapleton Sugar Co., Rico-Wellington Mining Co., Spring Canon Coal Co., Tintic Milling Co., Utah Ore Sampling Co., Tintic Drain Tunnel, Miller Hill and Big Hill mining companies.

Trojan Mining Co. Buys Holdings of Ofer Company

A deal has been closed whereby the Trojan Mining Co., the second largest gold producer in South Dakota, becomes the owner of all mining ground formerly owned by the Ofer Mining Co. in the Bald Mountain district. Although the purchase price paid by the Trojan company has not been stated it is large, inasmuch as the Ofer company's holdings were extensive and among the most valuable in that section. The Trojan company now owns nearly all the valuable ground from the head of Nevada Gulch to the foot of Annie Creek.

The Copper Position in Sweden

"Svenska Dagbladet" Comments on Recent Article in "Engineering and Mining Journal"

A recent article in the *Engineering and Mining Journal* on the copper position in the United States has been reproduced in *Svenska Dagbladet* (Stockholm), with the following comment: "The abnormal conditions, above referred to, also fully prevail in our own country. As with us, since the crisis years, there remains a tendency to resort to substitutes, which, at present prices, are in the long run dearer than copper and its alloys. The chief reason for this, probably, is that the eyes of the public have not been opened to the fact that copper is no longer an expensive metal, since it can be sold from Swedish copper works at 1.30 kroner per kilogramme."

All Utah Power Consumers Must Pay Regular Rate

The ruling of the public utilities commission of Utah ordering that holders of special contracts with the Utah Power & Light Co. pay the regular rate for power has been upheld by the state supreme court in a decision just handed down, Judge Frick presiding and the other justices concurring.

Soviet Russia's Iron Ore Output Small Last Year

From official Russian sources it appears that the mines of Kriwoi-Rog, which before the war contributed about three quarters of the whole Russian iron production, have in the last year produced nothing. The production of the copper mines has dwindled down to insignificance. The production of lead is 10 to 25 per cent that of the prewar output.

The total of iron-ore production in 1920 was one-tenth of the quantity expected. In the Ural districts only 9,000 workmen instead of 27,000 as before the war are employed.

Differential Flotation Success on Cœur d'Alene Ores

Dorsey A. Lyon, chief metallurgist and superintendent of experimental stations of the U. S. Bureau of Mines, in discussing the work of the station at Moscow, Idaho, in charge of A. W. Fahrenwald, recently said:

"Mr. Fahrenwald assures me that by the end of the fiscal year next July the station will have done all in its power to improve the efficiency of the Cœur d'Alene milling processes. These are now excellent and commercially efficient, and it is our aim to make them metallurgically efficient. In differential flotation experimental work to effect a clean separation of lead and zinc, Mr. Fahrenwald has been successful. We feel that when our work is completed this coming summer we will have been able to point the way to get higher recoveries in Cœur d'Alene ore treatment."

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

McFadden Gold Bill Favored by Subcommittee

Voted To Report Measure to Full Committee—Final Action Delayed by Legislative Jam

By a vote of 3 to 1 the Timberlake subcommittee of the Committee on Ways and Means voted just before Congress adjourned to report favorably to the full committee the McFadden Gold Bonus Bill. Owing to the congestion incident to the closing of Congress, no opportunity was afforded for the subcommittee to make its report to the full committee, but the favorable report will be conveyed to the committee immediately on the assembling of Congress in extra session. In connection with the action of the committee, which constitutes another step in the progress of this legislation, the American Mining Congress, which is working to secure its enactment, issued the following statement:

"This bill was introduced by Congressman Louis T. McFadden, chairman of the Banking and Currency Committee of the House in the last session of Congress, to prevent a further decline in the nation's gold production and the continued wastage of developed gold ore resources by caving, flooding, and the rotting of timbers when the mines are shut down. The gold production of the nation declined from $101,000,000 in 1915 to $49,500,000 in 1920, which indicates to what extent the mines have already closed down. At the time of the Civil War our gold fields, both quartz and placer, although largely unworked, were fairly well known to constitute resources adequate to the country's need for gold. Since then, these fields have yielded over three billion dollars, and the best deposits are exhausted. There is less chance now for the discovery of new gold mines, and prospecting has virtually ceased because gold mining is no longer attractive to capital.

"Our present limited resources are principally low-grade ores, developed at great cost and requiring large-scale operations. The mines that are still working are mostly restricting production to their best ores, gutting the mine. This is a fatal policy, involving not only permanent loss of developed ore reserves, which cannot be replaced, but the non-use and scrapping of expensive plants which the mines will not again justify building.

"The Director of the Mint reports that the gold supplied for the manufacture of jewelry and other industrial uses in 1919 amounted to $75,500,000, in excess of the production for that year of $15,000,000. The price of gold being fixed by the Government has rendered gold production unprofitable during this period of rising costs, while for the same reason the jewelers and other consumers of gold being supplied with their metal at the pre-war price, are in effect subsidized. Mr. McFadden, in an interview, stated that the bill which he has introduced merely corrects the cost and price equation between the producer of new gold and the industrial consumer of gold without in any way interfering with the monetary unit. On account of the emergency now confronting the gold mining industry Mr. McFadden urges that Congress expedite the enactment of this bill."

Government's Silver Purchases

Purchases of silver under the Pittman Act at the close of business March 5, totaled 41,065,391 fine ounces.

No Money for Butte Station This Year

The appropriation added by the Senate to the Sundry Civil Bill, with the idea of providing funds for the establishment of a mining experiment station at Butte, was lost when the House conferees declined to accept the amendment. After considerable wrangling in conference over the matter, the Senate conferees receded.

Bill To Control Transportation of Explosives Passed

One of the last acts of the 66th Congress was to pass the bill regulating transportation of explosives. The bill, as passed, is the one recommended by the Interstate Commerce Commission. The commission is authorized to promulgate regulations to givern the transportation and packing of explosives.

War Mineral Awards

Awards totaling $51,704.53 were recommended by the War Minerals Relief Commission during the week ended Feb. 26. The largest award was in the claim of Holbrook & McGuire. In that case an additional award of $21,482.31 was recommended. When the claim was considered first, an award of $20,548.22 was allowed. In the tungsten claim of Edward Wagner, an award of $17,056.14 was recommended. An award of $564.17 was recommended in the manganese claim of William C. Hull.

In the light of additional evidence, further awards were made in several cases, as follows: Philipsburg-Chicago Manganese Syndicate, $3,453.65; Edward A. Silverstein, $3,323.40; Nelson & Merser, $303.75; Ladd & Ladd, $421.50; W. G. Marqua, Engineering Co. $5,099.61.

NEWS BY MINING DISTRICTS

Special London Letter

Labor Indifferent to Capital's Problems—F. M. S. To Hold Tin Stocks for Profit — Germans Seeking To Renew Zinc Convention

By W. A. Doman

London, Feb. 22.—Labor apparently pays no attention to the serious economic problems that confront capital. First there was the strike at Broken Hill which kept the mines closed for about seventeen months; now the Australian shipping strike is holding them up again, and in addition, the broken Hill Proprietary has closed down its last blast furnace at the Newcastle, N. S. W., steel works, and has discharged the bulk of its employees.

The miners on the Rand who struck frivolously and against the advice of the union leaders have now caved in. Having been discharged, it was necessary for them to apply for reinstatement. This has been granted in the majority of cases, but on very different conditions from those obtaining previously. To put it plainly, the men have only injured themselves. Had they not returned many of the mines would have remained closed, as with the decline in the gold premium the difference between the falling price of the metal and the cost of producing it has almost vanished.

A report has just come to hand that the men at the Shamva Mines in Rhodesia have ceased work. No explanation is given. The [illegible] low-grade property, something under 1½ dwt per ton, and [illegible] not afford to make any [illegible] concessions in regard to [illegible].

The Falcon [illegible] producer which sells its [illegible] the United

States, makes a poor return for last month. From 15,301 tons of ore treated it obtained 241.742 short tons of blister copper, containing 2,803 oz. of gold and 5,722 oz. of silver, of an estimated value of £28,881. The low grade is explained by falls of ground in the stopes. The company gives an alternative valuation; taking copper at £65 p.t., gold at 100- per oz. and silver at 2/6 per oz. the figure is £30,151. Working expenses and profits are not stated. Today's price of copper is £72/7/6.

The decline in silver to 33d. per oz. is severely hitting the mining companies. Santa Gertrudis £1 shares, for instance, are no better than 7/9. Burma Corporation shares are only 7/6. Presumably the company feels the virtual cessation of the demand in the Far East, where its production is customarily sold.

The Modder Deep did remarkably well last year in the way of opening up new ore. In December, 1919, the reserves were 3,775,000 tons, of an average value at normal price of gold of 38/8 per ton; in 1920 there were milled 507,700 tons and at the end of the year the reserves were estimated at 4,100,000 tons of an average value at normal price of 39/11 per ton.

The Exploration Company, whose principal investments are in North and South America, took advantage of the appreciation in the United States dollars last year to dispose of the majority of its American holdings at a profit. The profit earned was only £74,560, as against £107,020 in 1919, the latter being a record for the reconstructed company. A dividend of 10 per cent is declared, comparing with 15 per cent in 1919 and 7½ per cent in 1918.

The Federated Malay States have stated their policy in regard to tin. Last year the government purchased the metal at the equivalent of £237 per ton, and it now announces that it will not sell its accumulated stocks until a profit can be realized. Apparently this does not carry the mining companies very far, for it is not clear whether current production is being purchased. Quite recently the price was reduced from 115s. to 100s. per picul, and a term to purchasers had been suggested.

The mining market is absolutely dead, and prices are slipping away, mainly on account of the fall in the price of the metals. It is reported that the Germans are endeavoring to renew the zinc convention; but so far they have met with no success.

AUSTRALIA

Queensland

Government Asked To Take Over Properties of Thermo Company

Brisbane—The Thermo Company, an English concern, was formed to acquire and work properties in the Cairns hinterland containing wolfram, molybdenite and scheelite. Since January, 1917, it has spent £357,000. From May, 1918, to March, 1920, the company exported metal to the value of £214,000. The company, however, was engaged for a long time in installing machinery, and had recovered only £61,000 worth of metal from its own mines up to March, 1920, at which date, when it had just reached the real producing stage, work was stopped owing to a reduction of the price of the metals and the company went into liquidation. Recently the Cairns Chamber of Commerce took steps to urge upon the Commonwealth Government that it take over the properties of the Thermo Company, which are valued at £100,000, the principal argument in favor of this course being that every ounce of wolfram and molybdenite should be conserved for the use of the Empire, and that even if the properties were not worked until another war occurred they would be an insurance asset for the Commonwealth. So far it has not been stated whether or not the Federal Government is inclined to look upon the matter in the same light.

FINLAND

Finnish Copper Company Bankrupt

From Our Berlin Correspondent

The copper deposits near Outukumpu in Northern Finland rank as to quality and quantity amongst the best of Europe. Soon after discovery mining operations were begun. In 1917 the mines were leased by the Outukumpu Company. This contract was revised in 1919 and the company agreed to start at once to erect adequate works. Since then the company has fallen into disagreement with the owners, who are of the opinion that the mines are not properly equipped and managed, and that the agreement has been violated by neglect. As the company cannot find the necessary capital it has lately gone into bankruptcy.

The largest shareholder is the Nikkelraffineringsverk at Kristiansand in Norway. Mining operations are carried on with financial assistance of the state.

COLOMBIA

The South American Gold & Platinum Co.'s No. 2 dredge has now reached dredging ground and an increase in production is anticipated. A third dredge will probably be put in operation this year.

CANADA

British Columbia

Coast Range Steel, Ltd., Offered Bounty on Pig Iron

Victoria—The British Columbia Government has entered into an agreement with the Coast Range Steel, Ltd., a new provincial incorporation, under the terms of which the government undertakes to pay bounties on pig iron manufactured in the province from local ore to an amount not exceeding $3 per long ton and on pig iron manufactured in the province from foreign ore to an amount not exceeding $1.50 per long ton. It is set out that British capitalists are ready to invest the necessary money in the establishment of the industry upon the execution of the agreement and upon receipt of the report of engineers, now engaged in the province investigating the iron ore resources, that conditions are suitable. These particulars were laid before the provincial legislature recently and it was further stated that the incorporation fee had been reduced to $50 in order to encourage the enterprise.

Provision is being made by the British Columbia Government for the distribution of powder to prospectors at a considerably cheaper figure than it now is available to them. This privilege, however, will be open only to "the bona fide mineral prospector." It will not be open to those engaged in general mining operations. The concession is being made as a result of strong representations, backed by forcible arguments, from the B. C. Prospectors' Protective Association.

Trail—Ore shipments received at the Consolidated smelter during the week ended Feb. 28 totaled 8,031 tons, coming only from company mines.

Ontario

Board of Arbitration Favored To Consider Wage Question—Taxation Increase Opposed—Easier Assessment Work Requirements Proposed

Cobalt—In connection with the wage reduction of 75c. per shift throughout the Cobalt district, which came into effect on Feb. 15, the workmen have decided to ask for a board of arbitration. A vote taken showed a very large majority in favor of such a board, but no strike vote was taken, nor, in view of all conditions, is there any possibility of a strike taking place. The mine managers agreed to appoint a man to this board, and it is expected that hearings will start within the next two weeks, unless the Minister of Labor decides that the board is not necessary. The final decision on this point rests with the Minister of Labor, but it is very seldom that a board is refused, particularly when applied for by the men.

Recently strong opposition has developed throughout Northern Ontario to the proposed new increase in taxes. At present all mining companies except the nickel mines pay provincial taxes amounting to 3 per cent on profits over $10,000 a year and up to $1,000,000, and 5 per cent on such profits over $1,000,000. It is now proposed to increase this to 4 per cent up to $1,000,000 and 7 per cent over $1,000,000. This, of course, does not include the Dominion income tax, which amounts to approximately 5¼ per cent. The companies consider this a most inopportune time to make an increase, particularly when the mining industry seems to be the only one on which an increased tax is proposed. The gold mining industry is just now getting on its feet again. In the nickel field the companies are only doing sufficient work to maintain their organizations. In Cobalt, owing to high costs and the low price of silver, only a few mines are operating, and less than 900 men are employed, as compared with over 2,000 ordinarily. The amount it is expected to raise by the new tax is not much, but it is felt that any further increase in the burden which the mining industry has to bear will retard new development.

The proposed amendment to the Mining Act provides for a change in the requirements for assessment work. At present 240 days' work must be done within three and one-quarter years, and it is proposed to change this to 200 days, spreading it over five years. It is also proposed to increase the number of free assays by those holding a miner's license from two to twelve. Last year prospectors took advantage of the free assays on account of the small number granted.

Porcupine—The McIntyre mines in Porcupine has secured a lease on the Sturgeons Falls, on the Mattagami River, about thirty miles below the Sandy Falls plant of the Northern Canada Power Co. It is understood that these falls have a capacity of about 9,000 hp., which the McIntyre can develop, if it so desires. Any action they may take, however, will depend upon the assurance they can obtain from the power company as to a future supply of power. During the past winter there has been a shortage of power, and the McIntyre has been forced to curtail operations to a considerable extent.

The annual report of the Hollinger Consolidated for the past year has just been issued.

At the annual meeting of the Goldfields, Ltd., held in Toronto, the shareholders approved the sale of the company's property to the Canadian Associated Goldfields, Ltd., a $30,000,000 company which has been formed to take over the various holdings of the former company.

During January the Lake Shore mine in Kirkland treated 1,674 tons, and recovered $37,375, or an average of $22.34 a ton. The broken ore reserves amount to 18,702 of an average value of $23.37 per ton.

The Wright-Hargraves mill is practically ready to start, but on account of the uncertain power situation it has been decided not to begin operations until spring, when it is expected that the freshets will provide a surplus of power.

Port Arthur—The Atikokan iron mine, 130 miles west of Port Arthur, Ont., has been purchased by Clement K. Quinn, of Duluth, from the National Trust Co., trustee for the bondholders, for $1,500,000. The City Council of Port Arthur, which had invested $200,000 to assist the establishment of a blast furnace in the city to be supplied with ore from the mine, has ratified the deal, consent of the other bondholders having previously been obtained. The city receives the amount of $150,000 invested in the mine and it is reported that it also retains an interest in the blast furnace.

Quebec

New Black Lake Asbestos & Chrome Co. Board Elected

Black Lake—The fight for control of the Black Lake Asbestos & Chrome Co., Ltd., was decided at the annual meeting held in Toronto March 2 by the election of a board of directors nominated by J. A. Jacobs, of Montreal, including the following: Jacob A. Jacobs, Montreal; Maurice Amado and Leon Schinasi, New York; and W. G. Ross and John W. Cook, Montreal. The annual report for 1920 showed a profit from operations of $161,097, as against $155,129 for the preceding year, and after payments for interest and allowance for depreciation there was a surplus of $1,510 as compared with a deficit of $4,975. Notice was received of an application by bondholders for the winding up of the company.

CALIFORNIA

Carson Hill Gold Finds Excellent Ore in Morgan Mine—Placer and Drift Mining More Active

San Francisco—Gold dredge castings have dropped a cent per pound, a recession of approximately 5 per cent. Other mining supplies are dropping in price somewhat but when price drops are reduced to a per ton basis there is but litttle decrease in the per ton cost, which still remains high. There is a noticeable increase in placer and drift mining activities. This is due to a more abundant water supply in the case of hydraulic and placer properties, and in the case of drift mining to a keener realization of opportunities in this kind of mining.

Jackson—Continued progress is being made in unwatering the Argonaut and Kennedy mines. Central Eureka at Sutter Creek is operating steadily. Fremont Consolidated, near Drytown, is reported to have almost completed mill repairs. The Elephant hydraulic mine near Volcano is in operation.

Johnsville—The Plumas Eureka is reported to be about to resume operations on an extensive scale.

Plymouth—The main shaft of the Plymouth Consolidated has reached a depth of 3,235 ft., at which point a station is being cut. The orebody on this level will be ready for stoping by the time the station and pocket are completed. A winze was sunk from the 3,050 level on the orebody to the 3,235 level, from which point development both north and south is in progress in a vein which, as far as it has been exposed, is over 13.5 ft. wide and carries excellent ore. The shaft will be carried down to 3,400 ft. as rapidly as possible. Shaft sinking will be continued without interruption for the entire year. The output for January was $56,000, but owing to excessive costs and the large amount of development work very little profit is shown.

Melones—Recent development on the 1,750 level in the Morgan mine of the Carson Hill Gold Mines group has disclosed ore of commercial grade, which if it continues will mark one of the most important developments in the history of the mine. The two new ore shoots recently developed on the 1,600 level are of great importance to the company's future. The north shoot is several hundred feet north of anything yet discovered. Other development openings continue satisfactory. In the mill the additional ten stamps have been completed. At present twenty-five stamps are in operation and five are held in reserve. On Feb. 24 the tonnage crushed by 25 stamps totaled 502 tons, or better than 20 tons per stamp per day.

Red Mountain—The W. K. Minerals Co. is developing a magnesite deposit at Red Mountain in Stanislaus County. The present plans of the company, which is headed by G. C. Williams, with M. W. Kirk as manager, include marketing high-grade magnesite. The deposit is in vein form and the mineral amorphous magnesite of high purity. There is an active demand for magnesite of this grade from electrical and chemical companies. Operation is expected to start early in April. The magnesite will be hauled by automobiles twenty-five miles to Patterson, on the Southern Pacific.

NEVADA

Brougher Divide Levies 2-Cent Assessment To Finance Deeper Development —Elkora Making Notable Gold Production

Reno—Reports from the Peavine district, near Reno, state that the ledge recently encountered on the 300 level of the Standard Metals has widened to 10 ft., and the entire width is shipping grade.

Jarbidge—The Elkora mine, at Jarbidge, operated by the Guggenheim interests, is said to be producing at the rate of $175,000 per month in gold. This mine was the second largest producer of gold in Nevada in 1920, the Nevada Consolidated Copper Co. at Ely being first.

Virginia City—On the Comstock the Con. Virginia shipped 444 tons of $21 ore last week. Mine conditions are stated to be excellent. In the Ophir values in the Hardy vein on the 2,000 level are improving, and the face of the drifts shows 6 ft. of $45 ore with no walls in sight.

Tonopah—In the Tonopah district bullion shipments, representing the first two weeks' operations in February, are as follows: Tonopah Belmont, $105,000; West End, $52,000; Tonopah Extension, $50,000; and Tonopah Mining, $42,000. The Tonopah Extension has declared a 5-cent dividend payable April 1. Daily ore shipments of this mine have been increased 25 tons to 300 tons per day. West End profits for January are announced as $54,419.6[illegible] [illegible] 5,716 tons of West End ore and [illegible] tons of Jim Butler lease ore.

Divide—No favor[illegible] ing conditions [illegible] levels of the [illegible] has been reported. A raise is being driven from the 1,000 to the 800 level for ventilation, the heat at present being a deterrent factor.

In spite of unfavorable results as a whole in the Divide district during the last year many companies are operating and chances for the discovery of new orebodies in 1921 are better than in 1920. Surface work and shaft sinking have been completed and future work will be crosscutting and drifting. The Brougher Divide has levied an assessment of 2c. per share to finance deeper development to the elevation of the 1,000 level of the Tonopah Divide. At 718 ft. depth a narrow width of good ore has been encountered on which drifting is being done.

The northerly and southerly crosscuts on the 900 level of the Kernick Divide are making good progress. This is important work for the entire western portion of the district.

Manhattan — The Mammoth shaft, now 100 ft. deep, and originally sunk at a point where high-grade ore showed on the surface, is to be sunk an additional 50 ft. and a drift run northerly to intersect projections of important surface showings.

Eureka—In the Eureka district the Eureka Nevada is driving a tunnel into Prospect Mountain to open up orebodies at depth and facilitate ore handling. The tunnel is now in 1,000 ft. and several promising shoots of ore have been found. The Eureka Holly has 4 ft. of good ore on the 400 level. The crushing plant of this company's new mill is being given a preliminary tryout.

Goldfield—At Goldfield 18 in. of high-grade ore has been discovered in a raise below the 266 level of the Great Bend, 2½ in. assaying $11,000 per ton. Eight lease blocks are being worked in the Florence with fair results. High-grade ore has been opened up on the 500 level of the Cracker Jack in what may prove to be a spur vein from the hanging wall side of the Little Florence vein. Many lessees are working profitably in the mines of the Goldfield Consolidated.

The shaft of the Goldfield Deep Mines Co. has reached a depth of 180 ft. More rapid progress will be made after March 1, when two shifts instead of one will be employed. The present objective is 2,400 ft., or 650 ft. deeper than the Merger shaft, which is the deepest shaft in the Goldfield district.

Johnnie—Drifting and stoping is well under way at the Eureka Johnnie. The hoisting plant has been enlarged and the two-stamp mill is now running on custom and Eureka-Johnnie ore. The treatment is plain amalgamation, as the gold is very free and coarse. Charles Labbe is in charge. A road is to be built to Death Valley Junction before the hot weather sets in. This will bring the district 20 miles closer to the T. & T. R.R.

The Congress claims have been leased to A. N. Coe, who is taking out ore averaging $20. This is about 2 ft. wide in an open cut off the main vein. Wedekind is pushing ahead development work on his group of claims and is taking out ore for an extensive mill test.

Mina—The accompanying cut shows the flow sheet of the new mill of the Simon Silver-Lead Mines Co. Construction work is 60 per cent completed and 90 per cent of all machinery and materials is on the ground.

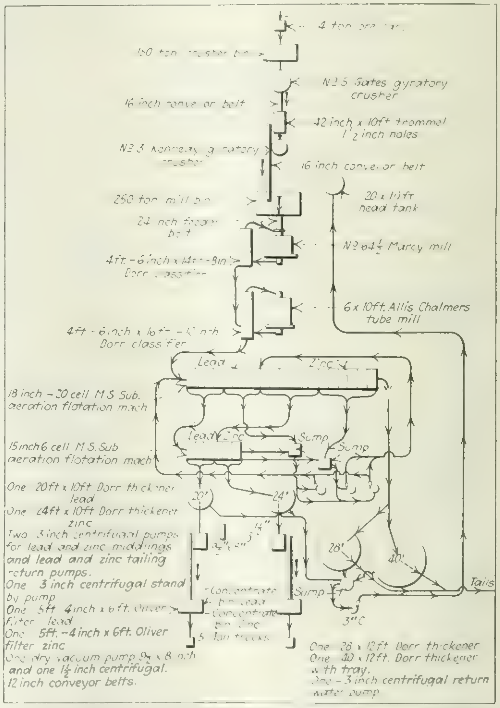
UTAH

Ophir Silver Mines Tunnel Reported to Have Cut Buckhorn Fissure

Milford—At the Leonora considerable mineralization is reported in a drift on the 325 level following an east-west fissure. Mineralization shows over three feet, and of this, although as yet no assays have been taken, one foot is thought to be shipping ore. The drift is only a short distance from its objective, the intersection with a north-south fissure.

Eureka — Ore shipments from the Tintic district for the week ended Feb. 26 amounted to 178 cars as compared with 155 cars the week preceding. Shippers were: Tintic Standard, 57 cars; Chief Consolidated, 41; Dragon, 19; Iron King, 17; Eagle & Blue Bell, 14; Iron Blossom, 11; Victoria, 8; Centennial - Eureka, 3; Gemini, 3; Grand Central, 3; Eureka Hill, 1; and Mammoth, 1.

Ophir—It is reported that the tunnel at the Ophir Silver Mines has cut the Buckhorn fissure, which at the point cut is several feet thick, with heavily mineralized streaks in the limestone.


4 ton ore car
150 ton crusher bin
Nº 5 Gates gyratory crusher
16 inch conveyor belt
42 inch x 10ft trommel 1½ inch holes
Nº 3 Kennedy gyratory crusher
16 inch conveyor belt
250 ton mill bin
20 x 10 ft head tank
24 inch feeder belt
Nº 64½ Marcy mill
4ft-6inch x 14ft-9in Dorr classifier
6 x 10ft. Allis Chalmers tube mill
4ft-6inch x 16ft-10inch Dorr classifier
Lead
Zinc
18 inch - 20 cell M S Sub. aeration flotation mach
Lead
Zinc
Sump
Sump
15 inch 6 cell M. S. Sub aeration flotation mach
One 20ft x 10ft Dorr thickener lead
One 24ft x 10ft Dorr thickener zinc
Two 3 inch centrifugal pumps for lead and zinc middlings and lead and zinc tailing return pumps.
One 3 inch centrifugal stand by pump
One 5ft 4inch x 6ft. Oliver filter lead
One 5ft.-4inch x 6ft. Oliver filter zinc
One dry vacuum pump 9½ x 8 inch and one 1½ inch centrifugal.
12 inch conveyor belts.
20'
24'
1½"
28'
40'
Tails
Concentrate bin lead
Concentrate bin zinc
5 Ton trucks
Sump
3"C
One 28 x 12ft Dorr thickener
One 40 x 12ft. Dorr thickener with tray.
One - 3 inch centrifugal return water pump

FLOW SHEET OF NEW MILL OF SIMON SILVER-LEAD MINES CO., IN MINA DISTRICT, NEVADA

Park City—Shipments for the week ended Feb. 26 amounted to 1,818 tons of ore and concentrates. Ontario shipped 360 tons; Judge allied companies, 938; Silver King Coalition, 460; and Maildriver, 60.

Leeds (near St. George).—The renewed activity at the old camp of Silver Reef continues. Large tonnages of tailings were left by earlier operators, and these are to be made available with modern methods. Mills are to be built to treat this ore, and a good profit is expected. Only the richer ore was milled or marketed years ago. Some development is also being done. The Silver Reef Consolidated has good showings of ore. The Honest, a new mine, is being opened, and is reported to have good ore. The Thompson mine is being unwatered. Ore of good grade is reported to have been opened in the old Leeds mine. The ore at this camp occurs in relatively flat dipping sandstone beds, sometimes in the vicinity of porphyry dikes, but extending some distances from them.

Perry—Suit has been brought by the field service of the U. S. Land Office against J. M. White, J. M. Dalton, Ephraim White, Brigham Mebeker and C. N. Butler to cancel the patent on 80 acres of land three miles east of Perry, Utah, the question at issue being whether the land was known to be mineral bearing or not at the time of entry. The government charges that the defendants made application for the land under the homestead act, claiming that to their knowledge the land contained no mineral deposits. The further charge is made that Butler in 1898 filed a mineral claim on the land, protesting the homestead right of the other three men, and a record of agreement between Butler and them to withdraw his protest upon promise of a half interest in the tract is cited by the government as proof that Dalton, Nebeker, and White knew the land to contain mineral. It is contended that the land now has a working mine, which is producing $40 gold ore.

COLORADO

Kokomo Company and Colorado Silver Mines Co. Plan Small Mills

Aspen—Development in the Park tunnel has opened a 4-ft. vein of good silver ore, the important mineral being polybasite. Selected streaks assay above 200 oz. silver a ton. The Park tunnel has a total length of 2,900 ft. and is being advanced to cut the Last Dollar vein. A raise will be driven to connect with workings above the tunnel level, and tributary to the Jenny Lind tunnel.

Plans have been made to continue development at the Hurricane during the spring. Operations were suspended in the shaft workings on account of water, but the lower tunnel will be advanced to drain the upper workings to permit further development.

Kokomo—The Kokomo Mining Co. is developing the Pearl Consolidated property through the Pearl tunnel. A raise 18 ft. above the tunnel level has cut a 9-ft. vein of ore which has been opened by a drift for about 25 ft. Average samples assay $2 gold, 15 oz. silver and 3 per cent lead. Selected streaks assay over 60 oz. silver per ton. Erection of a mill is being considered.

Romley—The Colorado Silver Mines Co. is developing its property on Shavano Mountain, and trial shipments have been made to the Ohio & Colorado smelter at Salida. Sorted ore averages about 50 oz. silver a ton, plus small values in gold, silver, copper and lead. Milling ore averages 15 oz. a ton. Erection of a small concentrator is under consideration.

Central City—The Cornucopia Leasing, Mining & Milling Co. is connecting its workings with the Reform shaft. Considerable milling ore has been opened and the company plans the erection of a concentrator in the near future. John Havens is president.

Victor—The Edna Forrest Mining & Milling Co. is developing the properties of the Dante Gold Mining Co. and the Gold Sovereign Mining & Tunnel Co. under lease below the tenth level. The new crosscut on the twelfth level of the Gold Sovereign has been advanced 100 ft. and will be continued to connect with the main shaft of the Dante.

Idaho Springs—The Gem Mines Co. will remodel the recently acquired mill at the Newhouse tunnel, at a cost of about 150,000. The new plant will have a capacity of 200 tons per day. The company proposes also to expend about $75,000 in development work. In order to stimulate activity in the tunnel, the transportation charges have been reduced 50 per cent. As a result of this reduction, development has been resumed in the Kansas and Concrete properties. The Mazda vein has been opened on the 1,600 ft. level in the face of the east drift.

The Amherst Mining Co. plans to sink its shaft on the Hampton property an additional 200 ft. A new pump will be installed.

Cripple Creek—The output of the Cripple Creek district during January is estimated as follows: 15,000 tons to Golden Cycle mill, 17,556 tons to Portland mill, and 2,000 tons to smelters: total, 34,556 tons. The average assay value per ton was $12.25, and the total assay value was $422,610.

NEW MEXICO

C. & A. Organizes Co-operative Mercantile Store at 85 Mine

Lordsburg—The 85 Co-operative Mercantile Co. has been organized at the 85 Mine branch of the Calumet & Arizona Mining Co. The authorized capital is $50,000 divided into 500 shares of a par value of $100 each. The board of directors for the first three months will be as follows: Karl I. Mohler, general manager of the 85 Mine, statutory agent; J. C. B. Amos, John B. Rawlings, B. H. Cross, mine foreman, and J. H. Clark, master mechanic. The store will be operated on the same plan as the co-operative store of the same company at Ajo, Ariz., which has paid regular annual dividends of 15 per cent to the employees who participated.

Messrs. Ves Chase and Robert Reynolds have bought the half interest held by Frank Weldon in the Nelly Gray mine which joins the Bonney mine on the north. This gives Chase and Reynolds a five-sixth interest in the property. Negotiations are now under way for a lease on the mine which has produced high-grade copper-silver ores. The Co-operative company has shipped a car of high-grade lead-silver ore to the El Paso smelter. A 50-hp. gas engine has been purchased from the Monte Rico Mining Co.

The Co-operative Mining Co. has opened a strong vein of lead-silver ore on the 300 level. Ore is being hauled to the loading platform for shipment to the El Paso smelter. E. H. Walters is general manager.

Silver City—Arrangements have been made whereby the Silver City waterworks will pump water for domestic purposes from the main shaft of the Silver Spot mine on Boston Hill. Drought caused a serious shortage of water last year. An electric pump of 200 gal. per minute capacity will be installed. Development will be continued in shaft No. 2.

Columbus—Development at the Homestake has reached a depth of 150 ft., with ore showing on all sides which is said to average 20 per cent lead, 14 oz. silver and 18 per cent zinc.

Sulphide ore has been struck at 70 ft. in the Edwards shaft, and at 35 ft. in the Lackland shaft. Work upon the Romaho Mining Co.'s property will be continued.

Santa Fe—The U. S. District Court disposed of the entire proceedings brought by West Virginia stockholders against Lawrence Boyd, president, and the Monte Rico Mining Co., of Lordsburg, N. M. This was a suit to wrest the control of the company from Mr. Boyd, owner of the controlling interest, and was instituted four years ago.

ARIZONA

Delta Mine in Hassayampa District Under Development

Skull Valley—Development work continues at the J. & J. mine. A carload of machinery has been received recently.

Venezia — The lessees at the McMasters mine have produced two cars of ore assaying over 130 oz. silver to the ton. As weather permits, shipments will be increased. A large quantity of ore is ready for shipment. At the Bodie mine preparations are being made to resume shaft sinking. Some shipments of ore are being made. The Turkey Silver Mining Co., which recently purchased the Cutter mine on Turkey Creek, has begun operations, according to Edward Weaver and H. J. Peterson.

Wickenburg — After long idleness the Eva Consolidated Mining & Leasing Co.'s properties are to be reopened. The Magwood Copper Mines Co. has taken over the property and will develop it under the direction of Kirby Thomas, of New York. The company is being financed through the Standard Securities Co., of New York. The Consolidated Vanadium Co. is overhauling its milling equipment.

Prescott—The Delta mine, formerly the Atkin, near the Big Pine property in the Hassayampa district, is being developed by C. E. Anderson and A. O. Egbert, of California. The property at one time produced high-grade silver ore when operated by John Schaffer, postmaster at Groom Creek. Then the ore was shipped via Ash Fork to Pueblo, Col. The new operators are deepening the shaft and are drifting on the 100 level. The Dos Oris company is drifting on the 160 level from the Buzzard shaft. The orebody is over 7 ft. wide at this point, of which 18 in. is high-grade, carrying 275 oz. of silver and $14 in gold. Shipments are being made to Hayden. The company plans to develop the orebody to the 210 level and to install a mill.

At the Ruby Silver mine a contract has been let for an additional 150 ft. in the upper tunnel. The raise from the lower to the upper tunnel will be carried to the surface and used as a working shaft.

Yuma—A large body of tungsten ore has been located in the Fortune Range about three miles from Blaisdell by Herbert Connor and G. A. Rodenbaugh.

Winkelman — The outlook seems favorable for considerable activity in the old Saddle Mountain district which was abandoned during the rush to the Christmas field when that part of the reservation was opened some years ago. After many delays the Little Treasure negotiations are completed and active work has been begun. Mr. Chittenden, a pioneer in the district and the leading figure in the effort to open the reservation to mining around the Christmas mine, has taken over the old Saddle Mountain Mining Co. properties under bond and lease and is shipping high-grade silver ores.

IDAHO

Cœur d'Alene District

Hypotheek Crosscut Cuts Vein on 500 Level—West Sunset Develops Important Ore

Wallace—The crosscut on the Hypotheek has intersected the vein west of the shaft at a depth of 500 ft. and corresponding to a depth of 400 ft. below the collar. The company has developed the property by shaft to a depth of 1,100 ft. Much commercial ore was found on various levels down to the 900, but on the lowest level little ore was found. Two parallel veins north and south are in evidence on the surface and diamond drilling from the shaft shows both to carry lead-silver ore. The course of these veins indicates that they unite about 1,500 ft. west of the shaft.

The West Sunset Mining Co., which has extended the drift on the 1,000 level of the Sunset mine into its property joining on the west, has about 4 ft. of high-grade lead-silver ore in the face. When the drift was started there was only about 10 in. of ore. The drift is now well within the West Sunset ground, formerly known as the Portland. The Sunset mine is owned by Senator W. A. Clark, of Butte, and the success of the West Sunset in developing an important orebody may induce him to resume operations of the Sunset. He suspended work some three years ago, after having sunk 1,000 ft. and opened levels every 200 ft. without satisfactory results.

Murray—The Bear Creek Mining Co. is planning to install electric power and make other important improvements with the view to placing the property on a profit-earning basis. A stockholders' meeting will be held on March 22 to act upon the proposition to increase the capital stock of the company from 1,000,000 to 1,500,000 shares, the additional stock to be sold to provide funds to carry out the improvement plan. Electric power will be obtained from the Washington Water Power Co. and necessitate construction of a 4-mile transmission line.

MONTANA

Taxation Bill Passes Lower House at Helena

Helena—An administrative measure providing for an additional tax of 1½ per cent of the net proceeds of metal mines of Montana has passed the lower house of the Legislature at Helena, but its passage in the Senate is considered doubtful. A bill proposing an additional tax on hydro-electric plants in the state was defeated.

ILLINOIS

Fluorspar Mines Close Owing to Poor Business

Elizabethtown—The Fairview Fluorspar & Lead Co., operating the fluorspar and lead mines at Fairview, Ill., closed all mines on Feb. 11, laying off upwards of 150 men. W. C. Bahn, general manager, stated that the steel industry had slackened in production and that there was no market for fluorspar. He also said that the mines would be reopened when business justified it.

The Rosiclare Mines discharged part of its force over a week ago, retaining some on repair work.

The Pell Mining Co. has also closed down.

Cave-in-Rock — The Cave-in-Rock Fluorspar Co., has closed its mine at Cave-in-Rock, because of lack of market. One man was hurt recently at the company's Baldwin mine by stepping under a bucket that was being lowered in the shaft.

SOUTH DAKOTA

Golden Crest Consolidated Mining Co. Incorporated

Deadwood—Articles of incorporation have been filed with the Secretary of State at Pierre for the Golden Crest Consolidated Mining Co., of Deadwood, with a capital of $1,000,000. This property, which is situated about six miles southeast from Deadwood, was purchased late last fall by James D. Hardin and associates.

MICHIGAN

Marquette Range

Cleveland-Cliffs To Close Salisbury Mine at Ishpeming

Ishpeming—The Cleveland-Cliffs Iron Co. has announced that it will close its Salisbury mine, in this city, and that its Holmes mine and North Lake mines will be operated five days a week until further notice, the order to go into effect immediately. The closing of the Salisbury will let out 125 men, among the best miners in this district, all being old employees of the company. The large investment in ores now in stock and unsold, and the uncertainty of the market are reasons for the curtailment.

The mines of the Oliver company, the mining subsidiary of the Steel Corporation, are working their usual forces at the old rate of wages. No reductions have as yet been announced.

The Beaverboard company has closed down its rock-crushing plant, presumably from lack of orders. The company is seeking to place $20,000,000 bonds to finance its operations in the various fields in which it is busy. About seventy men have been let go.

MINNESOTA

Mesabi Range

Shenango Furnace Co. Closes Webb Mine Down

Hibbing—The Utica mine of the Pickands Mather Co. has been placed on a basis of four days a week. A temporary curtailment of production because of a decreased demand for ore at the lower ports was given as the cause.

The Webb mine, a property of the Shenango Furnace Co., closed down last week indefinitely. About 150 men were thrown out of employment.

TEXAS

Freeport Sulphur Co. Operating at One-Third Capacity

Freeport—The Freeport Sulphur Co. has shut down units A, B and C of its plant at the sulphur mine, and is operating unit D only, or at the rate of about one-third of total capacity. It is stated that the company will start at once to build a plant for the extracting of asphalt from Mexican crude oil. This company produces its own supply of fuel oil in Mexico, and has for some time successfully operated a topping plant at Freeport for the extraction of gasoline from this oil.

Chronology of Mining

February, 1921

Feb. 1—Further cuts in wages became effective in numerous camps throughout the country—Northern Pacific, Great Northern, and Oregon-Washington roads lowered freight rates on low-grade Cœur d'Alene ores to Northport, Wash. — Anaconda Copper Mining Co. suspended zinc operations.

Feb. 9 — British Columbia section, Canadian Institute of Mining and Metallurgy, opened annual meeting at Vancouver, B. C.

Feb. 11—Idaho Mining Association met at Boise, Idaho.—Public legislative hearing held at Helena, Mont., on 1½ per cent tax on mining companies.

Feb. 12—Torreon smelter, at Coahuila, Mex., resumed operations after several months' idleness. — Republic Iron & Steel Co. ceased operations on Mesabi Range.

Feb. 14—U. S. District Court at Phoenix, Ariz., remanded to Superior Court suit of Iron Cap Mining against Arizona Commercial concerning titles in Globe district.

Feb. 15—Wages cut $1 per day at Oatman, Ariz., and 75c. at Cobalt, Ont. —Colorado Industrial Commission at Denver held hearing on question of wage reduction announced by mining companies.

Feb. 19—U. S. Mint at Philadelphia resumed coinage of silver dollars, the first put into circulation since 1905.

Feb. 21—Minerals Separation, Ltd.'s supplemental bill to bring Mineral Separation North American Corporation into suit against Miami Copper, argued at Wilmington, Del., district court.

Feb. 24—Anvil-Palms and Newport mines of Steel & Tube Co. of America, at Ironwood, Mich., cut to four days per week.

Feb. 26—British America Nickel Corporation closed mine and smelter in Sudbury district, Ontario.

Feb. 27—Anaconda Copper Mining Co. shut down electrolytic zinc plant at Great Falls, Mont.

Feb. 28—Northwest Mining Convention opened at Spokane, Wash.— U. S. Supreme Court reversed Utah Circuit Court of Appeals award of $570,000 damages to Conkling Mining Co. from Silver King Coalition Mines Co.

THE MARKET REPORT

Daily Prices of Metals

March	Copper, N. Y. net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
3	12.10	27.00	29.00	4.00	3.85@4.00	4.75
4	12.10	26.50	28.75	4.00@4.10	3.85@4.00	4.75
5	12.10	26.50	28.75	4.00@4.10	3.85@4.00	4.80
7	12.00	26.50	28.50	4.00@4.10	3.90@4.00	4.80
8	11.85@12.00	26.25	28.00	4.00@4.20	3.90@4.00	4.85
9	11.75@12.00	25.75	27.00	4.00@4.20	3.95@4.00	4.85

*These prices correspond to the following quotations for copper, "delivered": 12.35, 12.35, 12.35, 12.25, 12.10@12.25, and 12@12.25c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

March	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
3	67⅝	67⅜	73	154¾	158	18¾	19⅜	23⅝	24⅞
4	66¾	67¼	72	153	156½	18⅝	19¼	23⅝	25⅛
5	....	....	..	.....	....	....	....	..	..
7	66	66¼	71	153	156½	18⅛	18¾	24¼	25¾
8	66	66¼	71	150¾	154½	18	18⅜	26¼	26½
9	65½	66	70	148	151	18¼	18⅝	26¾	26¾

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Mar.	Sterling Exchange	Silver New York, Domestic Origin	Silver New York Foreign Origin	Silver London	Mar	Sterling Exchange	Silver New York Domestic Origin	Silver New York, Foreign Origin	Silver London
3	389	99½	54¾	31⅞	7	390	99½	54¾	31⅜
4	389½	99½	53½	31⅛	8	388¼	99½	53¾	31¼
5	388½	99½	52⅝	30⅞	9	387	99½	54⅛	31⅝

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, March 9, 1921

Lead and tin have been more active than usual during the last week, but copper and zinc have yet to find in evidence any consuming demand. The post war troubles in Europe have affected marketing conditions abroad somewhat, and international business has been even less than usual. So far no sign of a resumption of activity by metal-manufacturing interests has appeared. Also, such metal consumers continue indisposed to speculate by laying in stocks of raw materials at current low prices, most of the buying being for early use. Generally, the reason is lack of money rather than expectation that prices will go lower.

Copper

A buyer's market is very much in evidence, and inquiries are few and far between. The large producers are holding aloof from the market, at 13c. delivered, although at least one would sell for prompt delivery at 12.75c. The metal offered by certain custom and trading interests seems sufficient to more than fill all orders, so that price cutting is resorted to for the purpose of securing such business as may be had. Some tempting inquiries for large lots from certain electrical and steel corporations have strengthened this tendency. One large interest is freely offering prompt copper today for 12c delivered.

Foreign demand is very poor, but some cash business has been done in England. The differential between standard and electrolytic in London has grown very small.

It is evident that even with the present curtailed copper production, stocks are accumulating. One estimate we heard places production at 110,000,000 lb. per month, and consumption at 70,000,000, thus leaving 40,000,000 lb. monthly surplus.

Lead

The A. S. & R. official price continues at 4c., New York and St. Louis.

The firmer tendency for lead prices, which we reported last week, caused a scurrying by consumers to buy before the price advanced further. In general, the lots sold were not large, but the aggregate was very satisfactory. Most of the lead sold was for March delivery, sellers not being disposed to offer much metal for later shipment. The business was well distributed, but cable manufacturers seemed a little more active than usual. We are unable to confirm the high prices (up to 4.40c.) quoted in the metal trade papers, and if such prices can be obtained, they no doubt represent small speculative spot lots. Lead has been freely offered for prompt delivery to reputable customers by one of the largest interests for 4c. throughout the week. A premium is being asked for chemical lead, however, and on this brand we quote 4.25@4.45c. St. Louis throughout the week. This lead, of course, costs more to make, inasmuch as no silver is obtained in its reduction. Some important curtailments in the Missouri and near-by lead districts are rumored to be impending.

Zinc

Due entirely to the better sentiment in the London market and a rise of over £3 in the London spot quotation, the market in St. Louis has risen steadily during the week from 4.75c. to 4.85c. today. Domestic buying has been no better, which accounts for the relatively small reflection of the London jump in price. With the German supply of zinc temporarily removed or reduced, the gradual decline in zinc that has been taking place for weeks is arrested.

Producers are at a loss to ascertain whence an improvement in the market is to come. Present [illegible] tions have been unusually [illegible] zinc, and the methods used so far in meeting the situation, such as curtailing domestic production, have had little effect on prices. It is estimated the zinc production [illegible] usually low, not over 15,000 to 20,000 tons, or [illegible] duction in 1920.

High [illegible] the week for [illegible]

Tin

With current prices the lowest in twelve years, the temptation to buy has proved great, and a good business was done for both prompt and forward delivery, although it is unlikely that much of the tin will go directly into consumption. Electrolytic has been in good demand at, or about ⅛c. less than, the price of Straits. The differential between "99 per cent" and Straits is diminishing rapidly, and is now only about £6 in London.

Spot tin in London on March 1 was £158, instead of £152 as given last week.

Straits tin for future delivery: March 3d, 29.50@30.00c.; 4th, 29.50@30.00c.; 5th, 29.50@30.00c.; 7th, 28.25@28.75c.; 8th, 28.25@28.50c.; 9th, 27.50@28.00c.

Arrivals of tin, in long tons: March 1st, Straits, 5; 7th, Buenos Aires, 25; Straits, 15; China, 3.

Silver

Owing to continued selling by China and consequent weakness in the Indian bazaars, the price of silver was forced down to 30⅝d. in London on March 5. On buying by Indian bazaars the market reacted sharply to 31½d. on the 7th; but, the demand being satisfied, the price has since held fairly firm and closes quiet at 31⅝d., on Indian bazaars buying. Our local market has followed London, as there has been no active buying by the China banks. Eastern exchanges continue bearish, with large stocks of silver on hand. Indian rupee exchange closes at 1s. 3 5/16d. The news from Mexico continues to confirm the statement that production is being curtailed by the low price of silver.

Mexican Dollars—March 3d, 42⅛; 4th, 41; 5th, 40¼; 7th, 41⅝; 8th, 41; 9th, 41⅜.

Gold

Gold in London: March 3d, 105s. 7d.; 4th, 105s. 3d.; 7th, 105s. 3d.; 8th, 105s. 6d.; 9th, 105s. 11d.

Foreign Exchange

The commotion in Europe has, of course, influenced exchange rates to a certain degree, the tendency being weaker, with heavy liquidation in the last day or two. On Tuesday, March 8th, francs were 7.03c.; lire, 3.65c.; and marks, 1.525c. New York funds in Montreal, 14¼ per cent premium.

Other Metals

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 24@25c. per lb. Market quiet.

Antimony — Chinese and Japanese brands, 5¼@5½c.; market quiet. W.C.C. brand, [illegible] per lb. [illegible] "C" grade, spot, 9⅝c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony [illegible] per lb. [illegible] light, with heavy supplies available.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 7c.

Bismuth—$1.50@$1.65 per lb., 500-lb. lots. London price reduced Feb. 12 from 12s. 6d. to 7s. 6d., accompanied by a decline here.

Cadmium—Nominal, $1.40 per lb., in 1,000-lb. lots.

Cobalt—Metal, $4.50 per lb.; black oxide, $3@$3.10 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $275@$300 per oz. Some dealers feel iridium is in a strong position.

[1]**Molybdenum Metal in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.**

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 38@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $70@$80 per troy oz.

Palladium—$65 per oz. Unchanged.

Platinum—$70 per oz. Steady.

Quicksilver—Nominally, $47@$48 per 75-lb. flask. San Francisco wires $46.75. Market dull.

[1]**Rhodium—$200@$225 per troy oz.**

Ruthenium—$175@$200 per troy oz.

[1]**Selenium—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.**

[1]**Thallium Metal—Ingot, 99 per cent pure, $20 per lb.**

[1]**Tungsten Metal—Wire, $35@$60 per kilogram, according to purity and gage.**

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 50@55c. per long ton unit, f.o.b. Atlantic ports.

Manganese Ore—35@40c. per unit, seaport; chemical ore (MnO_2) $60 per gross ton, lump; $70@$75 per net ton, powdered. Market dull.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

[1]**Tantalum Ore**—Guaranteed minimum 60 per cent tantalic acid, 40c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite—According to conditions, $70 @$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.**

Zinc and Lead Ore Markets

Joplin, Mo., March 5—Zinc blende, per ton, high, $24.75; basis 60 per cent zinc, premium, $21; Prime Western, $21 @$20; fines and slimes, $17.50@$15; calamine offered $8, no sales. Average settling price, all grades of blende, $23.03.

Lead, high, $44.50; basis 80 per cent lead, settling $45@$40; offerings $35; average settling price, all grades of lead, $40.73 per ton.

Shipments for the week: Blende, 4,544; lead, 850 tons. Value, all ores the week, $139,380.

The zinc blende output of this district is close to 60 per cent of the peak of highest production, and retorts in operation are reported at 25 per cent of full capacity. Ore stocks have increased approximately 20,000 tons since the first of the year, indicating a weekly output in excess of the demand of nearly 2,000. Output figures are estimated around 7,000 tons per week; the prewar demand was around 5,000 tons. Yet producers wonder why prices continue to sag. Prices are practically on a par with the panic prices of 1896. Offerings of $32 for lead last week found few sellers. This week offering of $35 is getting a fair tonnage.

Platteville, Wis., March 5—No market for zinc and lead ore. Shipments for the week: Blende, 722 tons. Shipments for the year: Blende, 7,193; lead ore, 510 tons. Shipped during week to separating plants, 323 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $2,000@ $3,000; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@ $75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, $23; ground (white), $35; ground (off color), $25@$30 per net ton, less than carload lots, f.o.b. New York. Crude, first grade, $10 per ton, f.o.b. cars, Missouri; floated, $28 per ton in bbls.; $26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis.

Chalk—English, extra light, 5@5½c. Domestic light, 4½@5c.; heavy, 4@4½c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@ $10; washed, $10@$12; powdered, $15@ $20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $15@ $20, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30;

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

imported lump, $15@$25, f.o.b. American ports; powdered, $35@$45, f.o.b. New York.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar—Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $25 per ton, f.o.b. Illinois mines, and $25, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, $60; lump, $17.50, f.o.b. Heathden, N. M. In Canada 85 per cent calcium fluoride sells for $20 per ton, f.o.b. Madoc; output limited. Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines. Demand very slack, with ample stocks on hand.

Fuller's Earth—$16 per ton, carload lots, f.o.b. mines.

Graphite—Ceylon lump, first quality, 8@9c. per lb.; chip, 7c.; dust, 5½c. No. 1 flake, 7c.; high-grade amorphous crude, 3c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Dolomite, 1@2 man size, $1.60@$1.65; 2@8 in., $1.55@$1.65 per net ton, f.o.b. Plymouth Meeting, Pa.; fluxing, $1.65@$1.75 per net ton, f.o.b. Howellville, Pa.

Magnesite, Calcined—High-grade caustic calcined. lump form, $35@$40 per ton, carload lots, f.o.b. California points. In Chicago district, $57.70; Atlantic seaboard, $60.

Dead-Burned—$38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); all f.o.b. New York.

[1]**Monazite**—Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Domestic demand weak; movements of stocks into consuming channels reported slow. Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $8.35; 68 per cent, $7.85; 68@66 per cent, $7.60.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 16c., c.i.f. Atlantic seaport; furnace size, 16½c.; Spanish lump, 14@15c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$40, talcum powder grade. Southern talc, powdered, carload lots, $10@$14 per ton; less than carload, $25, f.o.b. cars; freight to New York $5.25 per ton, carload lots; less than carload lots, $9.25. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 9@10c. per lb. in carload lots. Usual spring demand is not being felt for insecticides. Supplies are plentiful and market is dull.

Sodium Nitrate—$2.85@$3 per cwt. ex vessel, Atlantic ports. Market quiet.

Sodium Sulphate—For 95 per cent material, $20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; $30 per ton, New York.

Potassium Sulphate—Domestic, $220@$230 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 15c. per lb. of chromium contained; 4 to 6 per cent carbon, 14½c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $90@$95, f.o.b. furnaces; resale, $90, delivered; English, $90@$95, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $35@$40, f.o.b. furnace.

[1]**Ferromolybdenum**—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $55@$60; 50 per cent, $85@$90; 75 per cent, $145@$150.

Ferrotungsten—Domestic, 70 to 80 per cent W, 50@55c. per lb. of contained tungsten, f.o.b. works. Foreign, 60c.

Ferro-uranium—35 to 50 per cent U, $7 per lb. of U contained, f.o.b. works.

Ferrovanadium—Basis 30 to 40 per cent, $5 per lb. of V contained, plus 75c.@$2 differentials and according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York list price, 20½@20¾c. per lb.; wire, 15@15½c.

Lead Sheets—Full lead sheets, 8c.; cut lead sheets, 8½c. in quantity, mill lots.

Nickel Silver—33½c. per lb. for 18 per cent nickel.

Yellow Metal—Dimension sheets, 18¾c.; sheathing, 17¾c.; rods, ⅝ to 3 in., 15¾c.

Zinc Sheets—$11 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $80 per net ton, shipping point; arches, keys, wedges, $85; splits, soaps, $100.

Fire Brick—First quality, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $45@$50.

Magnesite Brick—9-in. straights, $90@$100 per net ton; 9-in. arches, wedges and keys, $105; soaps and splits, $120.

Silica Brick—9-in., per 1,000: $45@$55 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, March 8, 1921

There have been some cross-currents in steel prices in the last week. Some extreme prices on bars, shapes, and plates appear to have disappeared, presumably because there proved to be no prospect of their bringing out orders large enough to make extreme prices worth while. On the other hand, sheets can be had on orders of ordinary size at $2 a ton below the previous market, and at least one large producer has begun openly to quote nails at $3, this comparing with a special price of $3.10 quoted by some producers on the first break and afterward withdrawn, at least as an open quotation.

The situation is puzzling, as it is plain the price decline is not taking the usual course, and there is even a thought in some quarters that the breach may be repaired.

A slight improvement in demand in general, particularly for sheets, is now observed, and further improvement is expected for spring.

Pig Iron—Foundry pig iron has been quoted freely at $26.50, Valley, or 50c. decline. Bessemer remains nominally $27, Valley. At least one small lot of basic has sold at $23, but [illegible] is still regarded as nominally [illegible]. About one-fourth the merchant furnaces in this general district are operating, and they are piling [illegible] of their make.

Charcoal and Coke

Charcoal—Willow, [illegible] per lb. [illegible]; hardwood, 5½c. per lb. [illegible] bbls. Barrel charge is 35c. additional.

Connellsville—Furnace, [illegible]@$5; foundry, [illegible].

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Four-Cent Lead and Its Significance

Dollar Price of Domestic Silver Is Causing Rocky Mountain Producer To Increase Lead Production—Missouri Operators Curtailing Because of Unusually Low Lead Prices Prevailing

THE record of lead in the beginning of 1921 is disappointing. Lead below 4c. per lb. New York can only be visualized in company with unusual times, such as the beginning of the war, the panic of 1907, and similar periods. During only one year in the last fifteen years has lead dipped for any length of time below 4c., and that was in 1914.

AVERAGE YEARLY PRICE OF LEAD, NEW YORK
In Cents Per Pound

1905	4.707	1913	4.370
1906	5.657	1914	3.862
1907	5.325	1915	4.673
1908	4.200	1916	6.858
1909	4.273	1917	8.787
1910	4.446	1918	7.413
1911	4.420	1919	5.759
1912	4.471	1920	7.957

What is happening today to lead is identical with what has already occurred to other metals, such as copper, zinc, and tin, with the important difference that the decline in lead follows an extended period of trading and production at abnormally high prices, so that the depression in lead has not been of the same duration as that in the other metals. Lead producers must now solve some of the problems faced by the copper companies. Fortunately for them, they have no unwieldy surplus stocks comparable to those of the copper producers, and have already taken steps to cut production heavily. In fact, one of the largest lead producers in the country has taken the bull by the horns and decided, as present prices are below his cost of production, to purchase lead in the open market, it being far cheaper to follow this procedure than to mine and market lead at a loss, besides depleting a valuable asset.

The controlling factor in the lead situation is the almost continual importation of foreign lead into the United States at prices below the market level at New York. Ever since lead first began to drop last summer domestic producers have tried to prevent importations by lowering the domestic prices, but the attempts have been practically ineffectual. Until the quantities that are available in Europe, and elsewhere, are consumed in the United States or by European manufacturers, this market depressant will continue.

Position of Leading States Under Present Conditions

The most important lead-producing states are, in order, Missouri, Idaho, Utah, Colorado, and Montana. Each of these states has a different problem to face in producing lead with a 4c. market. This is because of the varying quality of ore (the common association of lead with other metals, particularly with silver), and the stipulations of the Pittman Act. These conditions have imposed certain restrictions upon different operating companies in meeting the present market that are bound to have considerable effect. Thus Missouri, the leading lead producing state, recovers an insignificant amount of silver from local lead ores. Idaho, Utah, Colorado, and Montana, on the contrary, produce large amounts of silver from local lead mines. Although in order of importance as lead-producing states they rank as indicated, the ratio of silver to lead production from lead ores is greatest in the reverse order. The table is based on calculations which are too detailed to reproduce here, covering the results of an investigation as to the average value of silver recovered per pound of lead produced in the states mentioned. The value of silver is taken as that established by the Pittman Act, $1 per troy ounce.

VALUE OF SILVER RECOVERED PER POUND OF LEAD PRODUCED

	Probable Average Range	Approximate per Cent of Total United States Lead Production 1920
Missouri (a)	Negligible	49.0
Idaho	$0.025 to $0.035	25.4
Utah	.035 to .060	14.2
Colorado	.045 to .060	4.8
Montana	.070 to .110	3.4

(a) Includes Missouri, Kansas, Oklahoma, and Wisconsin lead mining districts.

This table cannot be considered as giving a hard and fast range of silver recoveries, but it does present the relations between the various states in point of silver credits. Most of the lead-silver mines can exercise appreciable latitude in the selection of lead ores rich or low in silver, a privilege which may alter the ratios shown. Nevertheless, it is striking that the majority of the Rocky Mountain lead producers on the average have a sufficiently large silver credit to balance, partly or completely, the present price of lead. The lead companies in Southeastern Missouri and in fact of the entire Middle West are in a different position and have no valuable byproduct compensatory recovery. If the price of silver received by the domestic producer were as low as that prevailing in the foreign market—around 54c. per oz.—the value of these silver credits would be cut almost in half.

Byproduct Lead Rather Than Byproduct Silver

Glancing at these figures, it is not difficult to see why domestic lead can sell at the present low prices—it is notable that most of it being sold is either imported or of Far Western origin—and why the attitude of various producers toward cutting down production is bound to be different. The Rocky Mountain producer is moved by the consideration of taking maximum advantage of the Pittman Act, which is of measurable duration; in other words, of obtaining the largest share possible of the premium the Government is giving the domestic silver producer. Instead of producing silver as a byproduct in the Rocky Mountain belt, lead is now being produced as a byproduct of silver. It is no exaggeration to say that in some cases the disposal of lead is entirely secondary to that of silver, and that the greatest silver output possible is the ruling factor at the present time.

Such companies as the Federal Lead Co. and the St. Joseph Lead Co. operate their own mines in Missouri, and, although they have low costs of production, they are unable to realize the advantages possessed by their fellow producers in the West. Hence, even though they may desire under present market conditions to cut production drastically, the tendency in the West would appear to be counterbalancing. One advantage in Missouri production is that the lead output does not have to stand the heavy freight charges imposed upon the Western product in transporting it to the market.

An interesting feature of the transportation element is the comparison between the rail charges from Idaho points to St. Louis and New York which enable Western lead to compete in either market. The rate from Idaho to New York is about $22 and from Idaho to St. Louis $20. The Missouri producer pays about $10 per ton in moving lead from St. Louis to New York consuming points, and although this is much less than the cost from Rocky Mountain points, it is apparent that but a small differential between the St. Louis and New York markets exists as far as the Idaho producer is concerned. "Milling in transit" rates, or special freight charges covering shipments of lead to a refinery, where it may be treated, and thence to its ultimate destination, also aid the producer furthest from a market.

Silver Purchases Under the Pittman Act

	Ounces
Silver to be purchased under the Pittman Act	207,000,000
Silver purchased to March 1, 1921 (a)	39,200,391
Silver purchases remaining	167,799,609
Average monthly purchases	4,126,300

(a) Government purchases of silver at $1 per ounce, 1,000 fine, began May 13, 1920

COMPANY REPORTS

Utah Copper Co. Deficit Increases

A statement of the results of the operations of the Utah Copper Co. for the fourth quarter of the calendar and fiscal year 1920 states that the copper contained in concentrates for this quarter, 23,921,581 plus a total of 1,157,562 lb. of copper contained in precipitates from the leaching plant, gave a total gross production for the quarter of 25,079,143 lb. The net production of marketable copper derived from this gross output, after allowing for smelter deductions, was 23,943,816 lb., as compared with a net production of 24,103,161 lb. for the third quarter, 27,793,114 lb. for the second quarter, and 26,057,667 lb. for the first quarter.

The average cost per pound of net copper produced from concentrates and leaching plant precipitates was 17.309c., as compared with 17.156c. for the third quarter. These costs include plant depreciation and all fixed and general charges, but exclude Federal taxes. No credits are made to costs in either case for the gold and silver or miscellaneous income. The value of the gold and silver in concentrates totaled $185,680.05, and the miscellaneous income for the quarter amounted to $328,778.38. These items combined are equal to 2.149c. per net lb. of copper produced, which, being deducted from the operating cost above stated, results in a net cost of 15.16c. per lb.

Financial results of operations for the four quarters:

	Fourth Quarter	Third Quarter	Second Quarter	First Quarter
Net profit from copper production only	$668,703(a)	$329,021	$1,254,033	$2,291,013
Miscellaneous income, including payment for precious metals	514,458	581,850	736,312	329,452
Income from Nevada Cons. Copper Co. dividends	....	250,125	250,125	250,125
Income from Garfield Chemical & Mfg. Corporation dividends	100,000	. .	. .	
Total income	$54,245	$502,954	$2,240,470	$2,870,590
Net loss on marketable securities, etc.	535,270	.	. . .	
Total net income	$589,515	$502,954	$2,240,470	$2,870,590
Disbursements to stockholders	2,436,735	2,436,735	2,436,735	2,436,735
Net surplus	....	....	....	$433,855
Net deficit	$3,026,250	$1,933,781	$196,265	....

(a) Deficit.

The earnings for the fourth quarter are computed on the basis of 14.516c. per lb. for copper, as against 15.791c. for the third quarter, 18.209c. for the second quarter, and 21.994c. for the first quarter. The comparatively low carrying price of copper for the fourth quarter is due to the sales having been considerably less than the production. The deduction from the total income for the quarter is due almost entirely to loss from the sale of Liberty bonds. The regular quarterly disbursement of $1.50 per share was paid.

Chino Passes Fourth-Quarter Distribution

A statement of the operations of the Chino Copper Co. for the fourth quarter of the calendar year 1920 states that the net production of copper for the quarter after smelter deductions was 10,457,661 lb., as compared with 12,023,444 lb., 11,411,178 lb., and 10,159,566 lb., respectively, for the preceding quarters of the year. The total amount of ore treated for the three months was 409,564 tons.

The cost per pound of net copper produced from milling operations and crude ore shipped to the smelter was 15.09c., compared to 15.01c. for the third quarter. This cost includes plant depreciation and all other items excepting charges for Federal taxes. Income from precious metals and miscellaneous sources amounted to $137,753, equivalent to 1.32c. per lb. of net copper produced, which, being credited to the cost of producing copper, reduces the net cost for the quarter to 13.77c., as against 14.53c. per net lb. of copper for the third quarter computed on the same basis.

The financial results of the company's operations for the four quarters follow:

	Fourth Quarter	Third Quarter	Second Quarter	First Quarter
Net income from copper production only	$66,826(a)	(a)$51,080	$260,032	$737,605
Miscellaneous income, including payment for precious metals	137,753	57,703	70,120	72,122
Total	$70,927	$108,783	$330,152	$809,727
Distributions to stockholders	......	326,243	326,243	326,243
Net surplus	$70,927		$3,910	$483,485
Net deficit	......	$217,460	....	......

(a) Loss.

The operating loss for the fourth quarter is based on a price for copper of 14.45c. per lb., as compared with 15.43c. for the third quarter, 18.175c. for the second quarter, and 21.88c. for the first quarter.

No distribution was made to stockholders during the fourth quarter, the directors having deemed it to the best interest of the company and its stockholders not to weaken the company's cash position during the then and still existing depression and unsettled state of the copper metal market by further borrowings on copper for the purpose of continuing disbursements to stockholders. Though the operations for the year 1920 showed a surplus after payment of three distributions to stockholders, and the quick assets Dec. 31 were approximately $4,500,000 in excess of current liabilities, most of this surplus and the excess quick assets were represented by copper and supplies on hand. The financial results for the year are as follows:

		Per Share
Total net income	$1,319,588.90	$1.517
Disbursements to stockholders	978,727.50	1.125
Net surplus for the year	$340,861.49	$0.392

Ray Consolidated Earnings Decrease

A report of the Ray Consolidated Copper Co. covering the fourth quarter of the year 1920 states that the total net production for the quarter, after allowing for smelter deductions, was 10,617,651 lb., as compared with 12,631,222 lb. for the previous quarter, 12,553,623 lb. for the second quarter, and 11,259,534 lb. for the first quarter of the year. During the quarter there was milled 375,228 tons.

The average cost per pound of all net copper produced for the quarter was 16.27c. This figure does not take into account any credit for the value of gold and silver or for miscellaneous income, and compares with a cost of 15.96c. for the previous quarter. These costs include a charge of 15c. per ton for the retirement of mine development expense, but are exclusive of estimate of Federal income and profits taxes. Miscellaneous income for the quarter, including net income from gold and silver produced, amounted to 1.105c. per lb., resulting in a net cost of 15.16c. per lb., as compared with a net cost, computed in the same way, of 15.47c. for the preceding quarter.

The financial results of operations for the four quarters follow:

	Fourth Quarter	Third Quarter	Second Quarter	First Quarter
Operating profit or loss	$178,082(a)	(a)$113,519	[illegible]	[illegible]
Miscellaneous income	117,350	61,370	[illegible]	[illegible]
Total	$60,731	$52,149	[illegible]	[illegible]
Disbursement to stockholders	394,295	394,295	[illegible]	[illegible]
Net surplus for quarter				[illegible]
Net deficit for quarter	$455,026	$446,444	[illegible]	

(a) Loss.

The average carrying price of copper for the quarter was 14.590c. as compared with 15.057c. per lb., 18.426c. and 21.96c., respectively, for the third, second and first quarterly periods. A quarterly distribution to stockholders of 25c. per share, which was paid Dec. 31, 1920, amounted to $394,294.75.

MINING STOCKS

Week Ended March 5, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Adventure	Boston	¾	¾	¾		
Ahmeek	Boston	50	48	48	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	9/16	½	9/16		
Allouez	Boston	22	21½	21½	Mar. '19	1.00
Anaconda	New York	38⅝	38	38	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2⅞	2¾	2¾		
Ariz. Com'l.	Boston	8½	8½	8½	Oct. '18,	.50
Big Ledge	N. Y. Curb	⅜	¼	5/16		
Bingham Mines	Boston	....	...	8½	Sept. '19, Q	.25
Calumet & Arizona	Boston	47¾	46½	46½	Dec. '20, Q	1.00
Calumet & Hecla	Boston	238	236	236	June '20, Q	5.00
Canada Copper	N. Y. Curb	....	....	*13		
Centennial	Boston	10	9½	10	Dec. '18, SA	1.00
Cerro de Pasco	New York	27¾	27	27	Mar '21, Q	.50
Chile Copper	New York	11⅞	11	11		
Chino	New York	21¾	21⅛	21¾	Sept '20, Q	.37½
Columbus Rexall	Salt Lake			*34		
Con. Arizona	N. Y. Curb	....	....	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	....	....	2⅛		
Copper Range	Boston	35⅞	34	34	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*39	*35	*36		
Davis-Daly	Boston	6½	6¼	6¼	Mar. '20, Q	.25
East Butte	Boston	9	8½	8¾	Dec. '19, A	.50
First National	Boston Curb	*90	*85	*85	Feb. '19, SA	.15
Franklin	Boston	2¼	2⅛	2¼		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol.	New York	....	....	22	May '19, Q	1.25
Greene-Cananea	New York	21½	21½	21½	Nov. '20, Q	.50
Hancock	Boston	2	2	2		
Howe Sound	N. Y. Curb	....	....	3	Jan. '21, Q	.05
Inspiration Consol.	New York	34¾	33½	33¼	Oct. '20, Q	1.00
Iron Cap	Boston Curb	....	....	6½	Sept. '20, K	.25
Isle Royale	Boston	20⅛	20⅛	20⅛	Sept. '19, SA	.50
Kennecott	New York	18⅛	17⅛	17¾	Dec. 20, Q	.50
Keweenaw	Boston	....	....	1½		
Lake Copper	Boston	...	..	3		
La Salle	Boston	....	....	1¾		
Magma Chief	N. Y. Curb	...	..	*21		
Magma Copper	N. Y. Curb	23	21½	22	Jan. '19, Q	.50
Majestic	Boston Curb	*10	*10	*10		
Mason Valley	Boston	1½	1½	1½		
Mass Consolidated	Boston	2¼	2	2	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	4	3¾	4		
Miami Copper	New York	18¼	17¾	18	Feb. 21, Q	.50
Michigan	Boston	3	2½	3		
Mohawk	Boston	48½	47¼	47½	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5¼	5	5		
Nevada Consol.	New York	11	10½	10⅝	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	15	14	14	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....	....	*5		
North Butte	Boston	12	11	11	Oct. '18, Q	.25
North Lake	Boston	....	....	*45		
Ohio Copper	N. Y. Curb	....	....	3/16		
Old Dominion	Boston	20	18	20	Dec. '18, Q	1.00
Osceola	Boston	27	26½	26½	June 20, Q	.50
Phelps Dodge	Open Mar.	....	†180	....	Jan. '21, Q	2.50
Quincy	Boston	39	39	39	Mar. '20, Q	1.00
Ray Consolidated	New York	13½	12¾	13½	Dec. '20, Q	.25
Ray Hercules	Boston Curb	..	....	*63		
St. Mary's Min. Ld.	Boston	32	32	32	June '20, K	2.00
Seneca Copper	Boston	16¼	15⅞	16¼		
Shannon	Boston	1 3/16	1	1	Nov. '17, Q	.25
Shattuck Arizona	New York	6⅛	5⅞	5⅞	June '20, Q	.25
South Lake	Boston	1½	1¼	1¼		
Superior Copper	Boston	4	4	4	Apr. '17,	1.00
Superior & Boston	Boston	2⅛	2⅛	2⅛		
Tenn. C. & C. cfs.	New York	8½	7⅝	7⅝	May '18, I	1.00
Toulumne	Boston	*55	*50	*55	May '13,	.10
United Verde Ex.	Boston Curb	28	27	28	Feb. '21, Q	.50
Utah Consol.	Boston	4½	4½	4½	Sept. '18,	.25
Utah Copper	New York	51	46¾	49¾	Dec. '20, Q	1.50
Utah M. & T.	Boston	1 13/16	1½	1½	Dec. '17,	.30
Victoria	Boston	1¾	1¾	1¾		
Winona	Boston	*80	*50	*80		
Wolverine	Boston	13¼	11½	11½		
		NICKEL-COPPER				
Internat. Nickel	New York	15	15	15	Mar. '19,	.50
Internat. Nickel, pf.	New York	80	80	80	Feb. '21, Q	1.50
		LEAD				
National Lead	New York	72	70¼	72½	Dec. '20, Q	1.50
National Lead, pfd	New York	105	105	105	Dec. '20, Q	1.75
St. Joseph Lead	New York	11	11¼	11¼	Dec. '20, QX	.50
Stewart Mining	Boston Curb		....	*6	Dec. '15,	.05
		ZINC				
Am. Z. L. & S.	New York	[illegible]	8¼	8¼	May '20,	1.00
Am. Z. L. & S, pfd.	New York	27½	26½	27½	Nov. '20, Q	1.50
Butte C. & Z.	New York	5	4¾	5	June '18,	.50
Butte & Superior	New York	12¾	12¼	12½	Sept. '20,	1.25
Callahan Zn-Ld	New York	5½	5	5½	Dec. '20, Q	.50
New Jersey Zn	N. Y. Curb	[illegible]	140	140	Feb. 21, Q	2.00
Success	N. Y. Curb	[illegible]	2	[illegible]	Jan. '16,	.03
Yellow Pine	Los Angeles	..		*59	Sept. '20, Q	.03

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

Stock	Exch.	High	Low	Last	Last Div.	
		GOLD				
Alaska Gold	New York	1¼	1⅛	1⅛		
Alaska Juneau	New York	1⅝	1½	1⅝		
Carson Hill	N. Y. Curb.	....	...	22¾		
Cresson Consol. G.	N. Y. Curb	1⅛	1	1 1/16	June '20, Q	$0.10
Dome Extension	Toronto	....	....	*45		
Dome Mines	New York	16	15½	15½	Jan. '21, Q	.25
Golden Cycle	Colo. Sprgs.	‡.		*73	Dec. '20, Q	.02
Goldfield Consol.	N. Y. Curb	*9	*7	*8	Dec. '19,	.05
Hollinger Consol.	Toronto	6.65	6.60	6.61	Feb. '21, M	.05
Homestake Mining	New York	50	49½	50	Sept. '19,	.50
Kirkland Lake	Toronto	*49	*49	*49		
Lake Shore	Toronto	1.16	1.16	1.16	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	2.00	1.96	1.99	Jan. '21, K	.05
Porcupine Crown	Toronto	*23	*21	*21	July '17,	.03
Portland	Colo. Sprgs.	‡.	....	*60	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*5½	*4½	*5	May '19,	.05
Silver Pick	N. Y. Curb	*7	*6	*7		
Teck Hughes	Toronto	*10½	*10	*10		
Tom Reed	Los Angeles	1.27	1.23	1.26	Dec. '19,	.02
United Eastern	N. Y. Curb	2½	2⅜	2½	Jan. '21, Q	.15
Vindicator Consol.	Colo. Sprgs.	‡...	....	*18	Jan. '20 Q	.01
West Dome Consol.	Toronto	*8	*7	*7⅜		
White Caps Mining	N. Y. Curb	*10	*7	*10		
Yukon Gold	N. Y. Curb	....	....	*100	June '18,	.02½
		SILVER				
Arizona Silver	Boston Curb	*19	*15	*16	Apr. '20, M	.03
Batopilas Mining	New York	¾	¾	¾	Dec. '07, I	.12½
Beaver Consol.	Toronto	*39	*38	*38	May '20, K	.03
Coniagas	Toronto	2.05	2.05	2.05	Nov '20, Q	.12½
Crown Reserve	Toronto	*18	*17½	*17½	Jan. '17,	.05
Kerr Lake	Boston	....	....	2⅞	Jan. '21, Q	.12½
La Rose	Toronto	....	....	*25½	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	....	....	*30	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.09	1.00	1.00	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	8	7½	7⅝	Jan. '21, QX	.50
Ontario Silver	New York	4½	4½	4½	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	1⅞	1⅛	1½	Jan. '12,	.10
Peterson Lake	Toronto	*9	*9	*9	Jan. '17,	.01½
Temiskaming	Toronto	*25	*25	*25	Jan. '20, K	.04
Trethewey	Toronto	*16½	*15	*16	Jan. '19,	.05
		GOLD AND SILVER				
Atlanta	N. Y. Curb	....	....	*2		
Barnes-King	Butte	‡....	....	1.11	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*67	*62	*66		
Cashboy	N. Y. Curb	*9	*6½	*8		
El Salvador	N. Y. Curb	¼	¼	¼		
Jim Butler	N. Y. Curb	*16	*14	*15	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*9	*7	*8	June '16,	.05
Louisiana Con.	N. Y. Curb	..	....	¼		
MacNamara M. & M.	N. Y. Curb	*17	*15	*15	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	..	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1⅝	1½	1⅝	Jan. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1 3/16	1 1/16	1⅛		
Tonopah-Extension	N. Y. Curb	1⅝	1⅜	1½	Jan. '21, Q	.05
Tonopah Mining	N. Y. Curb	1½	1¼	1½	Oct. '20, SA	.05
West End Consol.	N. Y. Curb	1 1/16	1	1 1/16	Dec. '19, SA	.05
		SILVER-LEAD				
Caledonia	N. Y. Curb	*13	*10½	*12	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	1.15	1.15	1.15	Dec. '20,	.15
Chief Consolidated	Boston Curb	2¼	2⅜	2¼	Feb. '21, Q	.05
Consol. M. & S.	Montreal	19½	18	19	Oct. '20, Q	.62½
Daly Mining	Salt Lake	....	....	2.50	July '20, Q	.10
Daly-West	Boston	3⅜	3¼	3¼	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	.	....	2⅛	Dec. '20, K	.25
Electric Point	Spokane	*7	*7	*7	May '20, SA	.03
Federal M. & S.	New York	6	6	6	Jan. '09,	1.50
Federal M. & S., pfd.	New York	.	....	26½	Dec. '20, Q	1.75
Florence Silver	Spokane	*16	*15	*16	Apr. 19,	.01½
Grand Central	Salt Lake	.	....	*37½	June '20, K	.03
Hecla Mining	N. Y. Curb	4 1/16	3⅞	3 15/16	Dec. '20, QX	.15
Iron Blossom	N. Y. Curb	17	*17	*17	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake		..	3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*8	*7	*7		
Prince Consol.	N. Y. Curb	5/16	5/16	5/16	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*7½	*7	*7½	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*7	*7	*7		
South Hecla	Salt Lake		..	*66	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	1/16	1/16	1/16	Oct. '17,	.05
Tamarack-Custer	Spokane	1.90	1.80	1.80	Jan. '21, K	.04
Tintic Standard	Salt Lake	3.40	3.20	3.20	June '20, Q	.10
Utah Apex	Boston	2	2¼	2½	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*3½	*2	*3	Nov. '17	.01
		QUICKSILVER				
New Idria	Boston	....	....	*95	Jan. '19,	.25
		VANADIUM				
Vanadium Corp.	New York	35½	32⅛	34	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal	*76	73	80½	Jan. '21, QX	3.50
Asbestos Corp., pfd.	Montreal	90½	89	90	Jan. '21, QX	3.75
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref.	New York	41¼	40¾	40⅞	Dec. '20, Q	1.00
Amer. Sm. & Ref. pf.	New York	80	79½	79½	Mar. '21, Q	1.75
Am. Sm. pf. A	New Yor	65	65	65	Jan. '21, Q	1.50
U. S. Sm. R. & M.	New York	34	32½	32½	Jan. '21, Q	.50
U. S. Sm. R. & M. pf.	Boston	43½	42	43	Jan. '21, Q	.87½

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Hoover and Reorganization

THAT the position of Hoover in the Cabinet in Washington will further certain plans which have recently engaged the attention of engineers and of the mining industry is indicated by the tenor of recent dispatches. It is known that Hoover has studied very seriously the chaotic condition of the administrative organization of the Government at Washington, and has applied himself to a consideration of the remedy; and it is commonly understood and reported that Harding has listened sympathetically, and agreed to favor reorganization, and reassignment of the work of various bureaus, if not the bureaus themselves, in such a way as to improve efficiency and minimize duplication.

As president of the American Institute of Mining and Metallurgical Engineers and of the Federated American Engineering Societies (the order in which we mention these is designed), Hoover has been firm in his support of a Department of Public Works, and unquestionably he will further the movement now. The first changes which will take place, however, will be those which concern his own department. The Department of Commerce has hitherto been a subordinate affair, mostly a happy-go-lucky agglomeration of bureaus, without having charge of any powerful function of government. Hoover has secured from the President a promise that under him certain great powers over commerce now held by organizations without the department will be there concentrated.

Apart from domestic commerce and trade, there is the question of a foreign trade policy. The handling of this has long been a bone of contention between the departments of State and Commerce, and till now it has remained with the former, largely on account of its otherwise greater prominence and influence. This control centers in the organization of the Foreign Trade Adviser of the State Department, as the State Department has always maintained—and with considerable reason—that the foreign policy of the Government and the foreign trade policy could not be dissociated. However that may be, the supervision of foreign trade is now likely to be transferred to Hoover's administration, with the State Department in the capacity of adviser. This is a matter of importance to the mining industry, for during and after the war a conclave of representatives of various departments, called the Economic Liaison Committee, met under the chairmanship and at the call of the State Department to advise the latter concerning questions of commercial policy, especially foreign commercial policy, and there was in this organization a subcommittee on mineral industries, the chairmanship and leadership of which was in the Interior Department, through representatives of the Bureau of Mines and the Geological Survey. Through this connection of knowledge and opinion, the Mining Bureau influenced powerfully the mineral policy of the Government, especially the foreign mineral policy. This liaison, of course, should be maintained, and, if transferred to the Commerce Department, will constitute a direct relation of Hoover to the mining industry.

Another point of contact is obtained through the Bureau of Foreign and Domestic Commerce of the Commerce Department. This bureau has been in the habit of sending abroad Foreign Trade Commissioners to investigate and report on industrial conditions in various parts of the world. All industry was included in this program, including the mining industry. Accordingly, certain mining engineers and geologists were appointed as commissioners, and were sent to investigate the mining industry in various selected localities, as in the Far East, or in Spain. No administrative tie-up existed between this work and the mining bureaus of the Government. The location of the latter in the Interior Department presupposed the conclusion that the mining industry and the mining policy of the Government was purely a domestic affair.

During the war it was brought home unmistakably that this was not even relatively so; that the mining industry had two almost equally important aspects, the domestic and the foreign side, which could not be dissociated; and the Interior Department bureaus boldly attacked, so far as powers and funds allowed, foreign problems.

Both the Bureau of Mines and the Geological Survey sent men abroad to study critical mineral problems; and the World Atlas of Commercial Geology, just published by the Geological Survey, is a testimony to its war and post-war activity in the world field. These Interior Department emissaries abroad overlapped in some cases with mining engineer commissioners sent out by the Commerce Department; and in communications which ensued the latter department suggested that foreign mining investigation be turned over to it, a request which was not pressed in view of the sound arguments to the contrary.

All the mining and mineral organizations of the Government should be centralized in one organization, and this will be one of the problems that we look to Hoover to solve.

The Slump in the Nickel Industry

NOT IN YEARS has the Canadian nickel industry been so depressed as at present. Upon the outbreak of the war, a curtailment comparable to that now in force was carried out, but it was of only short duration. The leading interest operating in the Sudbury district, the International Nickel Co., produced in 1913 about 3,700,000 lb. of [illegible] It

September, 1914, this amount dropped to 1,200,000, but immediately the war demand began to be felt, and in 1918 production reached over 7,000,000 lb. per month. Now it has dropped back to but little over 1,500,000 lb.; the reverberatory department of the smelter is completely shut down, and only two of the eight furnaces are being operated.

The second largest interest, the Mond Nickel Co., has had only one furnace out of four in blast for the last two years, and is producing about 700 tons of bessemer matte per month, or around 600,000 lb. of nickel. Even during the war, the Mond production was never expanded in the same ratio as that of the International, for the reason that the product is shipped to Wales for refining, and ships were not available. The close of the war, therefore, found a large stock of bessemer matte at the smelter. Furthermore, government war stocks of nickel in Europe were sufficiently large to take care of peace-time demands for a year or so.

In view of the great demand for nickel during the war, a third company was organized, the British America Nickel Corporation, Ltd. This company was formed to mine and smelt ore from the Murray mine, the original discovery which was made when the main line of the Canadian Pacific Ry. was graded, in 1883. Several previous plans to work the property under various corporate names resulted in failure. Without doubt, both the International and Mond companies had the opportunity to acquire the property, but did not find it sufficiently attractive.

The birth of the present company was accompanied by more or less mystery, but it is generally understood that the British government financed in large part the development of the mine and the construction of the smelter and refinery. The government also agreed to take a certain amount of the product at the market price. About a year ago the smelter was blown in, and on Feb. 26, 1921, the operations were shut down completely, an event which was not unexpected.

From the first there was considerable doubt as to the successful outcome of this project. The ore was not as high grade as that of the International. Also, power costs were high, inasmuch as imported coal had to be used for fuel; whereas the International and Mond companies had developed cheap hydro-electric power. Production began just in time to meet the post-war slump in demand, and the contract with the British government proved a burden instead of an asset. We can imagine that operations were carried on at a loss, and we are told that the British government became very uneasy when the conditions of the loan were not being met. Apparently there was considerable agitation in Parliament over the matter. W. A. Carlyle, until recently managing director of the company, informs us, however, that the finances of the corporation have been put on a firm basis against the time of resumption. Recently the financiers had four experts from the United States, including Pope Yeatman, examine the mine, plant, and processes, and all of their reports are said to have been most satisfactory.

We suspect, however, that it will be a long time before operations are resumed, as there seems to be no necessity for a third company in the district. Both the International and Mond companies are capably managed low-cost producers, with facilities for over four times the present production. The selling policy of these companies has been eminently fair, and prices have been so adjusted as to return a reasonable profit to the stockholders over an extended period. Even at the height of the war demand, with the accompanying high cost, little or no increase was made in prices.

How long will the depression in nickel continue? Formerly nickel was largely used in the manufacture of nickel-steel for armor plate and in other munitions. Signs now point to a reduction in armament by the leading powers, and no more big wars are likely for twenty or thirty years: possibly not then, if civilization should learn some of the lessons of the last struggle, wherein the victors' losses were staggering. The future of nickel will, therefore, depend more upon peace-time uses than before. These are being actively pushed by the producing companies, and demand only awaits the resumption of general industrial activity.

Thomas and Tungsten

DURING THE CLOSING DAYS of the Sixty-sixth Congress, a Senator from a tungsten-producing state, Henderson, of Nevada, attempted to rush through the Senate the bill providing for a tariff on tungsten, so that the dormant tungsten industry of the country might be revived behind the kindly wall of protection, which might keep at a safe distance the product of cheap labor in China and Bolivia. A Senator from another tungsten-producing state, Thomas, of Colorado, announced that he would talk (filibuster) from then till the end of the session, if need be, to prevent the passage of the bill: and the Senater from Nevada discreetly desisted.

There is a series of gossamer-light cartoons running in a New York daily, "Wonder what a ——— thinks about," the blank being changed daily, and varying from a New President to a Discarded Golf Ball. Well, we "wonder what a Senator from a tungsten-producing state thinks about."

When the War Minerals Relief Bill, of fragrant memory, was being pushed in Congress, it provided for compensation for the producers of all so-called war minerals, from asbestos to zircon. The Secretary of the Interior refused to indorse this principle, for the minor reason that no Government stimulation whatever had been applied in the case of many of these minerals; and on being pressed to name those concerning which Government stimulation had actually been exerted, he named the immortal three—manganese, chrome, and pyrite. Whereupon, it was whispered, Senator Thomas, of Colorado, rose up and declared that if tungsten was not included he would kill the whole bill. Tungsten *was* promptly added, for the good and sufficient reason that the Colorado Senator had provided; and Thomas thereby put into the pocket of producers, or would-be producers, of war tungsten a lot of the real stuff which they had been unable to catch up to by the more hazardous route of mining.

Finally, we "wonder what a Colorado tungsten producer thinks about Thomas." Probably he will be willing to let the good deed cancel the naughty one, and withhold his further judgment of the able and downright Colorado Senator. Certainly, if you wanted anything in the tungsten line, or didn't want it, Thomas has proved himself the critical factor. Incidentally, we believe that both Henderson, of Nevada, and Thomas, of Colorado, were in their last days in the Senate when the final incident occurred to which we referred in the beginning; and this may also be a factor in reading their respective thoughts.

Taking a "Long Shot"

A RECENT DISPATCH in the *New York Times* conveyed the startling information that a deal whereby the Shell and Royal Dutch oil interests had secured title to all properties in the Grosnaya district, in the Caucasus, had been consummated. At first we are likely to regard this in the same category as the Vanderlip concessions, but a more careful reading of the article shows that the bargain has been made with Russians who held title to the property under the Czar's régime, and that a time limit of ten years has been placed in the agreement. In other words, as the *Times* expressed it, the bargain "amounts to betting that the Bolshevist régime in Russia will fall within ten years."

There are many "ifs," "ands," and "buts" to such a contract, and to offer an opinion on the possible outcome of the venture would be largely guesswork. However, it may be assumed that considerably more judgment is being exercised than is shown by many purchasers of oil stock. At any rate, the oil is there in this instance, and the gamble concerns only the management, or, as we regard it, the mismanagement, of a country.

Eventually it must come about that the sorry plight of Russia will take a turn for the better and some semblance of a reasonable government be set up. With the establishment of such the rights of former Russian subjects will undoubtedly receive some degree of recognition, but whether this period will be reached in one, two, or ten years is an open question. However, we know the betting proclivities of Lloyds, and also take cognizance of the fact that the Englishman is a good loser. He is taking a "long shot," but the trophy is worth the chance.

The Change in the Secretaryship Of the Interior

THE SECRETARY OF THE INTERIOR is also at present the Secretary of Mines, although he does not always fully realize this dignity. Therefore, it is an important incident for the mining industry when there is a change in the Secretaryship, as there was on the fourth of March, due to a change in the administration, Judge J. B. Payne, on account of being a Democrat, stepping out, and Senator Albert B. Fall, on account of being a Republican, coming in. Judge Payne had had only a brief time of office, having succeeded, in a way, as a temporary appointee, the Hon. Franklin K. Lane, who not long after the close of the war gave up the political career to engage in business.

As Judge Payne's administration was under nonspectacular conditions, and, therefore, he had not much possibility of coming into the limelight as a Secretary, it is all the more fitting to record the ability with which he served. His assistants in the Interior Department came to value fully his keen mind, his trenchant fashion of getting to the bottom of problems, his faculty of making up his mind and announcing it, and his convincing manner of explaining the reason for his decision. We should have liked to see Judge Payne continue as Secretary.

Concerning Senator Fall's fitness to be Secretary of the Interior and of Mines, nothing can yet be said. He is a man of force and character. He comes from a great mining state. He has been conspicuous in calling attention to conditions in Mexico and demanding that the United States take steps to remedy them. This may or may not be a recommendation for a place in the Cabinet. Along with certain pre-election utterances of the President, the general outlook would be toward a more vigorous foreign policy as regards Latin America, and a less vigorous one as regards the rest of the world; and although the Secretaryship of the Interior is far from that of State, our domestic problems, especially that of mining, are now bound together inextricably with certain foreign problems.

Cyanide Treatment Of Amalgamation Tailings

IN THE BUREAU OF MINES January *Reports of Investigations* there appears a short article on the subject we have given this editorial. The article is a report upon concentration and cyanide tests on tailings obtained from a mill run upon ore from a mine in the Fairbanks district, Alaska. Percentage extractions are noted. An outline of a plant, with estimated costs; a flow sheet, cost estimate of operation, and the results of flotation tests upon slimes are given. In addition, the report states that "if the ore blocked out in the mine warrants the assumption that 3,000 tons of $40 ore can be mined and milled, the question of treating the amalgamation tailing should be seriously considered." The report in both form and substance is suspiciously like many we have seen over the signatures of practicing metallurgists. In fact, it falls distinctly into the class of commercial reports.

Whatever the merit of the particular case may be, we feel that the U. S. Bureau of Mines is treading upon dangerous ground both in carrying out testing work which is distinctly an encroachment upon professional practice and in spreading a report which might lead others to believe that the Bureau's research work has descended into the category of the side room of an assayer's shop. Professional metallurgists and engineers take pride in the Bureau's accomplishments in the broader fields of research, but their support cannot be expected to continue if the Bureau fails to observe the twilight zone between clearly defined commercial work such as a consulting engineer or metallurgist might expect to get, and its own special field.

A Gram of Radium for Mme. Curie

THE MOVEMENT that is under way to raise funds for purchasing a gram of radium to be presented to Mme. Curie when she comes to this country in May is a bit of sentiment not without its practical lesson. So rare and valuable is this substance, whose mysteries are but half explored, that its very discoverer, when asked as to what she most desired, said that she wanted a gram of radium more than anything else in the world. The great value of radium and the minute quantities in which it is dealt are evidence of its scarcity. The visible supply of both the element and the ores that yield it is small, and at the present rate of consumption a scant half dozen years may see the known deposits practically exhausted. Blind optimism cannot discover new ones.

Doubtless Mme. Curie's great desire has been made more keen by the prodigal way in which she sees radium wasted in the manufacture of luminous dials and similar articles. It is safe to say that the greater part of the current production of the substance is being so consumed. Radium thus used is, of course, a total loss. It cannot be readily salvaged as can old gold and silver. A gram given to Mme. Curie will be a gram saved, and saved it should be until everything is known about it, or, at least, until its promise as a cure for cancer fades.

WHAT OTHERS THINK

The Swinging Pendulum

The editorial comment in *Engineering and Mining Journal* of March 5, on the recent annual report of the Subcommittee on Employment of the Committee on Industrial Relations, A. I. M. E., is obviously based on what is contained in a single paragraph. The statements quoted do not represent what was intended to be emphasized by the Subcommittee on Employment, nor do they represent the sentiments of the Industrial Relations Committee, nor the sentiments expressed during the sessions of the Institute held under the committee's auspices.

No blanket indictment of all employers was made or intended by the report. There is no doubt that the majority of employers are sincere in their purpose to deal fairly with their employees. It was felt, however, that attention should be called to conditions and tendencies known to exist in some industrial organizations, with a view to emphasizing how important it is that the present situation be dealt with in the right way. The sentences you quote were merely intended to lead up to what immediately follows, in which is stated, *"Let us hope they (employers) will remain wise and able and not abuse the power that is theirs. Never was there a bigger and better opportunity for management to show that it is broad-gaged,"* which statement is omitted in the editorial but which might well have been included.

The constructive features of the report may be summarized as follows:

1. In spite of handicaps of less assured permanency, instability of labor supply, accident hazards and comparatively unhealthful working conditions, the mining and metallurgical industry has done much work, and constant progress is being made, toward the solution of these industrial problems. It is recommended that the Institute committee undertake to secure information on the present status of industrial relations in the mining and metallurgical industries of the United States and Canada, and to summarize this in a report for the benefit of the Institute membership.
2. A special responsibility rests on engineers to devote their attention and energy, their engineering skill and ability, to a constructive consideration of these problems and to give assistance to both employer and employee in an effort to reduce waste and promote industrial co-operation, emphatically indorsing the views of Herbert Hoover in his address before the first meeting of the Federated American Engineering Societies. And, as the report concluded, *"Let the mining and metallurgical engineers accept his doctrine of the initiative on the part of the employer, increased production on the part of the employee, and emphasize his keynote of good-will."*

The Committee on Industrial Relations hopes that its work will be of real service to the Institute members, by bringing to their attention what is being accomplished to promote increased confidence and respect between employers and employees. We hope that this communication may correct any wrong impression that may have been given through what was evidently a misunderstanding of the Employment Subcommittee's report.

SIDNEY ROLLE,
Chairman Subcommittee on Employment,
Committee on Industrial Relations, A. I. M. E.

Chrome, N. J.

Selective Converting First Developed In France

In your issue of Feb. 5, J. Owen Ambler describes the practice of selective converting at Clifton, Ariz., and calls it an adaptation of the old Welsh "best-selecting" process. The practice of selective converting was, to my knowledge, first developed by Paul David at the Equilles works, in France, in a spherical converter, which he called "sélecteur" (French for selector). This converter is provided with a pocket on its side, in which are stored the "bottoms."

After the matte has been blown to white metal, blowing continues for a relatively short period, until the impurities are collected in the first copper blown, which flows in to the side pocket of the converter. By turning the converter into proper position, the "bottoms" can be tapped. Blowing then continues on the rest of the charge. By this process David not only removed all the impurities from the bulk of the copper, but collected also the silver and gold in the bottoms, and effected great economies in the succeeding electrolytic refining operations. Only the bottoms were subjected to electrolytic refining; the other converted copper could be refined directly in furnaces. David's Sélecteur is described in "Annales des Mines," Vol. XIII, 1898, on page 621.

HERBERT HAAS.

San Pedro, Cal.

The Crowe Process as Practiced at the Homestake Plant

I have read Alfred James' "Sidelights on the Cyanidation Process," in your issue of Jan. 15, with interest. This is an expression of an individual's opinion. As such, it merits respect. Were it not that certain figures are quoted in discussing the Crowe process, there would be no occasion for comment on the article. But as figures are cited to make the author's point, there is justification for examining these to see whether they are authentic, typical and fairly representative of the most recent practice.

I quote the article in question: "It is obvious from Crowe's results that the consumption of 0.407 lb. per ton of ore should never have been permitted. Ought not Crowe's figure of 0.191 lb. to be reduced to at least 0.17 lb. (African practice) or more accurately 0.07 lb. (Indian practice) by reversion to zinc shaving?"

Merely calling attention to the fact that Portland ore is generally of higher grade than African, and that any comparison of practice at the two places should be made with this fact in mind, I give herewith, for Mr. James' information, recent precipitation data from Homestake. The Crowe process was used here: Period covered, year 1920; tons of tailings treated, 1,255,419; pounds of zinc dust used, 50,133; pounds of zinc dust per ton tailings, 0.04.

Substituting these figures in the paragraph quoted, it is apparent that the argument is thereby rendered futile.

ALLAN J. CLARKE.

Lead, S. D.

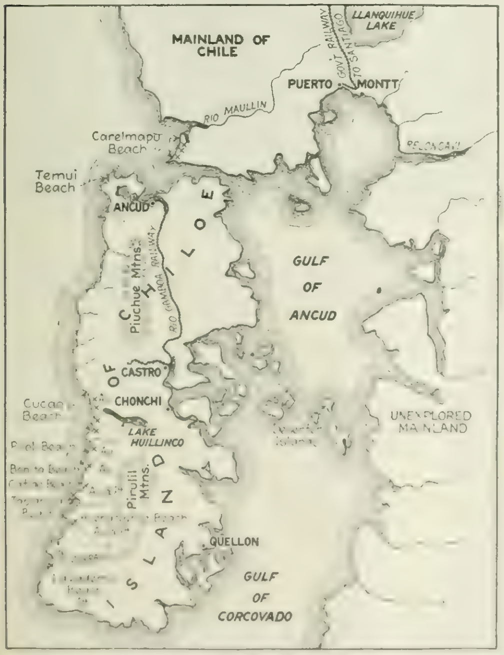
Black-Sand Deposits of the Island of Chiloe

Seven Beaches on the West Side of the Island Off the Chilean Coast Are Washed for Gold- and Platinum-Bearing Sands, Principally by Means Of a Local Amalgamating Device—Value and Extent of Deposits Erratic

BY FRITZ MELLA

Written for *Engineering and Mining Journal*

THE Island of Chiloe, a Chilean possession, lies in longitude 74 deg. West, between latitudes 41 deg. 50 min. and 43 deg. 25 min. It is 100 miles in length along a north-south axis, averages 30 miles in width, and is separated from the Chilean mainland on the north by the Chacao Channel and on the east by the gulfs of Ancud and Corcovado, which form the northern extremity of the inside waterway to the Strait of Magellan. Owing to the absence of ports on the Pacific side, and the lack of means of communication by land because of the thickly wooded nature of the country, the western coast is sparsely settled, and all commerce with the island is through the channels and the ports along the eastern coast.



MAP OF THE ISLAND OF CHILOE

Small, wood-burning freight and passenger steamers of about fifty-ton register ply between the island and Puerto Montt, the southern terminal of the Chilean government railway. By through train the 600-mile journey from Santiago to Puerto Montt can be made in twenty-four hours, and from Puerto Montt to Ancud, the capital of Chiloe, requires eight or nine hours by channel boat. Points further south, such as Castro, Chonchi, and Quellon, require twenty-four to forty-eight hours. A 60-cm. gage railroad connects Ancud with Castro.

The climate, though disagreeable during the rainy season or winter months of June, July, and August, when the high north winds prevail, is not severe, as frosts are rare and snow is unknown. The annual rainfall, however, averages about two meters. Except for the beaches and small tracts cleared for agriculture, the island is still a virgin forest. The principal woods encountered are laurel and cypress and a species of oak, and dense hardwoods, locally called "luma" and "tepu," with high calorific values and used universally in that section of the country for fuel, are plentiful and cheap. The native "Chilotes," although small in stature, are strong and hardy, and make fairly good workmen. Because of their environment, they are skillful woodsmen, and at the same time natural and daring sailors. The inhabitants of the west coast occasionally engage in gold washing; but their chief occupation while at home is the raising of potatoes, for which the island is noted.

The Spaniards are credited with having worked the gold-bearing gravels of the Rio Gamboa, near Castro, on the east coast, more than a century ago, but the black sand beaches on the west coast did not attract attention until 1890. Most of the work done since that time has been of an individual nature. Several attempts by placer miners from the Punta Arenas fields to work on a larger scale are said to have resulted in failure.

The principal beaches exploited for their gold-bearing black sands are, beginning from the south, Huenacoyhue, Catiao, Tablaruca, Bonita, Cucao, Temui, and Carelmapu, the last named being situated on the mainland just across the channel from Ancud. Gold has also been reported on the Island of Cailin, across from Quellon, and on the Island of Ipun, about eighty miles south of Chiloe. Appreciable quantities of platinum are found from Tablaruca south. The auriferous- and platinum-bearing black sands consist of quartz, olivine, zircon, garnet, and other silicates, with magnetite, ilmenite, and hematite as the heavier constituents. The sands probably represent the erosion products of the basic igneous rocks of the higher cordilleras of the continent, from which they were transported to the sea by streams when the island was still a part of the mainland.

GOLD VALUES IN SANDS SHOW VARIATION

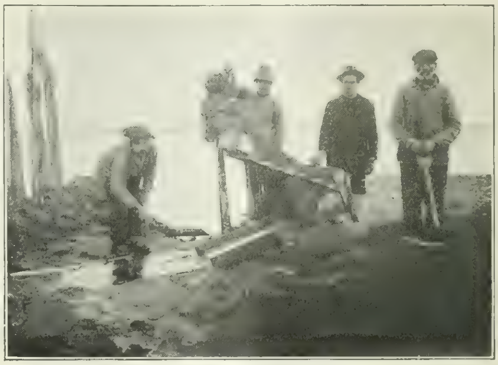
The present deposits are due to the concentrations of these sands by the sea as well as to the erosive action of the waves on the cemented sand bluffs jutting into the ocean at various points on the coast, some of which on panning yield the heavy black sands and colors of gold. The proportion of black sands on the various beaches varies from a trace to as high as [illegible] per cent of the deposit. As a rule, the highest gold values are found in banded layers of heavy black and [illegible] sands, varying from thin knife-blade [illegible] to as much as 20 cm. in thickness, and occurring between strata of lighter, gray sands. However, the presence of black sand does not always indicate the presence of gold, and although the deposits are extensive, the gold values appear to vary greatly within narrow limits. Elevated beds of shells on the east coast suggest that the island was subjected to at least two uplifts, so that the beaches investigated are probably all modern, and although high ancient concentrations may exist farther inland, their presence has not yet been disclosed. Owing to the thickly wooded nature of the interior, very little prospecting has been attempted there.

Generally, the concentrations of black sands are found close to the present high-tide mark, and between high and low tide, although a noticeable exception is Cucao, where the concentrated deposit lies from a hundred meters to one kilometer back from shore line. The same occurrence, but less marked, was observed on the Pilol and Bonita beaches, and it is possible that these concentrations, which are no longer subject to present wave influence, may be the results of an unusually heavy storm or a tidal wave, as they conform to the gently sloping contour of the present or modern beaches and differ from them only in their constituents. Similar conditions are reported on some of the beaches immediately north of Cucao, which, however, were not visited, as the gold contents of their sands were reported to be insignificant.

Both gold and platinum are encountered in the black sands, and, although little attention was paid to the platinum until recently, the Chilotes, who were aware of the latter's existence but not its value, termed it *oro blanco*, or white gold, and ignored it because of its failure to amalgamate. Platinum is found only in appreciable quantities from Tablaruca beach south, the richest samples coming from Lavaderos beach, the farthest south beach prospected. The gold, which occurs in fine thin scales, is unusually clean, running about 950 fine, and, unlike the gold in the Oregon deposits, amalgamates readily. It apparently occurs in a free state, as assays of the black sands from various beaches, after amalgamation, failed to disclose gold either chemically or mechanically combined. The coarsest gold is found on the southern beaches, pieces weighing up to 1½ milligrams not being uncommon, but the further north the beach the finer the gold, and at Carelmapu, the farthest north beach exploited, estimates show that 200,000 particles are required to make a gram, or about 3,000 colors to one cent. This is finer than the Snake River gold, which according to the U. S. Geological Survey, required 2,000 colors to make a cent.

NATIVE "APARATO" SUCCESSFULLY USED TO TREAT SANDS

Early attempts to save the gold in ordinary sluice boxes failed because of the tendency of the heavy black sands to clog the riffles, as a result of which the native amalgamating device locally termed *aparato* and sometimes *canaleta* was developed. The *aparato* is simply a wooden frame or box holding a series of inclined and sometimes staggered amalgamating plates and a tray with a screen for receiving the sands. The contrivance is set up near a source of water with a tub placed at one side and elevated so that water from a ¾-in. hole in the tub will flow into the tray in a continuous stream. The material to be washed is shoveled on the tray, from which, with the aid of the stream of water and a piece of board in the hands of the operator, it is moved over the screen, the undersize passing over the amalgamating plates and the oversize dropping at the back of the machine. As silver-plated plates are beyond native means, local custom decrees



OPERATING A NATIVE *APARATO*

Note the corrugated amalgamating plates in the lower tray. Material in the right foreground is sand and pebbles which is being washed. In right background is oversize from the device. To the left are the tailings that have passed over the amalgamating plates.

THE GOLD DIGGERS. NATIVE CHILOES, WHOSE CHIEF OCCUPATION IS RAISING POTATOES the use of a corrugated nickeled variety, but it is necessary to work these plates at a steep pitch to prevent the heavy black sands packing in the depressions of the corrugations. Notwithstanding the primitive arrangement of the apparatus, with well-dressed plates and in the hands of careful operators, the machine becomes a most efficient gold saver, although when it is crowded the gold losses are heavy.

WASHING BEACH SAND. SLUICES LINED WITH BURLAP

As the concentrated deposits are generally of a superficial nature, the enriched areas are prospected by means of shallow pits, and when the *manto* or rich strata is encountered it is stripped, carefully separated from the barren gray sands, and shoveled aside for subsequent treatment on the *aparato*. Gold pans are unknown, and, although a wooden batea is sometimes employed in the clean-up, an ordinary shovel is used for vanning and prospecting, the natives becoming very proficient in its use as a means of separating the fine gold from the heavy black sands.

The two principal beaches, from an acreage standpoint, are Carelmapu and Cucao, both of which were investigated in the expectation that the extensive yardages of sand would offer a promising field for operations on a large scale with modern appliances.

CARELMAPU BEACH FORMERLY SCENE OF ACTIVE WASHING

It is said that in the early 90's as many as two hundred *aparatos* were engaged in washing the Carelmapu beach, and although the remains of tailing mounds attest to considerable past activity, no authentic records of the gold produced exist. This beach is about 12 km. long by 2 km. wide, constituting one large, flat expanse of sand topped with a sandy soil that, in the rainy season and owing to insufficient drainage, becomes a vast swamp, but in the summer is transformed into a greasy meadow. Though the concentration of the auriferous black sands was apparently confined to the immediate shore line, subject to wave influence, pannings at almost any point on the meadow disclosed the presence of gold. In view of this fact, the entire area was located about two years ago by a group of Chileans in Ancud, and as samples taken by their representatives indicated possible values of $\frac{1}{2}$ to $\frac{3}{4}$ g. of gold per cubic meter, it was decided to investigate the meadow more thoroughly.

With considerable difficulty, owing to water and loose sand, eight test pits from three to four meters deep were sunk in a rectangle of 2 km. by $1\frac{1}{2}$ km. at the southern extremity of the meadow and where the most promising surface prospects were obtained. The results were disappointing in that the average indicated gold value of the samples was under 4c. per cubic meter, although one hole returned an average of 30c. Subsequent investigation showed this pit to have been sunk at a point where some surface concentration had been effected in an area of less than one hundred square meters. The material exposed by the test pits was composed almost entirely of the lighter, gray, beach sands, the black sands probably not representing more than 1 or 2 per cent of the total material excavated.

ATTEMPTS AT PROSPECTING

In view of the low results obtained on the meadow, and to investigate the possibilities of the concentrated strip of beach at shore line, a series of shallow holes were sunk at 100 m. intervals, about 20 m. back from and parallel to the high-tide mark. Notwithstanding that estimates by the owners credited this portion of the beach with values in excess of one gram, or about 60c. per cubic meter, the average of the pits was less than 11c. Some concentration is taking place continually between high and low tide, but the occurrences are apparently too erratic to warrant even small-scale operations, as no attempts to exploit them have been made in recent years. At several points in this vicinity a thin streak of pure black sand showing from fifty to sixty colors to the pan was encountered, but owing to the changeable action of the waves no reliance can be placed on the permanency of the streak.

About ten years ago the Carelmapu meadow was drilled for oil, and, although none was found, the log of a drill hole that attained a depth of 600 m. shows that a false bedrock of sandstone about 3 m. thick was encountered at a depth of 15 m. Following this, successive layers of loose and cemented beach sands, sandstone, and occasional layers of clay and pebbles were passed through, and the hole was stopped in sandstone. The records of the oil company contain no reference to gold in the deposit; nevertheless it is of interest that samples of the last drilling from the hole mentioned, on being panned, disclosed the presence of the characteristic heavy black sand and a few very fine colors of the same flaky gold encountered on the beach.

TRANSPORTATION AT CUCAO

Cucao beach, situated about half way down the coast of the island, is reached from the town of Chonchi over a 10-km. cart road to Huillinco, a settlement on the eastern shore of Lake Huillinco, and thence about 20 km. by boat across the lake, whose western extremity and outlet to the sea are on the Cucao beach. The road described is the only feasible overland communication between the east and west coasts, for dense forests cover the island.

Like Carelmapu, Cucao is an open roadstead about 12 km. long, the beach averaging about 1½ km. wide. The concentrated black-sand deposit can be distinguished from the lighter, gray, beach sands by a slight iron stain and a heavy covering of rounded beach pebbles. By virtue of these markings, the deposit can be traced on surface for approximately 12 km. in a practically continuous line, the average indicated width being about 50 m. The middle of the deposit, which is only about 5 m. above sea level, lies about 1 km. back from the present shore line, the extremities approaching within 100 m. of high tide. The work done to date, which includes some haphazard drilling, indicates that a section through the deposit on an east and west line resembles a lens about 7 m. thick in its center. The deposit rests on gray beach sands of unknown depth, bedrock as yet not having been encountered, although one of the drill holes is said to have reached a depth of 20 m.

The deposit differs from the adjacent gray beach sands in that it contains a larger proportion of the heavy black sands and beach pebbles, the latter seldom exceeding fist size. The black sands constitute probably 10 to 15 per cent of the deposit and the pebbles 40 per cent. The gold, although somewhat coarser than that found at Carelmapu, is nevertheless exceedingly fine and flaky. It is disseminated throughout the deposit, but the concentrations of the metal are found in layers of pure black and garnetiferous sands, varying in thickness from ½ to 20 cm.

Although both native and foreign prospectors have been washing the richest sands of the Cucao beach with *aparatos* for the last twenty years, about two years ago a Chilean company, after acquiring practically the entire deposit by purchase and location, made an attempt to exploit the sands on a larger scale. Its installation consisted of a clamshell bucket and a 25-hp. steam-operated winch, mounted on a truck running on rails. The clamshell dumped into an elevated puddling box at the head of a sluice lined with sections of screen with 2-mm. holes, the undersize from the screen discharging into an under-current fitted with silver-plated amalgamating plates. Riffles were dispensed with entirely, owing to the extremely fine flaky nature of the gold and the unusually large proportion of heavy black sands. Water was pumped to an elevated flume, through which it was conducted to the puddling box.

The plant, which was operated intermittently for a few months only, proved a complete failure; first, because of the inability of the clamshell to dig the tightly packed black sands without the aid of hand labor; second, because of the difficulties encountered in the disposition of the tailings, due to the flatness of the beach, and, third, because the bullion returns for the time operated indicated a lower-grade material than originally anticipated. In the absence of any other records, measurements of the excavation compared to the bullion sold indicated a recovery of 30c. per cubic meter. Operations were discontinued at the beginning of 1919, but as the pits sunk on various parts of the deposit were said to have encountered good concentrations to a depth of 6 m., and as prospecting beyond the limits of the known black sand deposit showed the presence of gold and indicated a possible mineralized area of 1,000 acres, a preliminary examination of the property was planned on the assumption that modern dredges might profitably exploit the deposit. A further incentive was the possibility of encountering commercially valuable quantities of platinum, as occasional colors are met in panning, and because an assay of some old mercury-trap concentrates was said to have shown several ounces of platinum per ton of concentrates.

It was realized that the nature of the deposit and the large proportion of black sands would present metallurgical difficulties hitherto not encountered in dredging practice. However, it was felt that attempts at their solution would have been justified in the event of confirming the expected yardage and values.

The investigation, which was undertaken in October, 1920, and for which test pits from 3 to 5 m. deep were sunk on both the known concentrated deposit and the adjoining ground, revealed the fact that the values were confined to erratic streaks of black and garnetiferous sand, generally within two meters of the surface, and never more than 20 cm. thick, two to three centimeters being nearer the average. The entire contents of each test pit were run over an amalgamating device, and the results checked by 0.10- to 0.20-cu.m. samples cut down the sides of the pits, concentrated on burlap, and the concentrates assayed in the usual way. The gold values of the pits on the known deposit averaged less than 6c. per cubic meter, the highest value for any one shaft being 13c. No appreciable platinum was encountered, and the ground adjoining the known deposit, which it was hoped might augment the yardage possibilities, proved to contain only traces of gold, the majority of the shafts thereon showing only barren, gray beach sands. The depth of the pits was limited by the water level, slightly higher at that time of year than in midsummer. The discrepancy between the return of 30c. for the company's operations and the low results of the pits is probably due to the fact that the actual volume of material excavated by the clamshell was in excess of the estimated quantity; that, as subsequent pannings showed, the company's work had been initiated on one of the most promising sections of the deposit, and, finally, that the average depth of somewhat over two meters, attained in the operations, included only the richer superficial layers.

UNSUCCESSFUL CLAMSHELL BUCKET PLANT ON CUCAO BEACH

The beaches of Pilol and Bonita were also visited. A small portion of the latter, sometimes called "Tricolor," is said to have been worked with some success about fifteen years ago by Don Juan Cristie, but the occurrences of the auriferous black sands as judged by panning tests are too erratic and limited in extent to interest other than individual operators. Samples taken from the beds lying about two hundred meters inland from the present shore line, though containing a large proportion of black sand, indicated insignificant gold values.

Samples from Tablaruca, Catiao, and Huenacoyhue show the presence of coarser gold and a larger proportion of platinum than the northern beaches, yet the southern beaches, because of their limited extent and inaccessibility, are exploited only in a desultory fashion, generally after winter storms. At best it appears to be a precarious business, even for the natives, to whom an equivalent of 75c. United States currency is a good daily wage.

PLATINUM AND IRIDIUM AT LAVADEROS BEACH

Lavaderos beach, where the best platinum prospects have been found to date, is situated near the extreme southwestern point of the island, immediately south of Rio Zorras. The beach is small, about 250 m. long and 25 m. wide above high tide, although the best concentration is found in a width of about 25 m. between high and low tide. The platinum-bearing sand, averaging from 10 to 20 cm. thick, is encountered on a false bedrock of clay and below a capping of about 50 cm. of light gray beach sand. A second streak of platinum-bearing sand is said to exist below the false bedrock, but an excess of water has hindered proper prospecting. Random samples brought to my attention indicate that a value of 1½ to 2 g. of platinum per cubic meter may be expected from the upper concentrated streak. The platinum occurs in thin, flaky scales, but tests conducted on 0.10- to 0.20-cu.m. samples show that it is easily saved on burlap, the proportion of heavy black sand in the beach probably not exceeding 2 or 3 per cent. The platinum is in a free state, as shown by assays of concentrates from which the platinum had been removed by amalgamation, and an analysis of the clean metal, which is of a light gray color, yielded 10 per cent of iridium.

An attempt is now being made by local operators to exploit the beach with a steam-operated dragline scraper with a daily capacity of about 20 cu.m., the sands after screening to be passed over amalgamating plates to remove the gold and thence concentrated on stationary canvas and burlap tables for the platinum. As the plant was placed in operation only a few weeks ago, no information as to results is available.

The investigations lead to the conclusion that though extensive deposits of black sand exist on the northern beaches, they contain only occasional traces of platinum and their gold values are both too erratic in distribution and too low in grade to permit of their profitable exploitation. It is possible that systematic prospecting on other southern beaches would disclose platinum-bearing sands that might be profitably exploited with high prices obtainable for the metal, but the limited extent of the beaches would indicate that no large deposits could be expected. Samples of sand in which monazite was suspected were tested qualitatively for thorium, but with negative results. It has also been suggested that the magnetite in the black sands might prove valuable as a source of iron ore. However, apart from the metallurgical considerations, the inaccessibility of the majority of the deposits and the wide distribution of the sands would discourage investigation in that direction.

Swedish Iron Industry in 1920

SPECIAL CORRESPONDENCE

AT THE MEETING of the Swedish Ironworks Association on Jan. 30, Manager Carl Sahlin presiding, the usual statement for the year 1920, and especially in its relation to the fourth quarter, was made. The export of iron ore had increased from 2,419,000 tons in 1919 to 3,737,000 tons in 1920, and the export of iron from 246,112 tons to 273,000 tons, of which the increase was entirely due to the pig iron. There was a heavy increase in the iron imports; viz., from 128,000 tons to 245,300 tons.

The number of blast furnaces in operation on Dec. 31, 1920, was 42, of 132 available; of bessemer furnaces 3, of 18 available, and 30 out of 80 available Martin furnaces. The output figures of all descriptions of iron in 1920 exhibit a falling off, and are the lowest during the last period of ten years.

The management states that the year 1920 has, for the Swedish industry, been a difficult one. The production has been unfavorably affected during the year by labor unrest and the introduction of the eight-hour day system. The revived inquiry during the spring and summer months, with resultant better prices, had, to some extent, balanced the unexampled increase in production costs, but despite this, the results for the year are, for the most of the steel and iron works, unsatisfactory, on account of the last quarter's depression, with prices that do not cover production costs.

The pig iron produced in 1920 amounted to only 452,300 tons, and is more than 200,000 tons under the average figures during the ten-year period. The cause of this low output is to be found in the minimum production during the first quarter. During the summer months a number of blast furnaces were put in operation, and during the year the average number operated was about sixty. In December, however, the figures fell to forty-two.

In addition, the industry has always had to contend with high freights, taxes and other disabilities, which the low production accentuated. The export figures show somewhat better totals for 1920 for the cast- and pig-iron group than the previous year, but the total is below the average for the last ten years. The chief cause of this is the general change over to peace requirements production, as also the unexpected exchange conditions, and last, but not least, the severe competition from Germany at prices which are far below the production costs of Swedish works.

The imports of iron, for the reasons given, show a distinct increase, viz., 110,000 tons more than during the previous year, the surplus being contributed by bars, with 33,000 tons, and rails, 25,000 tons; also thin and thick plates, 24,000 tons. The imports of malleable iron probably for the first time for a considerable period in the history of the Swedish iron industry exceeded the previous year's exports.

The association decided to resume the normal quotations for Swedish iron, which were inhibited during the war, and fixed the following: Export pig iron (maximum sulphur 0.015, phosphorus 0.025), 250 kronor;[1] billets (over 0.15 carbon), 500 kronor, wire [illegible] carbon), 570-600 kronor; Martin iron, base, 390 kronor, and Lancashire, ordinary, base, 500 [illegible] Swedish kronor, per 1,000 kg., f.o.b. works on thirty days' [illegible]

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[1] [illegible]

The Problem of Domestic Copper Consumption

Developing New Outlets and Uses for the Metal Not More Important Than Combating Inferior Substitutes — Producers Should Form a Research And Publicity Organization, Instead of Following a Laissez Faire Policy

By H. A. C. Jenison[*]

IN CONSIDERING the present condition of the copper industry one naturally turns to new and recently developed or discovered uses of copper as a possible solution of the problem. Such uses have a considerable potential if not demonstrated value, but it is far simpler, and correspondingly more enlightening, to investigate the abandoned uses of copper. The tremendous substitution of other materials where copper has heretofore always been satisfactorily used is striking. Only brief attention will be given therefore to some of the more important of the new applications of this metal, and abandoned or neglected uses will be considered more at length.

During the war, many new and satisfactory military uses of copper were undoubtedly developed, but such applications, because of their nature and the conditions under which they were applied, are of little or no commercial consequence at the present time. Of the new uses of copper that have been developed in recent years, among the most important seems to be that of the production of copper-steel of high corrosion resistance. Although investigations covering the corrosion resistance of copper-steel have been carried on for many years, the lack of attention given to them is disappointing.

DEVELOPMENT OF COPPER-STEEL

In a recent paper, D. M. Buck[1] has reviewed the development of copper-steel, and in his review points to some interesting and important results. His investigations, covering a long period of years, show that normal open-hearth steel is corroded at a very much lower rate when it contains a small percentage (0.15 to 0.30 per cent) of copper. Mr. Story,[2] in his paper, "Corrosion of Fence Wire," investigated a great many samples of fence wire which had been subjected to field service for varying lengths of time, and from his analytical results, together with the history and length of life of wires, states, "It has been definitely established that the durability of old steel wire is due to the presence of copper." Hoyt,[3] in 1919, from an extensive series of careful experiments, states: "The general conclusion which, it is believed, may be drawn from these exposure tests is that the so-called copper-bearing steel, in which the copper content is about 0.20 to 0.25 per cent, offers the greatest resistance to corrosion of the common sheathing materials."

INFLUENCE OF COPPER IN RETARDING CORROSION

The Railway Age for July 23, 1920, describes the series of tests conducted by the New York Central lines on the influence of copper in the reduction of the corrosion rate of steel tie plates. According to these tests, standard steel tie plates show approximately eight to ten times the loss that the special copper-treated ones show. In this connection it is interesting and reassuring to know that the New York Central is reported to have placed an order for 4,000 tons of steel containing 0.25 per cent of copper, or enough for 650,000 tie plates. This is one of the few instances that have come to my knowledge where investigations covering a new use of copper promise to become of industrial and economic importance.

The following is a quotation from the American Society for Testing Materials: "At the inland industrial location, out of 146 sheets of 22-gage copper-bearing materials (0.15 per cent copper or over), forty-one sheets, or about 28 per cent, had failed after forty-one months' exposure, while out of eighty-four non-copper-bearing sheets, eighty-one, or 97 per cent, had failed after forty-one months' exposure. With this overwhelming mass of evidence we may consider it as proved that by alloying a small copper content (0.15 to 0.25 per cent) with the normal open-hearth bessemer steel, the corrosion rate is enormously reduced wherever the products are exposed to alternate attacks of air and moisture, which conditions prevail in practically all characters of atmosphere. It is certainly very conservative to estimate that the life of sheet metal is doubled by this treatment."

THE COPPER-STEEL CAR

The manufacture of copper-steel has heretofore been largely confined to sheet metal, and the product has been tremendously improved. The usefulness of the discovery may readily be broadened by the use of copper in other steel and iron sections, thereby very greatly increasing their life. Steel freight cars, for example, particularly those of the open type, undergo great damage and deterioration from corrosion. If the life of thousands of such cars that have passed out of the field of usefulness during the last few years could have been extended only 20 to 25 per cent, much would have been accomplished in relieving and preventing the recent severe car shortage.

According to *Chemical and Metallurgical Engineering* of Oct. 27, 1920, several copper-bottom gondola cars were made six years ago for the Bessemer & Lake Erie Ry., one-half of the sheathing of each being ordinary plates and the other half copper-bearing steel. A recent inspection shows much better paint adherence and less than half the loss due to corrosion and abrasion in the case of the steel containing copper. Here is a simple, easily controlled, and comparatively inexpensive method of improving many products that are called upon to resist the attack of air and moisture, thus greatly increasing the period of service. At the same time an immeasurably important step is taken in the conservation of our natural resources.

The preceding illustrations indicate one of the new uses of copper. This new industrial application constitutes, I believe, the most important that has been developed and gives the most promise. The prospective field for copper consumption in this way, however, is far less than might be expected, one of the reasons for which will appear later.

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[*] Published by permission of the Director of the U. S. Geological Survey, and read at the January meeting of the New York Section of the A. I. M. E.

[1] Buck, D. M., quoted in *Chem. and Met. Eng.*, Oct. 27, 1920.

[2] Story, *Chem. and Met. Eng.*, op. cit.

[3] Hoyt, *Chem. and Met. Eng.*, op. cit.

THE ERA OF SUBSTITUTES

Recent years have been marked with the continual growing substitution of other material for copper in many of its oldest and most dependable uses. Some substitutes have been satisfactory, but I believe by far the majority are unsatisfactory and ultimately more expensive than copper or its alloys. Among these substitutions is that of unsatisfactory alloys in the building industry and in household use. The building industry formerly consumed great quantities of copper and copper alloys, but present consumption has fallen off tremendously.

Despite the apparently unanimous opinion of architects and building contractors as to the superiority of copper and brass over all other materials and alloys used for rŏofing, plumbing, and hardware, the substitution of other metals and other materials for copper has been constantly growing for years. Galvanized iron and plastic materials have almost entirely displaced roofing copper, because the investors in buildings lack the knowledge of the ultimate economy in the use of copper or even copper-steel. Brass pipe has, to a very large and disturbing extent, been replaced by iron pipe, which is of marked inferiority. Recent investigations and inquiries show that a few years ago the quantity of brass sold and consumed as screws, hinges, nuts, knurls and similar parts was double what it is today. Such products, which were formerly made entirely of brass, are now made of brass-plated steel, and consequently lack, to a great extent, the principal value of brass—its resistance to corrosion.

DISCOURAGING DOMESTIC USES

In the Jan. 8 issue of the *Engineering and Mining Journal* attention is called to the fact that the old household copper hot-water tank has been displaced almost entirely by the galvanized iron tank. The following quotation is from that journal: " 'What,' we asked our plumber, 'is the difference in price between a thirty-gallon hot-water tank made of copper and of galvanized iron?' 'Well, there is some difference,' replied the plumber. 'Copper tanks are so expensive we don't try to sell them and advise our customers against them. A galvanized iron tank will cost about $13 and a copper tank will cost about $40.' The difference in the value of the material in the two is five or six dollars."

It may well be asked why the five or six dollars difference in cost of material should result in a $27 difference in the dealer's prices.

In many, many other instances unsatisfactory substitutes have replaced copper, as, for example, in the manufacture of pins, which is a small item, but illustrates the situation. In 1914, about 1,840,000 lb. of copper was reported to have been used in the making of pins, 640,000 lb. going into steel pins and 1,200,000 lb. into brass pins. The consumption of pins has increased since then, but the gain has been made in steel. Today probably not more than half of the pins made are of brass. Incidentally, the inferior, quickly rusting steel pin is sold at brass-pin prices.

Another instance of the substitution of other materials for copper is found in the automobile industry, which has been and should be one of the great copper-consuming industries of America. It would appear that since the war there has been a steady tendency toward the replacement of copper and brass by iron in the manufacture of automobiles. According to Robert Mountsier[4], the total amount of copper and brass now used in the average automobile is only about thirty-six pounds.

It is common knowledge that automobile repair business has increased out of proportion to the additional number of cars in use in the last few years, and investigations on this subject would indicate that this is due largely to the substitution in the structural and movable parts of inferior materials in place of copper and copper alloys. In the coast cities it is particularly noticeable that not only the working parts but all other parts of an automobile which are made of materials not immune to rust are constantly breaking down when exposed to the weather. One motor car is on the market today which is famous for its durability and excellent performance; it contains about two hundred pounds of copper. The durability and dependability of this car is in striking contrast to other large, high-priced cars, one of which contains only about thirty pounds of copper and all the others of which contain relatively small amounts.

SUBSTITUTION OF ALUMINUM FOR COPPER IN THE ELECTRICAL FIELD

In the electrical field copper has been considered supreme, so it is with considerable alarm that we are forced to realize the increasing substitution of aluminum for copper. This fact is particularly true in high-tension transmission lines. The first aluminum cables which were produced for high-tension transmission lines were unsatisfactory, on account of sag, breaking of joints, and low fusion point. Recently a steel-reinforced aluminum cable has been developed which has, to a great extent, eliminated the sag and breaking of joints and so becomes a very dangerous competitor of copper in the field of high-tension transmission.

The advantage of the aluminum cable appears to be in its relatively low corona losses. An aluminum cable capable of transmitting 220,000 volts is about one inch in diameter, whereas a copper cable capable of the transmission of the same voltage is considerably smaller. It appears that to avoid high corona losses at that voltage the transmission line must be at least one inch in diameter. The present copper cable—one inch in diameter—is so much more expensive that the aluminum cable is displacing it. It would appear that if the copper cable is to compete in the field of 220,000-volt transmission, a cable must be developed that will be at least one inch in diameter and contain only about the same quantity of copper as the present smaller cable made for the transmission of that voltage. In the lower voltage lines the corona losses are so much smaller that copper does not appear to be in any immediate danger. In view of the tremendous development of electric power, with increasing high-tension transmission, it is important that the copper producer and manufacturer undertake research work which will make copper as suitable and inexpensive as aluminum for such purposes.

It may well be asked why the use of copper-steel in materials which are required to stand exposure has not come into more general use. Why, when copper and copper alloys have demonstrated a marked superiority and ultimate economy in the building and hardware industries, have they been displaced by inferior substitutes? Why has the automobile manufacturer come to use so little copper and copper alloys despite their definite superiority and ultimate great economy to the owner? Why has aluminum developed into an active competitor in certain electrical uses? Why have not new and broader uses of copper been developed?

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[4] *The Annalist*, Dec. 27, 1920.

NO EFFORT MADE TO PUSH COPPER

Both the reasons and the remedy appear simple. Of the reasons which have contributed to the present conditions, the attitude of copper producers and of their competitors is the most important. Until the end of the war the market for copper had always been so great that the copper producer experienced little difficulty in disposing of his product. The electrical industry and the industrial brasses and bronzes, together with the export market, consumed all the copper produced. These great industries maintained, to a great extent, staffs of engineers to determine the relative values and costs of materials used. Under such conditions copper was used where it was determined to be the most suitable. In other words, those industries kept themselves technically informed as to the relative values and costs of all materials.

In other industries, such as the building, hardware, and automobile, the small ultimate consumer who really determines, to a large extent, what material shall be used, is largely, if not entirely, ignorant of the relative durability and initial and ultimate costs of various materials, and is dependent upon the dealer, the contractor, and others through whose hands the product passes, for his information. He is also much concerned with costs, and in his ignorance does not know that the relatively small initial cost of the inferior substitute is ultimately, after replacements, a much greater cost than the higher initial cost of copper and copper alloys.

PRODUCERS IGNORE ULTIMATE CONSUMER

The copper producers have entirely disregarded the small ultimate consumer. They have made no effort to keep the general public informed as to the relative merits and the initial and ultimate costs of copper, copper alloys, and their substitutes. They have made no effort to conduct researches and investigations for the purpose of developing new uses, and successfully competing with the improved products of their competitors. In this field the producers of substitutes have far outstripped the copper producer. They have carried on a successful campaign of publicity and research. Their advertisements and publicity matter transmitted through dealers have been attended by such success that copper and copper alloys have, to an alarming extent, been crowded out of building, household, and automobile consumption. By means of their carefully and thoroughly conducted research and investigation work they have been continually improving their product, until now they are competing with copper in those fields where copper has long been considered supreme. The copper producer, on the other hand, has done little or nothing to improve his manufactured product, little or nothing to maintain the supremacy which belongs to copper. He appears to have failed more or less completely in his public relations.

The remedy for these unfortunate conditions appears to be as simple as the reason for them. The marked superiority and ultimate economy of copper and copper alloys in the building, hardware, and automobile industries has been demonstrated. With the inherent superiority of copper over its substitutes in other fields, it seems certain that only a little intelligent effort is necessary for it to regain and maintain its supremacy.

The producer must bestir himself. An organization for the purpose of research investigation and public education should be created and maintained. Such an organization should study and determine the relative merit and initial and ultimate costs of copper, copper alloys, and substitutes, and keep the public informed of the results of its research. The organization should also determine new appropriate uses for copper and conduct research work to improve the copper products. With such an organization properly conducted, the domestic consumption would inevitably in a short time be greatly increased, and competition by the substitutes would become very difficult. All that is necessary seems to be public education and some constructive effort to improve present copper products.

The domestic building and hardware industries must inevitably soon assume greater proportions. The consumption of metals and alloys in these industries must accordingly be tremendous, and greater than ever before. Obviously, it lies almost entirely in the hands of the copper producer whether he will supply those metals and alloys or whether the public will continue to use increasing amounts of unsatisfactory substitutes. There is no doubt that the copper producer can do it, but if he does he must educate the consuming public to the desirability and economy of copper and copper alloys. Such an education cannot fail to increase quickly and vastly the present domestic consumption.

WAYS OF ENLARGING THE DOMESTIC MARKET

Although it is inevitable that the electrification of railways must be undertaken on a great scale, and that such projects as the super-power scheme must one day be a reality, the undertakings are vast, and by their very nature and magnitude must be slow of realization and in effect on the copper market. Furthermore, Europe must sometime consume much more copper than at present, but when that will be is uncertain.

However, the domestic building, hardware, automobile, and similar industries can undoubtedly furnish a very much greater domestic market than at present exists or has existed in the past, and one that will be almost, if not entirely, independent both of European uncertainties and of the great time involved in the realization of such projects as electrification of railways and the super-power plan.

Only a few of the many fields for domestic copper consumption have been suggested here. Systematic investigation and proper organization would develop many more, and would soon create a greatly increased domestic copper demand, which would, to a very great extent, at least, solve the present problem.

Phosphate Mining Wasteful

The present practice of mining phosphate rock for treatment with sulphuric acid to produce acid phosphate entails a loss estimated at around 68 per cent of the phosphate that is mined, according to the U. S. Department of Agriculture. The department is working upon a method that promises to be cheaper and much more conserving of the phosphate-rock deposits. The department feels that this investigation should be pushed with the object of ultimately cheapening the cost of production and conserving the deposits.

A New Method for Copper Assaying

Modification of the Fleitmann Procedure Found More Convenient Than Iodide or Cyanide Processes

By George J. Hough

Written for *Engineering and Mining Journal*

THE volumetric determination of copper by solution of freshly precipitated metallic copper in ferric chloride, and titration of the reduced iron by standard potassium permanganate, has long been known as Fleitmann's method, but, owing to incomplete data for the method as published, it has not to my knowledge met with favor among technical chemists, although it really deserves more attention, as it has some advantages over other methods of copper determination.

The method as found in Sutton's "Volumetric Analysis" directs that the copper be precipitated by metallic zinc and afterward washed with dilute hydrochloric acid to remove any zinc, before solution in ferric chloride. In this process it is not well to use zinc for the reduction of copper, as minute particles of zinc may remain with the copper, and these particles will afterward react with the ferric chloride; also, the washing of the metallic copper with dilute hydrochloric acid is risky, as the nascent copper is easily redissolved. Furthermore, and most important of all, no mention is made of the fact that certain other metals, if present in the copper solution, are precipitated by the zinc and react with ferric chloride.

In the analysis of ores, about the only metals which will interfere are silver, antimony, and bismuth, all of which occur frequently in copper ores.

In the usual procedure of converting the copper to the sulphate, any or all of these interfering metals will be at least in part changed to the soluble sulphate, and consequently contaminate the copper precipitate. Silver, which is almost invariably present in copper ores, gives the least trouble; I have found that if there is not over 0.09 per cent, or 29 oz. per ton, it does not interfere. Antimony, however, interferes seriously, and a modified method must be used. When it is present, proceed as follows: Fuse 0.5 gram of ore with sulphur mixture (equal parts of sodium carbonate and sulphur), extract with hot water, filter off the copper sulphide, wash well, redissolve in a little nitric acid (1 to 2), fume with sulphuric acid, and proceed as directed later.

In the presence of bismuth, dissolve the ore in nitric and hydrochloric acids, evaporate nearly dry, dilute warm, and add an excess of ammonium carbonate solution (1 part ammonium carbonate to 4 parts of water and 1 part ammonia), filter and wash well acidulate the filtrate with sulphuric acid, add 10 c.c. excess, evaporate, fume, and proceed as directed later.

The modified Fleitmann method that I used for two years for ores free from antimony and bismuth is as follows: Dissolve a suitable amount of sample, usually 0.5 gm., in nitric and hydrochloric acids; add 10 c.c. sulphuric acid and fume; cool, dilute, add one drop dilute hydrochloric acid to remove any silver (if ore is low in silver, no hydrochloric acid is needed), filter through a close filter and wash; precipitate the copper by aluminum foil, boiling gently until all the copper is separated from the foil, and the aluminum is clean and white, remove and wash the foil, and let the solution settle a moment or two. Decant the supernatant solution through a small filter and wash twice by decantation with hot water. If care is used, all the copper will remain in the beaker.

Now add to the copper about 10 c.c. of saturated ferric chloride, stir to dissolve, warm gently a moment or two to be sure all copper is dissolved, dilute at once with about 200 c.c. of cold water, add 5 c.c. of syrupy phosphoric acid to decolorize, and titrate by standard permanganate. The iron factor of the permanganate multiplied by 0.567 equals the weight of copper. This factor has been determined by experiment, and, as will be noticed, is slightly higher than the theoretical factor 0.5625; 1 c.c. N/10 permanganate equals 0.00316 gm. copper.

To prepare the ferric-chloride solution, dissolve one part of the salt in two parts of water, and add a very little hydrochloric acid to clear it. When a sample is very high in copper, it may be necessary to use 15 c.c. ferric-chloric solution. The aluminum foil should be in the form of a cylinder two inches long by one and one-half inches in diameter and with a projecting strip about one and one-half inches long for a handle. Such a cylinder of $\frac{3}{64}$-in. foil will last for more than seventy-five determinations. To standardize the permanganate solution dissolve c.p. copper foil in ferric-chloride solution and titrate as above. Very thin foil has been ascertained to be the best.

I have found the method to give good results, and can recommend it as neat and more convenient to work with than either the iodide or KCNS method. However, owing to the tedious modifications required in the presence of antimony or bismuth, I believe it will find its greatest usefulness in the analysis of clean ores.

COMPARISON OF RESULTS BY VARIOUS METHODS

Kind of Ore	Per Cent Copper by Permanganate Method	Per Cent Copper by Iodide Method	Per Cent Copper by Cyanide Method
Carbonate	35.6	35.8	
Tetrahedrite	34.6	34.6	
Carbonate	4.1	4.11	
Carbonate	2.9	3.04	
Carbonate	6.5	6.6	
Bornite	53.6	54.0	
Sulphide	35.8	35.8	
Mill concentrates	15.64		15.66
Sulphide ore	31.35		31.4
Silver ore	10.9		[illegible]

The above examples will illustrate the accuracy of the method on various kinds of ore.

Federated Malay States Tin Exports

The total tin ore exported from the Malay Peninsula in 1919 amounted to 741,970 piculs (1 picul = 133⅓ lb.), valued at $32,247,444, compared with 768,157 piculs in 1918, valued at $41,623,383, according to Consul H. J. Dickinson in *Commerce Reports*. The following table indicates the movements of Straits tin shipments since 1910, quantities being expressed in tons of 2,240 lb.

Year	[illegible] Tons	[illegible] Tons	Continental Tons	Total Tons.
[illegible]	35,047	[illegible]	[illegible]	54,605
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	8,481	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

BY THE WAY

The Penalty of Ingenuity

"Back long we in tha h'early days, m'son," said Cap'n Dick, "afor' tha time o' these 'ere machine drills, there wuz some h'art an' science to tha swingin' o' a 'ammer an' tha twistin' o' a drill. Some rivalry there wuz, too, 'mong 'ammersmen. Settin' to one side h'all h'argument, 't wuz h'admitted that they chaps from daown St. Just way 'ad a pretty way with a single jack. Mus' be h'admitted, though, that most o' they St. Justers wuz such dreadful small chaps that they scarely h'appeared to be grawed h'up men. W'en twistin' a drill they never took a full 'and 'old but passed tha steel 'twixt third an' foorth fingers. This 'abit formed a callous, m'son. Cap'n Tredinnick, at Leadville, h'always 'ad a geek for tha callous 'pon a man's lef' 'and afoor 'irin' 'e. An' h'only once did 'e make a mistake; that wuz tha time 'e 'ired a teamster 'ose fingers wuz calloused from 'anging' fast o' tha lines o' a freight team. But some Cambourne an' Redruth chaps, Tom Penglase 'mongst 'em, 'ad never a good word for tha boys from St. Just. 'Dam-me,' sez Tom, 'saw one o' they little St. Just chaps back h'in Colorado kill 'isself tryin' to do man's work. This chap wuz so bloody short 'e mus' 'ave 'ad a hard time reachin' 'igh enough to wash 'is h'own face an' h'eyes. 'E wuz workin' h'on a stull one day h'in a 'igh stope tryin' for to gad daown a loose piece from tha 'angin'. Wuzn't strong h'enough nor 'andy h'enough to 'old tha gad w'ile strikin', so h'after 'e 'ad dropped un scores o' times, 'e took bit 'o string an' tied fas' to tha gad, makin' tha h'other h'end fas' to 'is nuddick. Nex' time 'e swung tha 'ammer 'is foot slipped. Gad fell one side o' tha stull, an', dam-me, St. Just chap fell h'on tha h'other side an' 'anged 'isself to death.' W'ot's think o' that naow?"

The Birth of a Nugget

"There was recently unearthed at Mount Leyshon, some sixteen miles from Charters Towers goldfield," writes our Brisbane correspondent, "what has been described as a nugget in the making, which is regarded as interesting and important as a link in the evidence as to the origin of gold nuggets. Quite unlike any of the nuggets with which most miners are familiar, it is a flattish piece of metal, like a broad, thin wedge from which the pointed end had been cut off. Its sides showed irregular, angular markings, with cavities sharply defined and with small pieces of quartz adhering plentifully to them. Only one or two spots were at all rounded; in fact, the mass of metal had the same appearance as it would have had if it were a cast made from a mold whose sharp corners it had once well filled, but which had suffered just a little from rough handling since.

A correspondent of the *Queensland Government Mining Journal*, who may be regarded as an authority on such subjects, namely, Mr. Edgar Hall, manager of the Silver Spur mine, in the south of Queensland, has expressed the opinion that this so-called nugget probably came from a vug in a lode, which vug it did not quite fill originally, the rest of it being occupied by pyrite, calcite, or other soluble mineral. In the process of weathering, the calcite and the rest have dissolved away, and finally the shattered rock has fallen apart, leaving the gold free. It was not long free before it became covered by sand, gravel, and detritus from the lode, which have protected it from the bumps, blows, and poundings it would have received if it had traveled far from its native place, and which would eventually have made it a nugget. It was born to be a nugget, but it never grew up, and it is still a nugget in the making. Probably it is also young in measurement of time, compared with most of the famous nuggets. Its birthday may have been only a few hundred years ago, or even less, and it may have been formed when its quartz womb was to be found not far below the present surface."

Again But Nevermore

M. W. Venable, a mining engineer of Charleston, W. Va., has contributed his mite to the bauxite literature of the day, but says that the whole question is much too complicated for him, concluding that, after all, it is largely a matter of taste how the word bauxite is pronounced. We feel equally philosophical about it, especially since the *Bauxite News* has so definitely settled the controversy. "Boxite" or "bawxite" it is from henceforth even for evermore. "Bozite" is taboo, and from now on it will be just as *gauche* to use this pronunciation as it will be to wear a tux at anything except a stag.

The Map That Disappeared

The present condition of hydraulic mining in California is well illustrated in the following incident which occurred in one of the old camps that in its prime added many millions to the output of the Golden State. A surveyor was desirous of locating a section corner near the town, and on inquiry was referred to the oldest inhabitant. Said o. i. pondered the question and then had an idea. Many years before a survey had been made of the townsite and a large wall map drawn which should show the location of the nearest corner. But what had become of the map? To his wife: "Amy, do you know whatever became of that old map of the town that Ed Uren made way back in the seventies?" A sweet-faced old lady, whom one could easily imagine a belle of the camp in the days when it was a live one, appeared at the door to the next room. "Why, let me see, Amos; you know that hung in the town hall for a long time until the hall fell down. Then they took it over to the saloon and kept it there awhile, but they were afraid that was going to fall down too, so they took it away from there, and I'm blessed if I know where they put it then."

Love's Labor Lost

A certain firm of Milwaukee that manufactures magnetic separators and pulleys recently received the following letter from Streetman, in the Lone Star State:

> Please send me your catalogue containing articles of magnetic power that can be used in the mines and on mineral fields and that will locate minerals at a distance in the earth, such as "mineral rods" and etc. I found your firm address in the ——— ———. So I would be glad to get your catalogue and price on the articles named above.

All this makes us very sad. Apparently there are some who remain untouched by our campaign to convince others how jackasinine it is to expect to push the prospector off the map with a divining rod. But we shall continue our efforts nevertheless.

CONSULTATION

The Occurrence of Diamonds

"What is the mode of occurrence of diamonds, and what are the surface indications? In what kinds of formations are they found? Are they mined in the United States?

"How are they recovered? Do they appear in quartz matrix or alluvial formation?

"Where may I procure the best illustrated literature dealing with diamantiferous formations and prospecting for the same?

"Where is the best place to send them for a test?

"I am an old prospector and have found some crystals that puzzle me, so that any information you may give me will be a great help."

Diamonds have been found and are at present being recovered in several localities in the United States, but the domestic diamond-mining industry is very small, particularly when contrasted to the heavy imports of diamonds into this country—the greatest diamond-consuming country in the world.

Thus, in 1919, about $86,800,000 worth of diamonds, in various forms, such as rough or uncut, dust, carbonados and glazier's stones, was imported, compared with a domestic production of a few thousand dollars.

Occasionally diamonds have been found in Wisconsin, Indiana, Michigan, California, Georgia, and North Carolina, but the most important diamond activities in the United States center around Little Rock, Ark. The Arkansas Diamond Co. operates a property described in the *Engineering and Mining Journal* of April 24, 1920, in an article entitled "Diamonds in Arkansas," and has erected a test mill for the purpose of treating the mineral found. The diamond area covers sixty acres, and the diamonds occur in peridotite similar in geologic characteristics to the diamond-bearing rock in South Africa. The diamonds which have been recovered are in many instances of the finest quality, and the few that have been cut made beautiful gems. Their weight has averaged a little less than half a carat. A few other mineral properties are in the same general district, but have been worked only intermittently.

The U. S. Geological Survey estimates that about 5,000 diamonds have been found in Arkansas from the properties mentioned above, between the time of discovery in August, 1906, and the end of 1919. These included white, brown, and yellow stones, and their average weight was between 0.3 and 0.4 carats. The largest diamond yet discovered in the state was found in the Arkansas mine in May, 1917, and was a canary-colored octahedron weighing 17.85 carats.

The most important diamond deposits in the world, those of South Africa, are associated with altered basic igneous rocks. Intrusive "pipes" of Kimberlite, as the formation is termed, have been extensively worked and have yielded an immense number of diamonds. This Kimberlite, or "blue ground," as it is often called, is a complex rock consisting largely of serpentine derived from the hydration of olivine. It may be designated as an altered peridotite. The pipes vary widely in their dimensions; usually they are not more than two or three hundred yards wide—frequently less. The depth of the workings also varies considerably. The famous Kimberley pipe has been mined to a depth of over 1,100 ft. The pipe-rock is considered good if it carries on the average of one carat of diamond per ton, and, from indications furnished by exploration, the deposit promises to be diamond bearing down to the greatest depths at which mining can be done.

Although the world's greatest diamond deposits are associated with basic igneous rocks, many occurrences are found with other geological relations. Thus, in India, the gem stone occurs in the Bundelkhand region of Central India in a bed of conglomerate that lies between shales and sandstones. The conglomerate is not more than two feet thick, and the diamond is associated with pebbles of jasper.

In the State of Minas Geraes, in Brazil, near Diamantina, surface gravels and earthy deposits, in part cemented with iron oxide, yield diamonds. The rocks of the area consist chiefly of geologically ancient micaceous sandstones, and it is held that the diamond-bearing gravels, being found only in the localities where this sandstone occurs, have been formed by its disintegration. Brazil furnishes, particularly in the Bahia districts, the diamond known as the carbonado, popular among diamond drill bit manufacturers.

Although a deposit of minor importance, an occurrence of diamonds found at Olivine Mountain, on the Tulameen River, British Columbia, is interesting for the association of the diamonds with chromite in peridotite. Reverting to South Africa, important sources of diamonds are the alluvial deposits in the Vaal River basin, and the Great Namaqualand coast of Southwest Africa, whose parent rock has not been discovered, although it is assumed that the diamonds have been derived from intrusive peridotites similar to those in the region.

Diamonds are recovered in South Africa from the hard blue ground by allowing the mineral matter to be exposed to the air in open fields. In due time it softens and crushes easily, and can be readily washed and concentrated. The concentrates are passed over oscillating tables covered with grease. It has been found that diamonds stick readily to the grease, from which they are recovered periodically. The article "Diamonds in Arkansas," referred to above, contains a flow sheet that indicates the steps that must be taken in the recovery of diamonds from this type of occurrence. In Brazilian alluvial formations, panning by natives is the rule.

The diamond can be distinguished from other minerals and from imitations by its extreme hardness, high refractive index, and certain optical characteristics, such as its isotropism. Diamonds can readily be distinguished from quartz and zircon by their great hardness. Optical tests quickly indicate the genuineness of stones. Reputable jewelers, state geological surveys, the U. S. Bureau of Mines and the U. S. Geological Survey are in a position to make authoritative tests on gem stones.

An extensive literature has been published regarding diamonds, some of it popular and in part technical. The paper "Gems and Precious Stones," published yearly by the U. S. Geological Surevy, contains valuable statistical information, and similar data are included in the papers published in the volumes of *Mineral Industry*.

HANDY KNOWLEDGE

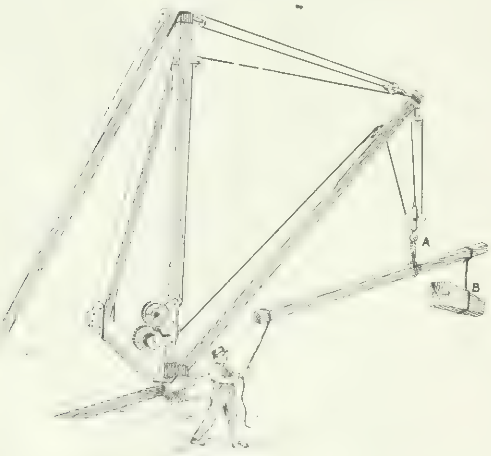
Extending a Derrick Boom's Reach

BY GEORGE J. YOUNG

Written for *Engineering and Mining Journal*

The boom derrick, so essential for general erection purposes, also has its uses around mine surface plants for unloading cars and handling material generally. The reach of the boom determines its radius of action. This radius can be increased by a simple expedient so that material can be handled in corners that would otherwise be difficult to reach. Steel or other material can also be shifted and put into place more readily by its use than by raising and lowering the main boom.

The device consists of a timber, usually a spare derrick boom, *A*, about which a sling is placed in such position as to almost balance the load, *B*. The overbalance is left on the free end of boom *A*, to which a rope as attached. When the load *B* is approximately in position, it may be easily maneuvered into place by pulling down on the rope to elevate it and from side to side to shift to position. Too great an overbalance on the free end of boom *A* would make the arrangement awkward to handle.



DEVICE TO FACILITATE HANDLING OF MATERIAL BY DERRICK

Method of Sampling Mine Dust

In seeking a method of determining the amount of dust in mine air, Dr. J. A. McCrae, of the South African Bureau for Medical Research, found that all the dust present could be caught in a tube containing 40 g. of pure cane sugar in a column about 9 cm. long by 8.5 cm. in diameter. An air suction pump was designed having 3.5 liters' capacity, and the required quantity of air was aspirated through the sugar column by means of this pump. The weight of dust was determined in milligrams per cubic meter of air. This "sugar-tube" method was adopted by the committee on dust sampling of the Transvaal Chamber of Mines. The routine for taking samples is described in the committee's report as follows:

Each dust inspector is provided with a pump of known capacity, a box containing ten sugar tubes, and a 6-ft. piece of rubber tubing to connect the sugar tube to the pump. Surprise visits are paid to the mines when possible. In any case the actual places of sampling are not decided on until the arrival at the mine. The dust inspector arrives at the mine between 8 and 9 a.m., sees the manager or mine captain and consults with him as to the places to be sampled, taking care to choose places where, from experience, it is known that dust is likely to be made.

The actual process of taking each sample by the sugar-tube method occupies from ten to fifteen minutes. The air sampled is in the immediate neighborhood of that actually being breathed by the men at work. The sugar tube is held in the hand at the height of the mouth, and is moved slowly round so as to sample the air at that height in the particular place under examination. In stopes, the sample is usually taken at the upcast side, and in ore bins to the leeward side.

The sampling being completed, the dust inspector makes the following notes: Mine, section, date, number of tube, place of sampling, time, nature of work in progress, number and type of machines, state of water supply and how applied, number of men (whites and natives), appearance of the working place (*i.e.*, wet, dry, or dusty), appearance of the air, and so on.

The dust inspector then proceeds to the next place to be investigated and repeats his sampling until he has completed his work. In the course of his journey through the mine, he is expected to note the general appearance of the workings as regards dust, and to report any deficiencies which he may observe in dust-allaying apparatus. The visit of inspection occupies half a day, and on its conclusion the dust inspector returns to the Chamber's laboratory, hands his samples over to the analyst, and enters a report of his visit on the record.

Jacks Used To Replace Derailed Steam Shovel

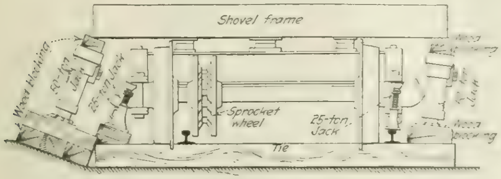
BY H. H. HUNNER

Written for *Engineering and Mining Journal*

In moving a 100-ton shovel backward around a sharp curve, the last pair of wheels dropped off on the inside of the curve. Several attempts were made to replace the two wheels, using "A" frogs, switch needles, dipper bases, and similar material, but the ordinary methods that usually suffice for a locomotive or stripping truck all failed. The great weight on this pair of wheels owing to the overhang of the boom and dipper stick makes them very resistant to climbing any description of replacing frog. One frog or the other is invariably pinched out of place.

On this particular shovel the sprocket wheel for the chain drive was on this axle and would engage the frog on the inside rail, shoving it out of place before the wheel could engage it.

The method that finished the job in less than half an hour on first trial was the one indicated in the sketch. The jack arms were not used. Blocking the other truck to prevent the shovel moving either forward or back, the dipper was rested on the ground just on the outside of the outer rail. Two fifty-ton jacks were started, one on either corner of the shovel frame, canted to draw the whole body of the shovel toward the center of the track. As soon as the body was free of the boulster, two twenty-five-ton jacks were started at the corners of the journal boxes. As soon as the wheels were clear of the rails, the frame gradually settled, dropping the wheels in place.



MANNER OF EMPLOYING JACKS IN REPLACING DERAILED STEAM SHOVEL

Plan of Pumping Station

High-head stage centrifugal pumps are either arranged with their lengths parallel with the width of the pumping station or parallel with its length. In rock that stands well the former arrangement is preferable, but where heavy support is necessary, the latter arrangement is more favorable, as it allows the minimum span of roof. An example of recent practice is given in the illustration, which shows in plan and cross-section the pumping station of the Randfontein Central Gold Mining Co., Ltd., in South Africa.

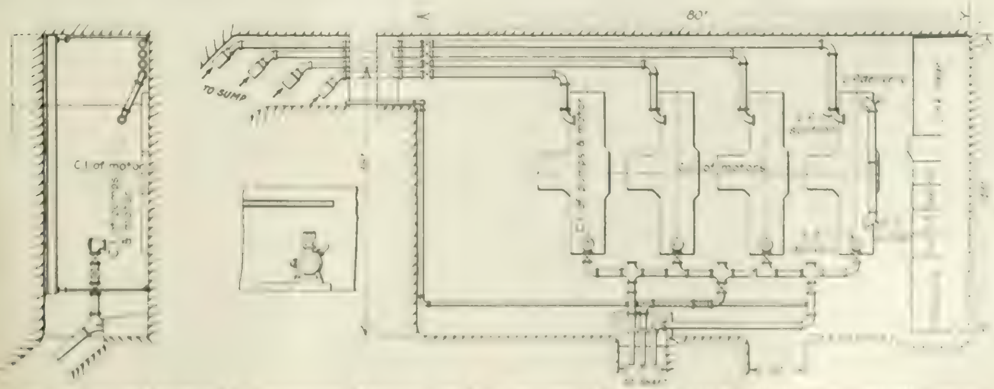
The description is taken from a paper by G. H. Beatty in the November, 1920, issue of the *Journal* of the South African Institution of Engineers. There are four units, each a thirteen-stage Sulzer pump of 1,400-gal. capacity per minute against a 2,500-ft. head. The unit consists of a five-stage right-hand suction pump and an eight-stage left-hand pressure pump. The two pumps are coupled in series and are on either side of a 1,750-hp. motor, which is on the base plate common to both pumps. The motor operates at 1,470 r.p.m. All four pumps discharge into a common header, which in turn is connected to three 10-in. pump columns.

The total capacity of the four pumps is 5,600 gal. per minute, equivalent to 748.8 cu.ft. per minute, or 46,800 lb. water per minute. The theoretical horsepower per pump is 886. Assuming a friction head of 52.25 ft., 18.5 hp. would theoretically be required to overcome this head. The combined theoretical head is 904.5 hp. The over-all efficiency is 51.7 per cent, as figured on the basis of 1,750 hp. input to the motor. The actual efficiency would exceed this amount. The velocity in 10-in. columns is equivalent to 22.8 ft. per second for maximum capacity.

Repair of a Broken Jaw Crusher

The repair of a broken jaw crusher described in *Engineering and Mining Journal's* issue of Jan. 29 last. is very interesting to the oxy-acetylene welder as indicating that there is yet considerable latitude for spreading the usefulness of his trade. The method described, though undeniably ingenious, is involved and roundabout. One side frame casting of a 36 in. x 42 in. jaw-type crusher was broken along the line of bolts that held in place the back end of the frame. Material used in the repair consisted of six sections of $2\frac{15}{16}$ in. shafting, each 14 ft. long; twenty-four drop-forged 3-in. nuts; six drop-forged 8 x 4-in. steel stays, each 7 ft. long; and four cast-iron pillar blocks, two being 34 x 6 x 10 in., and two 34 x 4 x 6 in. Four days were required to assemble the material, twenty-four hours for threading the six rods, twenty-one hours for drilling holes in the stays, besides the time for setting up. One lathe and one drill had to be relieved from production twenty-four hours and twenty hours, respectively, during the preparation of material for the repair. When the job was completed, the crusher, though capable of functioning, was nevertheless a broken machine tied together with an iron and steel crating.

By the method of re-making broken machinery by oxy-acetylene welding, the repaired crusher might have been restored to its original compact structural form, and, assuming the necessity of temporarily dismantling the fractured casting and redrilling of the bolt ports, the repair would very likely have been made in less time and at lower cost than it was by the method described. It is not intended to give the impression that this would have been a simple repair as compared to some welding operations, but it would certainly be within the range of the competent oxy-acetylene process, and is of a type that is often handled by repairmen in many industrial centers.



PLAN AND CROSS SECTION OF PUMPING STATION OF RANDFONTEIN CENTRAL GOLD MIN[illegible] SOUTH AFRICA

THE PETROLEUM INDUSTRY

The Isthmian Oil Fields of Mexico

BY ARTHUR H. REDFIELD*

THE ISTHMIAN oil-producing district of Mexico extends between 91 and 95 deg. longitude west of Greenwich, between 17 deg. 35 min. north latitude and the shores of the Gulf of Mexico. It includes the Tehuantepec and the Tabasco-Chiapas fields, and corresponds to the officially designated zone of Minatitlán.

In the early days of Mexican oil production the Isthmian district gave promise of a considerable output —so much so that the Pearson interests established a refinery at Minatitlán. The Isthmian oil fields, however, have been a disappointment. They have at no time produced enough to supply the refinery at Minatitlán, which has been operated on crude oil shipped from the northern fields. Development of the Isthmian fields languished when the Potrero del Llano, owned by the Mexican Eagle Co., in the Tampico-Tuxpam region, began its spectacular output. This soon eclipsed the modest production of the Isthmian district, and the latter was left to play a part of diminishing importance. Political disturbances have also checked the development of the Tehuantepec oil fields. In recent years their contribution to the oil supply of Mexico has been negligible. Whether the Isthmian region will ever be a large producer of petroleum remains open to question.

A comparison between the production in recent years of the zone of Minatitlán, which corresponds to the Isthmian district, and that of all of Mexico is afforded by the following table:

PRODUCTION OF CRUDE OIL IN THE ZONE OF MINATITLÁN AND IN MEXICO, 1914-1919
(In Barrels of 42 Gallons)

	Zone of Minatitlán	Mexico
1914	228,761	26,235,403
1915	226,163	32,910,508
1916	160,950	40,545,712
1917	23,549	55,292,770
1918	321	63,828,326
1919	904	87,072,954

The world-wide demand, however, for petroleum and petroleum products has awakened interest in fields previously considered negligible. The Isthmian district has accordingly had its share of the interest and the active attention of the oil men in recent months.

LOCATION AND EXTENT OF THE TEHUANTEPEC FIELD

The Tehuantepec oil field comprises the southern and eastern parts of the State of Vera Cruz, between latitudes 17 deg. 35 min. and 18 deg. 5 min. north and longitudes 95 and 94 deg. 10 min. west of Greenwich; and includes the San Cristóbal, Jáltipan, Ixhuatlán, and Tecuanapa pools. The oil-bearing area proper extends from the Chapopote ranch, southward to Medias Aguas station on the Tehuantepec railroad; from Sayula on the west to the border of the states of Tabasco and Chiapas. The extent of this area is about 100 square miles. Only about fifteen square miles, however, have been proved by drilling.

The thick residual soil and the dense tropical vegetation make geologic investigation of the region difficult. It can be seen, however, that the horizontal strata of Quaternary quartz gravels, reddish sands, and white to cream-colored clays, which extend forty miles southward to Minatitlán, lie unconformably upon blue argillaceous and micaceous sandstones, as well as unconsolidated sands, gravels, and conglomerates of Pliocene age, to a total thickness of 2,000 to 2,500 ft. These are underlain in turn by Upper Miocene blue marls and shales outcropping over an area 100 miles wide. The Tertiary beds are unconformably underlain by a Cretaceous dolomitic limestone, which is the oil-bearing formation of the region.

A journey along the Tehuantepec railroad from Puerto México to Santa Lucrecia discloses the Quaternary gravels, sands, and clays as far as Chinameca (22.99 miles from Puerto México), followed by Pliocene sands and conglomerates to Jáltipan and continuing to the 69 kilometer (42.87 mile) post. Here the Upper Miocene shales begin, continuing, though masked for wide stretches by Pliocene sands and gravels, to Medias Aguas (60.27 miles), where Cretaceous limestone outcrops. Beyond this, Pliocene deposits hide the underlying formations, but at Tortugas (65.86 miles) Upper Miocene marls are visible, continuing to Santa Lucrecia.

SAN CRISTÓBAL ANTICLINE IS PRINCIPAL STRUCTURE

The Cretaceous and Tertiary strata are considerably folded, forming close anticlines and synclines, of which the bearing varies between N. 45 deg. and N. 80 deg. W.

The principal structure of the region is the San Cristóbal anticline, which extends forty-four miles along an axis passing a little south of San Cristóbal and a little north of Sayula, bearing N. 75 deg. W. to N. 80 deg. W. The strata of the crest are slightly inclined; the flanks descend in a gentle slope. On the eroded crest of this asymmetric anticline is the San Cristóbal pool; on the north flank occur the Ixhuatlán and Jáltipan pools; and on the south flank are the Medias Aguas and Coapitoloya pools. The Tertiary strata are fissured in various directions, both along the axis and down the flanks of the anticline.

A second asymmetric anticline, very close, occurs south of Santa Lucrecia, near Cardenas station on the Tehuantepec railroad. From this point southward the Miocene marls continue in gentle undulations to the point where the Middle Cretaceous limestones outcrop.

SALT DOMES FREQUENT AND GROUPED

The occurrence of petroleum in the Tehuantepec field is closely connected with the salt domes that have been observed, principally on the north flank of the San Cristóbal anticline. These are of two types, true domes or quaquaversals, and anticlines with a salt core in the apex. The Isthmian salt domes are quite numerous, and in places they are closely grouped. The principal domes of this area are those of Ixhuatlán, Filisola, Palmitota, Cascajal, Tecuanapa, and La Concepción.

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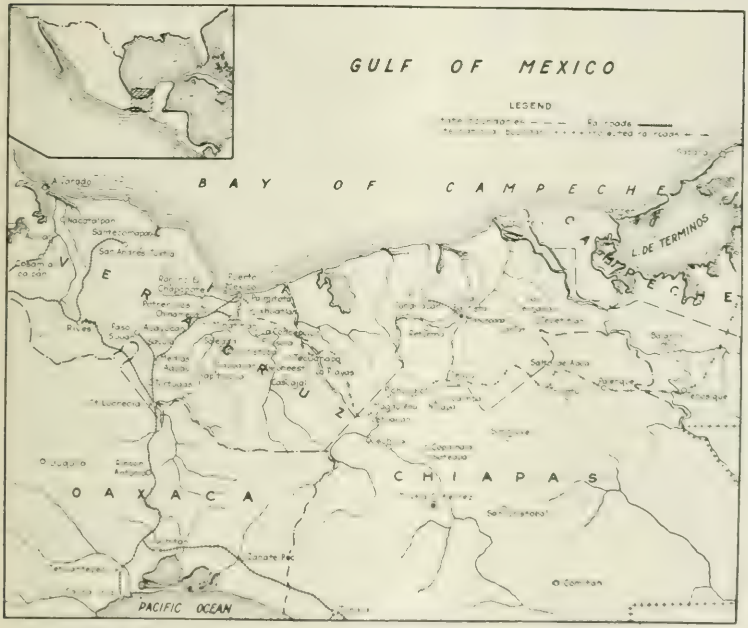
The Ixhuatlán salt dome has the general form of a northeast-southwest anticline, surrounded by bluffs of blue Pliocene sandstone, rising 200 ft. above the floor of the valley. The wells after penetrating the Quaternary detritus enter the Miocene marl. This formation has a number of intercalated sands, some of which produce oil. The dolomite which is found just above the salt plug is hard and compact and carries no oil. The Palmitota dome, though differing in form, is similar in its main characteristic geologic structure to that of Ixhuatlán.

The Tecuanapa salt dome is elongate, with its major axis running northwest-southeast. The Miocene formations occur quite close to the surface. The few Miocene sands occurring in this dome are water-bearing; the oil is contained in the Cretaceous dolomitic limestone. The salt mass has been abruptly cut off on the south side by a northwest-southeast fault.

The dolomite cap of the San Cristóbal-Capoacán salt dome shows a symmetrical double dome upon the San Cristóbal anticline, similar to the domes of the Texas-Louisiana region. The Soledad dome is also of this type.

The Filisola dome is formed at the intersection of two nearly equal axes, three miles long, running respectively northwest-southeast and northeast-southwest. A central surface depression surrounded by bluffs of Miocene marl dipping steeply away from the central core shows that the salt mass must have originally reached the surface and have been dissolved out, leaving a basin to become partly filled with débris. Drilling has revealed that the salt extends a considerable distance to the northwest.



GEOGRAPHIC SITUATION OF THE ISTHMIAN OIL FIELDS OF MEXICO

The elongated dome at La Concepción is a duplicate of the Tecuanapa dome, save that its major axis runs more nearly north-south.

The Cascajal salt dome, structurally almost a perfect dome, shows a dissolution of the outer portion of the salt core similar to that of the Filisola dome, and a partial replacement of the salt by Pliocene detritus.

According to Hartley, the domes of the Tehuantepec area may be grouped along two well-defined axes which may have a connection with lines of structural weakness. The trend of one axis, along which the Tecuanapa, Filisola, and Concepción salt domes are aligned, is northwest-southeast and generally parallel to the mountain front. A parallel axis to the south would take in the Cascajal, De Gheest, and San Cristóbal domes. The second of two principal axes runs northeast-southwest. Along it may be aligned the Palmitota, Ixhuatlán, and San Cristóbal domes. The intersection of the two hypothetical "lines of weakness" at San Cristóbal may account for the double dome which characterizes the San Cristóbal-Capoacán field.

This alignment is given by Hartley as tentative only. It is not possible at the present state of knowledge concerning the geology of the Tehuantepec oil fields to determine whether these lines, if they are proved to be lines of weakness, are folds or faults. De Golyer, however, believes that no general alignment of the salt domes of the Tehuantepec region similar to that reported in the Texas-Louisiana region can be traced. The structures produced by the salt masses generally resemble folds rather than symmetrical domes occurring at the intersection of faults. These folds may be traced from one dome to another, as the surface geology of the region is better exposed than in the Gulf-Coast areas of the United States.

ASPHALT AND OIL SEEPAGES

Surface indications of petroleum in the Tehuantepec region are confined to the Miocene and Pliocene rocks on the flanks of the San Cristóbal anticline. These consist of seepages of asphalt (*chapopote*), by which the principal pools were originally located. Oil seeps out in the Pliocene sands at Potrerillos, near Jáltipan.

The oil of the San Cristóbal pool is asphaltic, with a specific gravity of 0.892, (26.8 deg. Bé.) and a viscosity of 500 Saybolt, at 38 deg. C. (100.4 deg. F.). The oil contains 2.34 per cent of sulphur, and has a heating power of 10,107 calories. Analysis by the Engler method of a sample from a surface seepage gave the results indicated in the table entitled "Laboratory Distillation of Crude Oil From San Cristóbal," which appears at the top of the first column of the page immediately following this.

LABORATORY DISTILLATION OF CRUDE OIL FROM SAN CRISTÓBAL

Fractions	Per Cent by Weight	Specific Gravity
Between 20 and 150° C. (gasoline)	16.59	0.834
150 and 250° (illuminating oils)	10.66	0.906
250 and 300° (illuminating oils)	17.73	0.913
300 and 389° (heavy oils)	23.71	0.936
Residuum, asphalt	28.64	1.124
Water	1.29	1.000
Loss	1.38	....
Total	100.00	

Commercial distillation of crude petroleum from San Cristóbal at the Minatitlán refinery gave the following proportions:

REFINERY DISTILLATION OF CRUDE OIL FROM SAN CRISTÓBAL

	Temperature of Distillation	Per Cent	Specific Gravity
Naphtha	170 to 302° F.	12.0	0.717
Illuminating oil	302 to 572° F.	30.0	0.812
Gas oil	572 to 684° F.	20.4	0.892
Intermediate oil	684 to 732° F.	19.4	0.930
Water	....	0.3	.....
Liquid products	....	82.1	
Coke by weight	....	13.5	
Loss	....	4.4	
		100.0	

Crude oil from Jáltipan is asphaltic, with a specific gravity of 0.983 (12.4 deg. Bé.). The sulphur content averages 1.87 per cent. Analysis by the Engler method gave the following percentages:

FRACTIONAL DISTILLATION OF CRUDE OIL FROM JÁLTIPAN

Fractions	Per Cent	Specific Gravity
Between 20 and 150° C. (gasoline)	9.87	0.862
150 and 200° (illuminating oils)	10.41	0.908
200 and 250° (illuminating oils)	3.92	0.916
250 and 300° (illuminating oils)	25.20	0.924
300 and 389° (heavy oils)	23.44	0.934
Residuum (asphalt)	26.14	1.128
Loss	1.02	..
Total	100.00	

From the Tecuanapa pool was extracted a dark-brown oil, with phosphorescent properties, and with an odor of hydrogen sulphide. Its specific gravity was 0.856 (33.50 Bé.), and its viscosity at 70 deg. F. was 57 seconds by the Redwood scale. The flash-point occurred at 50 deg. F. and the point of ignition at 95 deg. F. Its heating power was calculated at 10,590 calories.

Distillation of crude oil from Tecuanapa by the Engler method gave the following fractions:

FRACTIONAL DISTILLATION OF CRUDE OIL FROM TECUANAPA

	Per Cent by Volume	Specific Gravity
Between 80 and 150° C. (gasoline)	13.0	0.730
150 and 200° (illuminating oils)	13.0	0.785
200 and 250° (illuminating oils)	11.0	0.822
250 and 300° (illuminating oils)	11.9	0.852
300 and 350° (heavy oils)	44.0	0.871
Residuum (asphalt)	4.0	
Loss	3.1	
Total	100.0	

In refinery practice 13 per cent of gasoline of 0.730 specific gravity was obtained; 36 per cent of illuminating oils of 0.810 specific gravity; 12 per cent of gas oil of 0.860 specific gravity; 30 per cent of paraffine oils of 0.875 specific gravity; and 4 per cent of asphalt.

Distillation of crude petroleum from the wells of Nanchital, in the Tecuanapa pool, by the Engler method, gave 10 per cent of gasoline; 40 per cent of kerosene; 0.9 per cent of sulphur; and no asphalt. In refinery practice 8 per cent of naphtha was obtained; 39 per cent of illuminating oil; 10 per cent of gas oil; 34 per cent of heavy oils; 4 per cent of asphalt; and 1 per cent of sulphur, with a loss of 4 per cent.

Crude oil from Ixhuatlán has a specific gravity of 0.913 (23.3 deg. Bé.), that of Capoacán a specific gravity of 0.885 (28.2 deg. Bé.). Both of these oils are asphaltic.

The production of crude oil in the Tehuantepec field in recent years is illustrated by the following table:

PRODUCTION OF CRUDE PETROLEUM IN THE TEHUANTEPEC FIELD, MEXICO, 1914-1917

(In Barrels of 42 Gallons)

	1914	1915	1916	1917
San Cristóbal	13,393	14,640	8,183	2,412
Tecuanapa	96,688	98,803	24,143	.....
Ixhuatlán	100,459	94,990	110,980	18,529
Soledad	9,101	9,154	6,480	......
Capoacán	9,120	10,567	10,868	2,252
Total	228,761	228,154	160,654	23,193

DRILLING RECORDS INCOMPLETE

Drilling records for the wells of the Tehuantepec field are not available with any degree of completeness or detail. The following table illustrated the progress of drilling in the Tecuanapa and the Ixhuatlán pools down to the closing of the former in August, 1916, and of the latter in April, 1917.

	Wells Drilled	Range in Depth	Average Depth, Ft.	Producing Wells	Dry Wells	Abandoned Wells
Tecuanapa	11	439-2,013	732	3	8	..
Ixhuatlán	16	311-2,497	1,049	10	3	3

The output of the Ixhuatlán wells ranged between 2½ and 60 bbl. a day, with an average production of 30 bbl. per day.

During 1919, five wells were located on the Hacienda de Cuyucuenda, near Cocuite, in the Municipality of Tlalixcoyan, State of Vera Cruz, by Alejandro P. Wiechers. Drilling, however, was not started.

The Mexican Eagle Co. located five wells in the Ixhuatlán pool and three in the Tecuanapa pool, but drilling was not started. One well near Ixhuatlán was carried to 513 ft., when work was suspended.

TRANSPORTATION AND REFINING

A pipe line conveys the oil of the Ixhuatlán pool to the River Coatzacoalcos, navigable by vessels of deep draught and leading to Puerto México, on the Gulf Coast, and another pipe line connects the Tecuanapa pool with the River Uxpanapa, a tributary of the Coatzacoalcos. The Capoacán and Soledad pools are situated along the River Coachapán, another tributary of the Coatzacoalcos.

A refinery was built in 1908 by the Mexican Eagle Co. at Minatitlán, on a branch of the Tehuantepec railroad. Though intended originally to serve the Isthmian district, it has for years received its main supply of crude oil from the company's wells in the Tampico-Tuxpam region. This refinery was almost totally destroyed by a fire on July 27, 1920. The intentions of the Mexican Eagle Co. with regard to rebuilding have not been made public.

The Minatitlán refinery was situated on the left bank of the River Coatzacoalcos, about eighteen miles northeast of the city of Minatitlán, between two marshes and upon a group of hills ranging from 66 to 98 ft. in altitude. Because of the local conditions of drainage, the buildings of the refinery were located upon the hills, despite the difficulty and expense of pumping up all the water that was needed. The refinery had a capacity of 12,000 bbl. daily.

The crude petroleum was shipped to the refinery up the River Coatzacoalcos in tank steamers. The refined products were shipped down the river in native dugouts and in tank boats to Puerto México. Formerly a pipe line led to the port; but as this had been laid over marshes and under bad conditions generally, it was useless at the end of five years.

The capacity and the activity of the Minatitlán refinery may be gaged by the exports of refined oil from Puerto México. It must be remembered, however, that practically all of the crude petroleum consumed in the preparation of these products came from the northern oil fields.

EXPORTS OF MINERAL OILS FROM PUERTO MÉXICO, 1913-1916
(In Metric Tons)

	1913	1914	1915	1916
Crude petroleum	21	7	. .	7,000
Refined petroleum				
Benzine	1,442	. . . .		. . . . .
Gasoline	4,742	7,151	8,521	4,327
Naptholine	5	1,641	2	11,239
Kerosene	20,978	19,100	. .	. .
Illuminating oil	4,664	23,649	37,110	32,142
Gas oil	4	23	2,438	.
Fuel oil	69,828	184,802	118,536	134,618
Lubricating oil	. . .	1,052	4,633	8,396
Asphalt	50,811	33,689	19,269	26,242
Other derivatives	833	26	. .	3,846
Totals	153,328	271,140	190,509	227,810

Exports of refined oil from Puerto México equaled 207,712 metric tons in 1917; 149,555 tons in 1918; and 283,262 tons in 1919.

The producing area of the Tehuantepec field is controlled entirely by the Mexican Eagle Oil Co., (Compañía Mexicana de Petróleo "El Aguila," S. A.), founded by the Pearson interests with British capital. The sale of a controlling interest in this company to the Royal Dutch-Shell group was announced in April, 1919.

LOCATION AND EXTENT OF THE TABASCO-CHIAPAS FIELD

The Tabasco-Chiapas oil field includes the south-central portion of the State of Tabasco and part of northern Chiapas State. It may be defined by a line extending from the El Triunfo ranch, on the Mexcalapa River, to Ostuacán, in Chiapas; thence to the historic ruins of Palenque, to Balancán, in Tabasco, and to the Gulf of Campeche. The probable oil-bearing area was calculated by Arnold in 1917 at twenty square miles. Only one-fourth square mile has been proved by the drill.

The surface of the Tabasco oil region is covered with horizontal Quaternary deposits of sand and clay. Below the Quaternary occur the marine Tertiary formations, which outcrop on the border between the states of Tabasco and Chiapas, bearing generally N. 80 deg. E. These consist of calcareous sandstones, alternating with shales, marls, and conglomerates. Oil horizons occur in the loose sandstones and conglomerates of the Tertiary. The finer-grained rocks of this series are found between Quechulac and Las Palmas, on the Mexcalapa River, in Chiapas; and the coarser grained in the subsoil of Tabasco. The Pliocene is represented by strata of chalk, sandy clay, and conglomerate. The Miocene formations, consisting of marls, shales, blue clays, and coarse limestones, rest unconformably upon nummulitic limestones belonging to the Eocene, which outcrop at Copainalá and Soteapa.

The Tertiary formations of Tabasco rest upon coraliferous dolomites and dolomitic limestones of the Upper Cretaceous which outcrop in Chiapas. These rocks, with their numerous cavities, are the principal reservoirs of oil in this area. They occur generally in thick beds, some of which present a brecciated structure. Below the Upper Cretaceous limestones and dolomitic limestones occur coarse beds of limestones containing *Rudista*, ascribed by Villarello to Middle Cretaceous.

Eruptive rocks are not plentiful in this region. They occur sporadically in the center of Tabasco, consisting chiefly of quartz-bearing micaceous diorites near Santa Fé, and andesites of Miocene and Pliocene age in the valley of Chiapas River. Miocene diorite and andesite, partly covered by marine Pliocene sediments, outcrop south and southeast of Pichucalco, principally along the axis of the Pichucalco-Salto de Agua anticline.

GEOLOGIC STRUCTURE

The Tertiary strata of the region are folded into two series of anticlines and synclines. The principal anticlines of the region are the Triunfo-Palenque, the Pichucalco-Salto de Agua, and the Reforma-Macuspana. The last named is considered an eastward extension of the San Cristóbal-Tecuanapa anticline, in the Tehuantepec region. All three are open anticlines, with broad arches, bearing N. 80 deg. E., the axial planes of the folds dipping steeply to the south. A second series of minor folds runs at right angles to the first, bearing N. 10 deg. W. The chief of these are the Pichucalco-Reforma and the Salto de Agua-Tepetitlán anticlines. Elongated domes occur near Ostuacán, Pichucalco, Reforma, east of Macuspana, and near Salto de Agua. Parallel to the two principal lines of folding run two systems of faults.

SURFACE INDICATIONS OF PETROLEUM

Surface manifestations of oil, gas, and asphalt are abundant in the Tabasco-Chiapas region. *Chapopoteras* (seeps of asphalt) occur in the northeast of Tabasco at Tlachontalpa, near Santa Ana and along the lagoon of Santa Ana; in the north of the state, from San Fernando through Macuspana to La Reforma; and in the south from Salto de Agua to Tacotalpa, Teapa, Pichucalco, Ostuacán, and Sayula. Along the crest of the Pichucalco-Salto de Agua anticline oil of good quality seeps out at the Hacienda de Guadalupe and along the Arroyo de Chapopote.

Gas, oil, and asphalt (*chapopote*) exude along the Ostuacán or Sayula River, on the crest of the Triunfo-Palenque anticline to the north of Pueblo la Magdalena. The limestone at Primavera, to the east of Magdalena, is impregnated with *chapopote*.

CHARACTER OF OIL

The oil from the well of Sarlat, northeast of Macuspana, is of a deep red color, with a specific gravity of 0.830 and a viscosity of 25 deg. Saybolt at a temperature of 38 deg. C. The flash-point ranges from 14.5 deg. to 17.8 deg. C.

The abandoned wells of the Anglo-Mexican Oil Fields, Ltd., at Caimba, southwest of Pichucalco, produced formerly a black oil with little fluorescence which showed dark red in transmitted light. Its specific gravity was 0.8712 (30.69 deg. Bé.), and its viscosity at 20 deg C. by the Engler scale was 106 seconds. Distillation of this oil by the Engler method gave the following results:

FRACTIONAL DISTILLATION OF CRUDE OIL FROM CAIMBA

Fractions	Per Cent by Volume	Specific Gravity 15 C
50 to 150 C (gasoline)	16.0	0.7215
150 to 250 (illuminating oils)	16.0	0.814
250 to 300 (illuminating oils)	9.0	
300 to 350 (heavy oils)	11.5	0.880
Residuum	47.0	0.980
Loss	0.5	
Total	100.0	

In refinery practice, 15 per cent of gasoline was obtained from this oil; 25 per cent of illuminating oil; 20 per cent of solar oil, and 35 per cent of lubricants, with a loss of 5 per cent.

In the Sarlat pool of the Tabasco oil field the Mexican Eagle Co. carried one well 4822 ft. during 1919, or to a total depth of 157.44 ft., but abandoned it in May as unproductive. A second well started in July had reached 156.46 ft. at the close of the year. No drilling was done by the Mexican Eagle Co. in the Reforma pool, Department of Pichucalco, Chiapas, but four wells were located.

The pool of Caimba abandoned by the Anglo-Mexican Oil Fields, Ltd., in 1910, was reopened in 1919 by the Mexican federal government. Nine wells were drilled. The first upon reaching a depth of 2,132 ft. proved a gusher. According to reports, three others, after reaching respectively 656 ft., 508.4 ft., and 115.04 ft., yielded oil by pumping. The remaining wells were carried to depths ranging from 55 ft. to 2,744.05 ft. Three were abandoned and two proved unproductive. No statement has yet been made public regarding the output of the Caimba field under government operation.

The output of the wells of Sarlat from 1915, when production began, is illustrated by the following table:

CRUDE PETROLEUM PRODUCED AT SARLAT, 1915-1919

Years	Barrels of 42 Gallons	Metric Tons
1915	9	1.17
1916	296	39
1917	366	48
1918	321	42
1919	904	119

The only producing wells in the Tabasco-Chiapas district, those of Sarlat, are owned by the Mexican Eagle Oil Co. (Compañía Mexicana de Petróleo "El Aguila," S. A.), founded originally by S. Pearson & Sons, Ltd., with British capital, but sold in the spring of 1919 to the Royal Dutch-Shell group. Its principal holdings are in the Macuspana and Pichucalco oil fields.

In 1919, as has been stated, the Mexican federal government entered the field by beginning the exploitation of the Caimba pool, near Pichucalco, abandoned in 1910 by the Anglo-Mexican Oil Fields, Ltd.

BIBLIOGRAPHY

Alcala, Maximino, "Criaderos de petróleo de Pichucalco." Memorias y Revista, Soc. Científica "Antonio Alzate," Vol. 13, pp. 311-326, 1900. Abstracted in *Mining Magazine* (N. Y.), Vol. 11, p. 88, January, 1905.

Arnold, Ralph, "Conservation of Oil and Gas Resources of the Americas." Proc. Second Pan-Am. Sci. Congress, Vol. 3, p. 222, Washington, 1917.

Aymé-Martin, H., "Le pétrole au Mexique." Bull. Soc. Geog. Com. de Paris, pp. 410-434, July, September, 1916.

Baud, Paul, "L'Avenir du Mexique." *Rev. Scientifique*, Vol. 2, pp. 260-272, Paris, 1912.

Casillas Cruz, S., "Estudio del campamento de Tecuanapa." *Boletín del Petróleo*, Vol. 2, pp. 423-446, November, 1916.

—— "Estudio del campamento de Ixhuatlán." *Boletín del Petróleo*, Vol. 3, pp. 125-134, Mexico, January, 1917.

—— "Estudio del campamento de Nanchital." *Boletín del Petróleo*, Vol. 3, pp. 305-309, Mexico, April, 1917.

—— "Estudio del campamento abandonado de Caimba." *Boletín del Petróleo*, Vol. 7, pp. 268-313, Mexico, March, 1919.

De Golyer, E., "Theory of Volcanic Origin of Salt Domes." Bull. A. I. M. E., No. 137, pp. 998-999, May, 1918.

Hartley, Burton, "Petroleum Geology of the Isthmus of Tehuantepec." *Economic Geology*, Vol. 12, pp. 581-588, November, 1917.

Laguerenne, Teodoro L., "Estado de Tabasco." Memorias y Revista, Soc. Científica "Antonio Alzate," Vol. 17, pp. 128-129, Mexico, 1902.

Petróleo, Vol. 3, No. 84, pp. 4-5, Mexico, 1915.

Petroleum World, Vol. 17, No. 238, pp. 277-278, London, July, 1920.

Rogers, G. Sherburne, "Origin of Gulf Coast Salt Domes." *Economic Geology*, Vol. 13, No. 6, p. 464, September, 1918.

Villarello, Juan D., "Algunas regiones petrolíferas de México." Bol. Inst. Geol. de México, No. 26, Mexico, 1908. Abst. in *Mining Journal*, Vol. 85, p. 609, London, May 15, 1909.

—— "Apuntes sobre la región petrolífera Tabasco-Chiapas." *Boletín del Petróleo*, Vol. 2, pp. 10-13, México, July, 1916.

The Exploitation of Petroleum by Means of Pits and Galleries

M. COURAU, ex-engineer of the Corps des Mines and a former member of the French General Committee on Petroleum, calls attention to the exploitation of petroleum by means of pits and galleries in *Technique des Petroles*, according to *L'Echo des Mines et de la Metallurgie*. "The complete exploitation of a deposit," says M. Courau, "should logically pass through three distinct phases, whose abilities of extraction should correspond, approximately, to the following proportions of the total volume of oil originally contained by the sandstone: Drilling, 10 to 20 per cent; drainage by means of subterranean galleries, 30 to 40 per cent, and mining of the sandstones and washing with boiling water, 30 to 40 per cent."

These figures, given by Paul de Chambrier, director general of the Péchelbronn mines, are not absolute and may vary from one deposit to another, but at least they give an idea of the order of magnitude of the phenomena involved. It is certainly true that the quantity of oil discharged through a boring that taps a petroleum deposit represents but a small fraction of the crude oil saturating it.

De Chambrier's method, which is described in a small publication,[1] offers the following advantages over ordinary well drilling: It permits the recovery of two or three times as much oil as that already secured from the same deposit by means of borings; it increases, to the above extent, the value of a concession by permitting one to at least estimate with sufficient accuracy, if not to calculate precisely, the oil reserves still held in the ground; from the economic point of view it offers possibilities in countries where oil deposits appear to have reached the limits of their yield; from the scientific standpoint, it is destined to solve a multitude of problems that have remained obscure heretofore, involving the origin of crude oil, its migration, its concentration in the lower strata, the behavior of the natural gas associated with the petroleum, and the stratification of the porous rocks.

New Oil Field Expected in Fresno County, Cal.

SPECIAL CORRESPONDENCE

A new and extensive field of petroleum in close proximity to Fresno is to be brought in, according to a report made by T. A. Piper, geologist to the board of directors of two oil companies which have been drilling in the western part of Fresno County, Cal.

The field is described as being twenty-eight miles long and about five miles wide. It is stated that the drills have penetrated three oil-bearing sands and have encountered a series of hard cappings, and that quantities of gas and indications of oil have been found. Two wells are being drilled, eight miles from each other, but in the same geological formation.

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[1] "Exploitation du Petrole par des Puits et Galeries," by Paul de Chambrier.

Technical Papers

Virginia Clays and Shales—Bulletin No. 20 of the Virginia Geological Survey (obtainable upon request to the Survey at Charlottesville, Va.) is a 118-page book entitled "The Clays and Shales of Virginia West of the Blue Ridge." The region covered by this report is shown to contain vast clay and shale resources desirable for the manufacture of certain clay products, for which there is a large and increasing demand. A map of the state, 21 x 33 in., is included.

Goodnews Bay, Alaska—The U. S. Geological Survey has issued a twenty-one-page bulletin (No. 714-E) on the Mineral Resources of the Goodnews Bay region, Alaska, which may be obtained on request. The pamphlet contains the results of investigational work done in 1919. The claims are largely of placer gold.

Canadian Mineral Production — The "Annual Report on the Mineral Production of Canada" for 1919 has been issued and may be had on request to the Department of Mines at Ottawa. The total value for the year was approximately $177,000,000.

Ceramic Industry—U. S. Bureau of Mines *Reports of Investigations*, No. 2,212 (obtainable on request) describes the work of the ceramic station of the Bureau, at Columbus, Ohio. The suitability of domestic clays and other materials for the following purposes is being studied: graphite crucibles, dolomite refractories, white pottery clays, and Ohio fire clays. The bulletin contains five pages and suggests possibilities of widening present demands.

Willow Creek, Alaska—Five mines were operated in the Willow Creek district in 1919, according to Bulletin 714-D of the U. S. Geological Survey, describing lode developments in that district in 1919.

Talc—"The Talc Industry in 1920" forms the subject of a five-page bulletin issued by the U. S. Bureau of Mines in its series of *Reports of Investigations*, No. 2,204. Conditions in the various domestic producing states are discussed and the foreign situation is summarized. The bulletin is free on request to the Bureau at Washington, D. C.

Colorado Resources—The annual review number of the "Railroad Red Book," January, 1921 (price 30c., 2,019 Stout St., Denver, Col.), contains a large amount of matter relating to the resources and attractions of Colorado, and, to a lesser extent, of Utah and New Mexico.

Tin Ore Dressing—In the February number of *The Mining Magazine* (price 1s. 6d., Salisbury House, London Wall, London, E. C. 2, England) appears a twelve-page article by R. T. Hancock entitled "The Physical Bases of Tin-Dressing."

Mine Ventilation—The U. S. Bureau of Mines has issued a preliminary report of forty-four pages entitled "Ventilation in Metal Mines," which may be obtained from the Bureau free of charge for a limited time, or from the Superintendent of Documents, Washington, D. C., for 10c. This paper discusses the conditions affecting the temperature, relative humidity, and composition of mine air; the effect of dust, and the influence of velocity. The necessity for efficient control of ventilation is emphasized and methods for securing it are suggested. The cost of efficient ventilation is approximately 5c. per ton of ore produced for large mines and 10c. for small ones, but, compared with possible savings, costs are said to be negligible.

Phosphate in Canada — The latest publication of the Canadian Department of Mines, Mines Branch, Ottawa (obtainable upon request), is an illustrated book of 156 pages entitled "Phosphate in Canada." Of late years the Canadian production has been small—less than 1,000 tons per year—but in the late '80s the industry was more important, most of the production coming from Quebec. In addition to describing the Canadian occurrences of apatite in considerable detail, a chapter is included devoted to associated minerals. Several pages are also devoted to general information and to the manufacture of phosphorus products, thus making the book one which will prove valuable to all those interested in this subject, even though in other lands.

Power Transmission—A new method of transmitting power by wave motion, the invention of a Rumanian, G. Constantinesco, is described in principle in *The Mining Magazine* for February. (Price 1s. 6d., Salisbury House, London Wall, London, E. C. 2, England). Another article descriptive of the various applications of the idea to rock drills and other machines will appear in the March issue.

Safety—Bulletin No. 8 of the Bureau of Safety, Sanitation and Welfare, United States Steel Corporation, is an attractive book of 97 pages which shows pictorially the several activities of this company at the various subsidiary plants. Over five hundred illustrations with suitable captions are included, and demonstrate the splendid manner in which the Corporation has provided for the well-being of its employees.

Chitina Valley, Alaska—The status of mining in this district in September, 1919, is covered in an eight-page pamphlet just issued by the U. S. Geological Survey, Washington, D. C., as Bulletin 714-C, obtainable on request.

Sand Filling in Stopes — A short sketch of the method used at the No. 3 mine of the Ray Consolidated is given in U. S. Bureau of Mines *Reports of Investigations*, No. 2,208, obtainable on request.

Book Reviews

Economic Mineralogy. A Practical Guide to the Study of Useful Minerals. By Thomas Crook. Cloth; 5½ x 8½; pp. 492. Longmans, Green & Co., London and New York; 1921. Price, $8.

Although this book is a compilation, the wisdom of the plan and the energy and accuracy of treatment plainly give it a prominent place among textbooks. "The aim of this book," say the publishers, "is to deal with the subject of mineralogy in such a way as to meet the needs of those who wish to restrict their attention to the utilitarian side of the subject." In other words, it is a study of minerals with special reference to the interests and purposes of the general student and the engineer. As such, it is a welcome and timely publication. We have heard on various sides the intention of preparing such a book: Mr. Crook has been the first to do it, and has done it in a remarkably thorough and satisfactory manner. We recommend it to the consideration of students in mining schools, and to mining engineers in general. Admirable judgment has been shown in the balance and selection of the technical characteristics of minerals—their uses, origin, and distribution. Of the twelve chapters, the first eight are general in their character, but altogether constitute only about a quarter of the book. They treat of the symmetry of crystals, their physical characteristics, the elements of crystal optics, their chemical examination, the physical analysis of crushed rocks, the geology of economic mineral deposits (23 pages), and the economic classification of useful minerals. Chapter IX (118 pages) is devoted to the description of the different ore-minerals; Chapter X (54 pages) to the individual gem minerals; Chapter XI (115 pages) to the "Miscellaneous Economic Minerals," including the abrasives, asbestos, asphalt, borates, building and decorative stones, carbonates, cement materials, clays, fertilizers, micas, graphite, and in general the whole group of what it has become the custom to conveniently term "the non-metallic minerals." There is added, at the end of the book, a set of determinative tables of mineralogy of more or less the usual type, which occupies 32 pages.

The idea of popularizing or vitalizing the study of mineralogy has occurred to many, and numerous attempts have been made in that direction. Unless we mistake, no one has done this so thoroughly, accurately, and in general so successfully as the author of this book. The description of the physical characteristics, the distribution, and the geological occurrence of each mineral is [illegible] [illegible]. A drawback is the price of the book, which is plainly a [illegible] [illegible] [illegible] [illegible] which we hope [illegible] [illegible] [illegible] [illegible] along with the [illegible] of other commodities.

J. E. S.

COURT DECISIONS IN MINING CASES

By Wellington Gustin

War Clause Held to Excuse Carrier

N. Y. Appellate Division Decides Excess Freight Paid on Shipment to Genoa Not Recoverable

Appealing from a judgment of the Supreme Court of New York for $167,428 as damages for a breach of contract, whereby the France & Canada Steamship Co., Ltd., had agreed to carry 3,000 tons of copper from New York to Genoa upon its steamships during December, 1916, and January, 1917, for the Compagnie de Trefileries & Laminoirs du Havre, the Appellate Division has reversed same and dismissed the complaint of the shipper.

The contract was subject to the usual war claims. The defendant was not a common carrier, but was privately operating seven vessels, one a British vessel, which it had been forbidden to take into the Mediterranean. There were six American vessels, two of which were torpedoed. On Dec. 8 one sailed for Genoa, and the shipper was informed that the vessel would carry whatever copper it desired to ship thereon. The shipping company was informed that the shipper had no copper then which it wished to ship. The only vessel thereafter sailing before May 15, 1917, was the "Missourian," which sailed for Genoa on March 19. Upon that vessel 750 tons of the copper was sent to Genoa. On May 15 the shipper notified the shipping company that as it could not take the shipments it would ship on other lines, and did thereafter ship on an Italian line, for which it paid freight rates in excess of the freight rates provided for in the contract between the parties in suit. The judgment represents the difference in freight rates charged to the shipper.

The court said the record showed the good faith of the shipping firm could not be questioned, and the shipper was given every opportunity for shipping that was possible, in view of the dangers of the service to Genoa. The firm offered to take the copper to France, but this was refused by the shipper. There was no claim of preference given other shippers, and under the contract the court said the firm had a right to discontinue its service, in view of the perils of transportation to Genoa, and especially in view of the fact that one of its ships had been torpedoed. The charter on the American vessels expired before the cancellation of the contract, and the owners would not renew the same. The court's conclusion was that the shipping company's offer to take the copper upon the first steamer bound to Genoa was a full compliance with its contract to make the shipment subject to the war clauses contained therein.

Therefore the judgment was reversed and the complaint dismissed, the court holding that, under the war clause in the contract, giving the company an option to cancel any contract when hostilities should make it improvident for vessels to sail, and the company, after losing vessels in the Mediterranean, declined to make further voyages, there can be no recovery for breach, where it carried some of the copper which it had agreed to carry, and offered to transport copper on the vessel last sailing for the Mediterranean port.

Status of Optionee Who Acts as Broker

Nevada Packard Mines Co. Wins Controversy Over Mines — Not Responsible for Officer Acting Wholly for Himself

In the action brought by W. A. Keyworth to recover an undivided one-fourth interest in the Packard No. 1, Packard No. 2, and Packard Fraction mining claims, situated in Rochester mining district, Humboldt County, Nev., from the Nevada Packard Mines Co., the Supreme Court of Nevada has affirmed judgment in favor of the Packard company.

In disposing of his claims, Keyworth and others gave R. L. Ray an option on them, and simultaneously agreed with Ray that if he should make a sale he should receive a commission of 20 per cent. The subsequent purchasers of the mines thought they were dealing with Ray as optionee, though the facts were that they were dealing with him as agent of the plaintiff and his associates.

The court said that plaintiff could not recover because he made it possible for Ray to represent himself only as an option holder, when, in fact, he was getting a commission for selling the mines.

Ray sold his interest in the option in consideration that the purchasers should make the initial payment on the option and organize a company to take title to the claims and divide with him the promotion stock. The court ruled that such did not create a partnership between the parties, any more than if the whole consideration had been paid in cash; and that such purchasers could not be charged as partners with the optionee's knowledge of the facts at issue.

Later Ray became director and officer of the company formed to operate the mines under the option. The court said this did not charge the corporation with knowledge of the officer's fraud on the owner of the claims; he having acted, in the matter under consideration, wholly for himself.

Must Plug Abandoned Wells

Supreme Court of Kansas Upholds Statute Making Land Owner Responsible for Compliance With Law

The Kansas statute requiring plugging of abandoned oil wells applies only to the owner, and not to the operator, declares the Supreme Court of Kansas in the state's criminal action against H. V. Foster and E. K. Clark. Both Foster and Clark were charged with drawing the casing from an abandoned well without plugging it, as the law prescribes. Clark was convicted in the Greenwood County District Court, and he appealed on the ground that he did not come within the application of the statute. Foster was the owner of the well and Clark was the operator, who had charge of the drilling and operations in exploring for oil. Foster was not apprehended, and the prosecution proceeded against Clark alone.

The well was abandoned, the casing was drawn, and it was not plugged by anyone. The validity of Clark's conviction depended upon the interpretation of the act, said the court. It found no penalty to be prescribed by the statute for the failure of an operator to plug an abandoned well. For failing to case out the water before drilling into the oil or gas-bearing rock, both operator and owner may be punished, but the Legislature chose to hold the owner alone responsible for failure to plug an abandoned well. It was declared that a court cannot extend a criminal statute beyond the natural meaning of the words employed by the Legislature.

Idaho Supreme Court Finds Against St. James Mining Co.

The Supreme Court of Idaho has affirmed judgment in favor of Peter B. Grant against the St. James Mining Co., Ltd., in Shoshone County. Grant brought this action to foreclose a lien claim of $2,693. He received a judgment for $525 plus an attorney's fee of $125 and costs.

The Mining company appealed from this judgment, contending that dynamite valued at $330 had been wrongfully charged to it, though sold to the Guelph company, in that Grant had purchased this dynamite for the St. James company without its authority and had converted it to his own use by sale to the Guelph company, and had never accounted therefor. The court found this purchase authorized and the sale to the Guelph company ratified by the St. James Mining Co. and denied the claim.

Another claim that Grant had appropriated certain payments received from the C. & R. Mining Co. was denied and judgment affirmed.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Copper Miners Must Fabricate Their Own Product

Calumet & Hecla's Manager Discusses Logical Cure for Rising Cost of Mining Operations

The relation between the copper producer, the manufactured product, and the profits from the latter was the subject of a recent talk before a large number of business and professional men, by James MacNaughton, general manager of the Calumet & Hecla Mining Co. He believes that the time will come when that company will be forced to manufacture its own copper products. This cannot be done at present, nor will it become practicable until the company can handle its total production. The market at present does not warrant manufacture of its copper products by the company, but he asserted that there is no question that the time will arrive when such a step will be logical.

Mr. MacNaughton outlined briefly mining conditions in the copper country. He said that the present production of copper ranges from 30 to 50 per cent of normal, and the fact that there is such a large surplus on hand, with such a low consumption, easily explains the condition of the copper industry. The average mine, he ventured, is hardly making enough to pay for depreciation. No betterment in the market can be expected, he said, until Europe can afford to buy copper as well as other commodities.

Outlining the trend of the copper market during the past few years, Mr. MacNaughton said:

"Copper before the war was a luxury, and during flush times people have used the metal in a luxurious sense. During the war, however, there was a noticeable shortage, and, as a result, steel, zinc, and other metals supplanted copper. Whether copper will return to its former use depends on whether the people can be re-educated to purchase such articles as copper tacks, which a few years ago were purchasable at any hardware store, and many other products formerly composed of copper."

Manufacturers of copper products make more profit than the producer, according to Mr. MacNaughton. He explained that they take no risk with respect to raw material, and can conduct their business so long as they can buy copper.

Northern Minnesota Engineers Hold Annual Banquet

The seventh annual banquet of the Engineers' Club of Northern Minnesota was held at Eveleth on Feb. 26, in the City Auditorium, over 350 members and guests attending.

Charles Grabowsky officiated as toastmaster. The principal address of the evening was delivered by F. W. McNair, president of the Michigan College of Mines, who related his experiences with the Pacific fleet shortly after the end of the Great War. The work undertaken by Mr. McNair and several associates was the perfecting of a new method of fire control for battleships. This was done during the war and was only completed when the war ended. The tested and approved method has been adopted by the Navy Department.

Tulsa Section of A. I. M. E. Urges Oklahoma Legislature To Help the State University

Mounting costs in every department at the University of Oklahoma, with a great increase in the student enrollment, and particularly the very rapid growth of its engineering department, which is inadequately housed and equipped, are seriously hampering the work of that institution. The local press has commented editorially on the danger of a complete shut-down of the university after March 15, through lack of funds, and the following resolutions were adopted by the Tulsa Section of the A. I. M. E. at its annual meeting on Feb. 25, 1921:

> Be it resolved that the Tulsa, Okla., Section of the American Institute of Mining and Metallurgical Engineers urge upon the members of the State Legislature of Oklahoma non-partisan and non-political consideration of the deficiency appropriation bill, and further urge its prompt passage, so that no discredit may be brought upon Oklahoma or its legislative bodies.
>
> Be is further resolved to urge upon the members of the State Legislature the importance of and necessity for increasing the appropriation for maintenance of the university, both as to current expenses and additional buildings, during the ensuing year, in proportion to the increase in enrollment, so that the progress of the university may not be impeded and that it may not lose its prestige and standing among the universities of this country.

At the same meeting the section elected officers.

Mining and Metallurgical Society Defines Anew Its Purpose

The council of the Mining and Metallurgical Society of America, to make clear its purpose and its field, has adopted the following

> DECLARATION OF PURPOSE
>
> The purpose of the Mining and Metallurgical Society of America is primarily to discuss, digest and take formal action by referendum of all its members upon those broad principles and questions which affect the mining industry, and which cannot be, or are not covered by other organizations, and then to put into operation so far as possible its conclusions.
>
> It excludes from consideration technology, methods, detail and special interests, in order the more effectively to concentrate its attention upon the fundamental principles and problems affecting the industry, such as labor relations, legislation, economics, and education, with which it may be competent to deal.

Committee on Elimination of Waste States Its Purpose and Methods

A recent statement from L. W. Wallace, executive secretary of the American Engineering Council, explains the origin, purposes, and plans of the council's "Committee on the Elimination of Waste From Industry," suggested and appointed by Herbert Hoover last month. Mr. Hoover, with the approval of the council, picked the following as members of the committee: J. Parke Channing, of New York City; Ira N. Hollis, of Worcester, Mass.; L. W. Wallace, of Baltimore, Md.; H. R. V. Scheel, of Passaic, N. J.; L. P. Alford, of New York City; George D. Babcock, of Peoria, Ill.; F. G. Coburn, of the Bethlehem Shipbuilding Co.; Morris L. Cooke, of Philadelphia, Pa.; Harrington Emerson, of New York City; E. E. Hunt, former labor investigator for the Clothing Manufacturers' Association; C. E. Knoeppel, of New York City; Robert Linton, of Montana; Fred J. Miller, J. H. Williams, Robert B. Wolf, and Mr. Hoover himself. His aim was to secure men of broad experience, of clear concepts, of unbiased attitude toward labor problems, and representative of managerial, consultant, educational, and editorial activities, as well as having widely distributed and varied industrial contacts.

At its organization meeting in January this committee outlined its purpose as being (1) to determine the causes of labor, material, and equipment waste in industry, (2) to determine as far as possible the extent of the waste arising through each major cause, (3) to suggest means of removing the cause for such waste.

It is the object of the committee to attain this purpose by studying the organization, the engineering features, the production control and cost control, the physical factors characteristic of ten representative industries mentioned in a previous issue of the *Journal*. From three to ten plants of each industry are being visited by an experienced engineer. By the aid of a carefully prepared list of questions with which he has been provided, the field worker will secure the information desired by the committee. This will be supplemented by authoritative data in existing reports from reliable sources.

A small headquarters staff plans and directs the field investigations, which are to be conducted by selected engineering firms. The latter are doing the work at actual cost. The headquarters staff will ultimately [illegible] and write the final report, which is to be reviewed by [illegible] whole. Every care will be taken to secure authentic quantitative data and to avoid a biased report.

MEN YOU SHOULD KNOW ABOUT

J. B. Tyrrell, of Toronto, Ont., is doing professional work in the vicinity of Calgary, Alberta.

F. W. McNair, president of the Michigan College of Mines, was a recent visitor on the Mesabi Range.

Walter E. Gaby, geologist, is with the Santa Gertrudis Co., Ltd., at Pachuca, Hidalgo, Mexico.

Frank M. Warren, mining engineer, of the Pine Land Co., Minneapolis, Minn., spent the week in New York City.

F. R. Wadleigh has been appointed assistant to the president of the Tuttle Corporation, 15 Broad St., New York City.

H. B. Lee, of the Mutual Chemical Co., has left Quebec for Florida, where he will conduct operations for his own company.

William T. Curley, formerly with the Oliver Iron Mining Co., sailed for Rio Janeiro, Brazil, the last week in February.

B. M. Conklin, of Hibbing, Minn., chief engineer of the Great Northern Iron Ore Properties, has returned from a trip to New Orleans, La.

Ralph Arnold, consulting geologist, sailed for London on March 12. He expects to return to the United States before the end of the month.

Charles Dubuc has resigned his position as engineer of the Consolidated Asbestos Co., in Quebec, to take up private practice at Sherbrooke, Que.

Sherwood Aldrich, president of the Ray Consolidated Copper Co., is traveling in Japan. He will visit China and the Philippines before returning to the United States.

W. P. Chinn, assistant general manager for Pickands, Mather & Co., Duluth, Minn., went to Birmingham, Ala., on March 2. He will visit New Orleans and other Southern points before returning.

Vernon Claypool, mining engineer for the Oliver Iron Mining Co., in the Coleraine, Minn., district, has been promoted to succeed **William Curley** as assistant superintendent in the Chisholm district for the Oliver Iron Mining Co.

Edward Thornton, who was for many years with the American Smelting & Refining Co., first in the exploration department and later in the operating branch, was in New York City recently. He is opening a consulting office in Los Angeles, Cal., and will specialize in operating problems.

W. H. Crago, in charge of mining engineering and exploration for the Union Minière du Haut Katanga, is visiting in Duluth, Minn., after an absence of three years in the Belgian Congo, Africa. Mr. Crago was formerly assistant to John Uno Sebenius, general mining engineer for the Oliver Iron Mining Co.

R. A. Cattell, petroleum engineer, will investigate and report to Louisiana the actual conditions in the gas fields of that state. The work is being done by the U. S. Bureau of Mines at the request of Governor John M. Parker, and under the direction of H. W. Bell, engineer in charge of the bureau's field office at Dallas, Tex.

Carl I. Lausen, geologist with the Moctezuma Copper Co., Nacozari, Mexico, has resigned to accept the position of geologist with the Arizona Bureau of Mines at Tucson, Ariz. Mr. Lausen, who is a graduate of the University of California, was with the Old Dominion Co., Globe, Ariz., for nearly three years before going to Nacozari.

L. W. WALLACE

L. W. Wallace, executive secretary of American Engineering Council, was in Washington recently on matters concerning the work of the Committee on the Elimination of Waste in Industries.

Henry C. Morris, mining engineer, was in New York City for a brief visit the middle of last week. Mr. Morris was on the staff of the U. S. Bureau of Mines during the Great War, being detailed for special service with the Economic Liaison Committee of the State Department. He also acted as chairman of the subcommittee on mineral industries.

Arthur Clark Terrill, mining engineer and geologist, formerly with the Kansas State Geological Survey, Baxter Springs, Kan., and head of the department of mining engineering at the University of Kansas from 1915 to 1919, is now in Tientsin, China, where he is serving as professor of mining in Pei Yang University. Professor Terrill became superintendent of the Doctor Jack Pot mine at Cripple Creek, Col., soon after he was graduated from the Colorado School of Mines, in 1905, and in 1906 went from that position to the University of Oregon, where he was in charge of the department of mining from 1906 to 1908. The next year he held a similar position at the University of Idaho. After some years spent in private practice, Professor Terrill enrolled as a student at Columbia University, which gave him the degree of A.M. in geology in 1914. In 1915 he helped prepare and was in charge of the New York State mining exhibit in the Palace of Mines of the Panama-Pacific Exposition at San Francisco. Professor Terrill is a member of A. I. M. E. and of several other societies.

SOCIETY MEETINGS ANNOUNCED

The National Petroleum Congress meets at Kansas City, Mo., March 22 to 25.

The **Tulsa, Okla., Section** of the **American Institute of Mining and Metallurgical Engineers** holds its next monthly meeting on March 25.

New York Section of Mining and Metallurgical Society of America will hold its next meeting the evening of March 24 at Columbia University Club. Following an informal dinner, R. C. Allen will talk on "Mine Taxation."

OBITUARY

Theodore M. Daulton, formerly in charge of hydraulic placer operations at Atlin, B. C., died at Seattle, Wash., on March 6, at the age of sixty. He was a member of the Canadian Institute of Mining Engineers and at one time was a member of the City Council of Seattle.

John Westerdahl, superintendent of the Tintic Standard mine at Eureka, Utah, was shot and killed on the night of March 9 by Mexicans who were robbing the Tintic Standard store. Mr. Westerdahl entered the store just as the hold-up was being staged, and thought the whole matter a joke. When told to stand against the wall and hold his hands up he advanced laughingly toward the bandits, of whom there were four, and was shot dead. Mr. Westerdahl had been interested in mining in this section for many years, rising gradually from the position of a common miner to that of superintendent. Another man was killed at the same time and the proprietor of the store and a miner were severely wounded.

Dwight B. Huntley died in Oakland, Cal., on March 7, 1921. He was one of the older gradutes of the University of California, class of 1875, and a member of the American Institute of Mining and Metallurgical Engineers since 1892. Mr. Huntley was a man of broad acquaintance, best known to many of the older members of the Institute. He carried out his professional work in the Western states and in Mexico and other foreign countries. From 1903 to 1906 he was in Rhodesia in charge of gold properties. In 1909 and 1910 he was professor of mining engineering at the University of Nevada, and a few years later again served in the same capacity at that university.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

High Royalties Restrain Operators in Joplin District

Question Comes Up in Considering Extension of Leases for Indian-Owned Land

Renewal of interest in the question as to the extension of leases for Indian-owned lands in the Joplin-Miami district has been recorded recently as the result of consideration of the question at Washington. Two of the larger companies in this field are asking for an extension of the leases for twenty-five years, or "so long as zinc and lead are found in paying quantities." It is understood they are asking renewal at the former royalty charge, which netted the incompetent Indian owners 5 per cent, with the tacit understanding that they are to renew subleases to actual operators at 15 per cent. Although there is little open opposition to this proposal, general opposition is rumored, and a few companies have come out openly and are asking that the Department of the Interior establish a maximum royalty on the lands of 10 per cent. They argue this will be better for the Indian land owners, and that it will particularly be a help to the zinc mining industry in this field, which just now is at a low ebb. It is declared that some mines now shut down could be operating and be giving employment to hundreds of miners now out of work if a maximum royalty of 10 per cent were established. As it is, royalties in some cases are as high as 25 per cent, and the average probably is around 17 per cent. Several of the holders of original leases have made hundreds of thousands of dollars of "velvet" out of the pyramided royalties.

WEEKLY RÉSUMÉ

A report has been made on smelter smoke conditions in the Salt Lake Valley by the commission headed by Prof. R. E. Swain, under whose supervision operations have been conducted at the Murray and Midvale plants ever since Judge Johnson rendered his decision a year ago. Wage cuts have recently been announced by the two plants mentioned. From the iron ranges of Michigan and Minnesota reports of either curtailment or suspension by iron ore operators continue to be received. The Oliver Iron Mining Co. continues its wage schedule unchanged. The freight rate hearing affecting Lake Superior ore carriers and shippers, that was to have been held by the Interstate Commerce Commission at Chicago on March 15, has been indefinitely postponed. At Spokane the Talbot suit against the Northwest Magnesite Co. has been settled out of court. At Wallace, Idaho, the Hecla Mining Co. has made its annual report, incidentally giving the terms of the settlement of the suit brought against it by the Federal Mining & Smelting Co. In Ontario numerous events are chronicled: The Moore Filter Co. has sued the Nipissing company for filter patent infringement. The Mining Corporation of Canada has shut down at Cobalt, and the Hollinger, at Porcupine, is suing a power company for damages.

In Washington it is said that an effort may be made to revive the Pomerene-[illegible] at the extra session. The war-time explosives regulation act is declared to be inoperative and all licenses are declared cancelled. H. Foster Bain is to be renominated as Director of the U. S. Bureau of Mines.

I. C. C. Freight Rate Hearing Postponed Indefinitely

The hearing before the Interstate Commerce Commission on Lake Superior ore freights, set for March 12 at Chicago, has been indefinitely postponed by the commission. Eighty-seven iron mining companies in Michigan, Minnesota and Wisconsin have requested the commission to investigate the rate schedules from June 25, 1918, to date, and to fix such a new rate as will net the carriers 6 per cent upon the value of the property utilized in ore hauling.

The commission has declined to suspend the increase of 10c. per ton for mine to dock haul and 5c. per ton dock charge put into effect by six of the railroads handling ore from the Michigan and Wisconsin ranges, despite the appeal of thirty-six independent ore producers in these districts.

Murray and Midvale Smelters Announce Wage Cut

The smelter of the A. S. & R. Co. at Murray, Utah, and the United States company's plant at Midvale have announced a wage reduction of 25c. per day for unskilled labor and 50c. for skilled on account of decreased living costs and lessened ore receipts. Neither smelter is operating at capacity, and it is possible that working forces may be reduced. The new wage scale became effective March 15.

Swain Reports on Smelter Smoke in Salt Lake Valley

Field Conditions About Murray and Midvale Plants Described — Safe Operating Conditions Discussed

The smelter-smoke commission headed by Prof. R. E. Swain, of Leland Stanford University, under whose observation operations at the Murray and Midvale smelters in the Salt Lake Valley, Utah, have been conducted ever since Federal Judge Johnson decided a smoke suit against the A. S. & R. and U. S. Smelting, Refining & Mining companies in February, 1920, has presented an exhaustive report after its year of research. Under the decision the two smelters were allowed to continue operations under certain conditions and under the observation of Prof. Swain's staff.

Prof. Swain, as commissioner, was to report his findings to the judge after one year. On this report was to be based a permanent stipulation as to methods of smelter operation that would avoid nuisance or damage in the neighboring districts. A brief summary of the conclusions in this report follows:

The evidence appears to be conclusive that the plant of the A. S. & R. Co. at Murray was not at any time during the period of investigation an agent of injury to crops or vegetation of any kind, or the cause of personal discomfort or ill-health to the residents of the district. No determination made on the air of this district showed an hourly average of more than one part of sulphur dioxide per million. Furthermore out of 5,923 single determinations only nineteen represented a concentration of three parts or more per million and only one a concentration of six per million. The highest concentration ever found in this district was 7.6 parts per million. These higher readings evidently represent momentary "puffs" of smoke. The contamination of the air in the immediate neighborhood of the plant through leakage of SO_2 from furnaces and flue systems is relatively light. Both plants employ the Dwight-Lloyd and the Wedge type of roasting furnaces. The amount of leakage from these furnaces is small, owing to their construction and to the good draft maintained, and the products of combustion are swept away under induced draft into the main flue system. The blast furnace building at each plant is well ventilated, and points where [illegible] products may escape are hooded and the emanations are carried out into the ventilating flue.

The results of the [illegible] at the Murray [illegible] daily loss from roasting operations through the 455-ft. stack of approximately 90 lb. of lead and 120 lb. of arsenic. These figures are probably fairly representative of the efficiency of the Cottrell process of electrical precipitation, with only two units in operation at one time. There is no evidence that the above losses of lead and arsenic are objectionable.

CONDITIONS AT MIDVALE

The results of the investigation lead to the unavoidable judgment that the Midvale plant has been at times during the past season, and under present conditions and methods of operation may continue to be, an agent of injury to the vegetation of the neighboring district. The conclusions reached by Dr. Pool are clear on this point. The "burns" reported by him in the Christensen, Lemich, Turner and Norvich cases were called to my attention by Dr. Pool and gone over carefully by us together. Thus in these cases my confidence in his judgment is supplemented by my own observations.

The work done by the chemists on the Midvale smoke stream also is indicative of a dangerous condition. Out of the 4,311 single determinations of sulphur dioxide made during the growing season, there was an average concentration of 0.49 part per million. There were twenty-eight determinations of 6 parts or more per million, the highest single determination made being 19.4 parts. There were four determinations over 10 parts per million; 153 over 3 parts per million; and 438 over 1 part per million. The highest hourly average recorded was 2.78 parts per million, there being thirty-four hourly averages over 1 part per million.

It cannot be denied that the more sensitive crops cannot, under weather conditions favorable to sulphur dioxide action, endure such concentrations as have been found in this field. On the other hand, the results hardly justify the finding that the sulphur dioxide in the gas stream from the Midvale plant is the cause of actual discomfort to the residents of the district. There were momentary concentrations sufficient to cause coughing and local irritation, but only four determinations in all the time spent in the gas stream making tests were above 10 parts.

All results on filtration tests at the Midvale plant point to the efficient operation of the baghouse units through which all flue gases are passed. The average daily loss in lead and arsenic is certainly too small to be a source of any possible injury to the animal life of the district.

REMEDIAL STEPS

It is my belief that steps should be taken by the United States Smelting, Refining & Mining Co. as soon as possible to improve the situation in regard to atmospheric concentrations of sulphur dioxide during the season of plant growth. The best means for accomplishing this end, in my opinion, lies in increasing the temperature of the roaster gases before their discharge into the air. No measure approaches this one in relieving an unfavorable field condition. I believe that a solution of the matter at the Midvale plant may be found without going to the expense of the suggested erection of a 450-ft. stack in addition to heating the gases.

It is my firm opinion that if the Murray plant is continued under skillful management, if attention is paid to keeping the baghouse and the Cottrell plant at their highest practical efficiency, and if the general operating conditions which prevailed during 1920 are maintained, the plant will be able to operate hereafter without being an agent of injury to its neighbors. But the fact should not be overlooked that the very favorable record of the past year is in all probability due to a number of important contributing factors, most of which fortunately involve no more than the continued intelligent and consistent use of operative measures which are already at hand and a part of the routine normal operation of the plant. These are:

1. The bag-filtration of the blast-furnace gases.
2. The electrical precipitation of roaster dusts and other suspended solids by means of the Cottrell installation, two of the three units of which have been in regular operation.
3. The discharge of the roaster gases, which carry the highest concentrations of sulphur dioxide, at a temperature high above that of the outside air. During the dormant season for plants the temperature of these roaster gases was increased, and incidentally their volume as well, by the delivery of the boiler gases from a neighboring power house directly into the main exit stack. During the season of plant growth the gases were heated by means of coal furnaces near the base of the stack.
4. The discharge of the gases from roasting operations from a high stack at a point approximately 455 ft. above the ground level.
5. A maximum daily elimination of sulphur from roasting operations amounting to about 100 tons. It can scarcely be denied that this plant is a potential agent of injury. Allow the filtration bags to deteriorate, reduce the voltage in the Cottrell plant, neglect the measures which have to do with maintaining a relatively high temperature in the exit gases, and a discharge of lead and arsenic in objectionable amounts or of sulphur dioxide under conditions of concentration and temperature which could give rise to serious injury to crops might easily result.

At once the question arises of what reasonable guarantees should be exacted, or what operating restrictions or other stipulations imposed to insure the indefinite continuance of safe operation. At first thought it would not appear unreasonable, with a plan of plant operation of proved safety before us, to make this the basis of future operation. This should at once give adequate protection to the residents of this community, but it has several serious objections. In the first place, as has been pointed out, there are many phases of plant operation involved as contributing factors to the present conditions of immunity from damage. These are not so much independent as they are interdependent.

Thus it is no longer wholly logical, as a single measure of protection, to place a restriction on the amount of sulphur eliminated or the tonnage of ore roasted when it is known that by a suitable change in one or more other factors, such as the temperature of the exit gases, double that amount might be eliminated with even greater assurance of immunity from trouble. Accordingly, if stipulations are drawn up along the line of plant operation, they must deal not with one but with a number of factors and to that extent be more or less complicated. There is another objection to this proposal which is more serious. These are days of industrial progress based largely upon a new relation between science and industry. Rule-of-thumb methods are yielding to more intelligent and progressive direction. A set of stipulations dealing with plant operation, such as mentioned above, are at once a barrier to progress. Until changed, they may be just as effective in preventing the introduction of improved methods of operation as they are in preventing a relapse into a condition which makes it a menace to the community.

Federal-Hecla Settlement Terms Given in Annual Report

In his annual report for the year 1920 James F. McCarthy, of Wallace, Idaho, general manager of the Hecla Mining Co., states regarding the apex litigation involving the east orebody: "We have made a settlement with the Federal Mining & Smelting Co. of the suit for possession of our east orebody. This settlement provided for the purchase by Hecla Mining Co. of the Tiger-Poorman property of the Federal company, which adjoins the Hecla company's ground, including the Russell lode mining claim, which claim the Federal company asserted contained the apex of our east orebody. It also includes a valuable water right at Burke, which is being used at present for the generation of electric power. The purchase of this property is subject to a lease held by Marsh Mines Consolidated, which expires in July, 1926. Included in this lease is the Russell claim. The settlement provides for the payment by Hecla Mining Co. to Federal company of the sum of $750,000, part of which is paid, the balance to be paid when the Federal procures from the Marsh company a cancellation of the lease and a release from all claims for alleged trespass, or when the Hecla company prevails in the suit which the Marsh company still maintains as an intervenor in the suit brought by the Federal company. Negotiations between Federal and Marsh for settlement of Marsh company's claim are now in progress."

Oglebay, Norton & Co. To Manage Richardson Fleet

The largest and most important transaction effecting the Lake shipping was transacted when the Richardson fleet of boats was purchased by the Columbia Steamship Co. The Richardson fleet consists of eleven steel steamers being operated by ten steamship companies. Under the new ownership the fleet will be managed by Oglebay, Norton & Co., of Cleveland, with John T. Kelly as fleet manager.

The officers of the new company are as follows: Crispin Oglebay, president; D. Z. Norton, vice-president; R. N. Case, secretary; John T. Kelly, fleet manager. The directors are E. W. Oglebay, D. Z. Norton, Crispin Oglebay, Garreston Wade, Isaac Scott, J. H. Frantz, Tracy Paine, W. W. White and John T. Kelly.

Homestake Mining Co. Breaks Ground for New Mill at Lead

Cyanide and Amalgamation Plant Will Have 120 Stamps and 1,800 Tons Capacity

The Homestake Mining Co., of Lead, S. D., has started work on a new mill which will be situated east of the Ellison hoist and on the south slope, immediately above cyanide mill No. 1. A large force of men is employed on the excavation work and it is expected that the new plant will be completed early this fall.

The general dimensions of the main building of this, the South Mill, as planned, are 150 by 160 ft.; the classification annex will be 70 by 70 ft. and the slime settling annex 100 by 40 ft. The general metallurgical scheme involves stage reduction, amalgamation after each reduction and the separation of sand from slime with cyanide treatment of each product in existing plants.

Preliminary to treatment, the ore will be run through the crushers and over a tramway to the mill bins. It will be crushed by 120 stamps weighing 1,550 lb. each and then discharged through 2-mesh screens. The oversize from the stamps will then pass to six 5 by 10-ft. Allis Chalmers rod mills with individual motor drive and in closed circuit with Dorr classifiers. The fine sand and slime from the stamps will by-pass these machines and unite with the classifier overflow.

At this stage the ore will go through an amalgamation process, four 1½ by 12-ft. silver plated copper plates being provided for each grinding unit. Suitable classifiers and two 5 by 14-ft. tube mills will be used to control the final sizing of the tailings passing from the plant.

For separating the slimes from the sand, two batteries of cones, eight of them 10 ft. in diameter and eight 7 ft. in diameter, will be installed. The slimes overflowing the cones will pass to two tanks 32 ft. in diameter and 20 ft. deep and equipped with three-compartment Dorr thickeners, for slime thickening and water reclamation.

The capacity of the new plant will be 1,800 tons daily and it has been so designed that additional units can be added from time to time to make it possible to increase the daily tonnage.

CYANIDE MILL NO. 1 OF HOMESTAKE MINING CO., LEAD, S. D. CROSS MARKS SITE OF NEW PLANT FOR WHICH GROUND HAS JUST BEEN BROKEN

Talbot's Suit Against Northwest Magnesite Co. Dropped

Litigation in which R. S. Talbot, a minority stockholder of the Northwest Magnesite Co., of Chewelah, Wash., sued to force a distribution of dividends by the Northwest company, was dropped by the Superior Court at Spokane, when it was announced that the question had been satisfactorily settled out of court. Mr. Talbot was the original operator in the Washington magnesite area and later sold a portion of his holdings to San Francisco interests who organized the Northwest company.

Mining Convention for Portland in April

The third annual International Mining Convention will be held at Portland, Ore., April 5 to 9 inclusive. The Municipal Auditorium has been secured for the occasion and will provide extensive floor space for the various exhibits. A large number of mining men from Canada and from the Western states are expected to be present. The first session of the International Mining Convention was held at Vancouver, B. C., in 1919.

Can't Reopen Compensation Case After Release Is Signed

Utah State Industrial Commission So Decides in Power Company Employee's Action

In regard to the working of the Workmen's Compensation Act in Utah, when an employee receiving injury signs a release upon receiving payment in settlement, the case, according to a recent decision of the state industrial commission, cannot be reopened. This decision was made in answer to the petition of R. S. Gardner, a former employee of the Cedar Electric Co. and the Dixie Power Co. Gardner, who was totally incapacitated from Nov. 15, 1918, to March 15, 1919, by injury to his hands from burns, signed a release March 31, 1919, upon the receipt of $150.

Seek To Dissolve Section 30 Mining Co.

Five of the principal stockholders representing a majority of the stock of the Section Thirty Mining Co. on the Vermillion Range in Minnesota have petitioned the district court for an order dissolving the corporation. The company was incorporated in 1909 for almost a million dollars but became insolvent in 1920 and ceased to do business after turning over its assets and obligations to the Section Thirty Mine, Inc. The men who have petitioned the court include George A. Sinclair, president of the old company; Alfred Merritt; A. W. Highfield and George H Sinclair.

Rand's Gold Production

The gold output of the Rand, in South Africa, [illegible] [illegible],000 oz., against [illegible]

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

May Re-enact Payne-Aldrich Tariff as Emergency

Advocates of Greater Protection for Ores and Metals View Prospect with Alarm; Duties Too Low

With the increasing probability that stop-gap tariff legislation will be enacted early in the extra session of Congress, much apprehension is felt on the part of those favoring higher tariffs on metals and ores that these items will not be given the amount of protection that they desire. The probabilities seem to favor the re-enactment, with some revision, of the tariff act of 1909, commonly known as the Payne-Aldrich Act. That act does not carry sufficiently high duties on metals and ores to meet the present situation, it is asserted. An effort will be made to secure the revision of many of the schedules of the Payne-Aldrich Act, in case it should be decided to re-enact that statute. Owing to the interest in this question, a comparison is made of the duty on the principal metals and ores under the act of 1909 (Payne-Aldrich) and the act of 1913 (Underwood) in the table given above. Forty-five metals and ores are included in this comparison.

COMPARISON OF DUTIES ON ORES AND METALS IN ACTS OF 1909 AND 1913

Metals and Ores	Act of 1909	Act of 1913
Aluminum in crude form	7c. per lb.	2c. per lb.
Barium, calcium, magnesium and potassium	3c. per lb. and 25 per cent ad val.	25 per cent ad val.
Antimony, regulus or metal	1½c. per lb.	10 per cent
As matte	1c. per lb.	10 per cent
Chrome	25 per cent	15 per cent
Ferrochrome, ferromolybdenum, ferrophosphorus, ferrotitanium, ferrotungsten, ferrovanadium:		
Valued at $200 per ton or less	25 per cent	15 per cent
Valued at more than $200 per ton	20 per cent	15 per cent
Ferrosilicon:		
Containing not more than 15 per cent of silicon	$5 per ton	15 per cent
Containing more than 15 per cent of silicon	20 per cent	15 per cent
Copper, plates and sheets	2½c. per ton	5 per cent
In strips	45 per cent	5 per cent
Gold leaf	35c. per 100 leaves	35 per cent
Silver leaf	10c. per 100 leaves	30 per cent
Lead-bearing ore of all kinds	1½c. per lb.	....
Lead-bearing ores containing more than 3 per cent lead	....	¾c. per lb.
Lead:		
Bullion	2⅛c. per lb.	25 per cent
Pigs and bars	2⅛c. per lb.	25 per cent
In sheets	2⅜c. per lb.	25 per cent
Metallic mineral substances in crude state	20 per cent	10 per cent
Molybdenum	25 per cent	15 per cent
Monazite sand and thorite	4c. per lb.	25 per cent
Thorium	40 per cent	25 per cent
Titanium	25 per cent	15 per cent
Tungsten	25 per cent	15 per cent
Nickel	6c. per lb.	10 per cent
Quicksilver	7c. per lb.	10 per cent
Zinc ore:		
Containing less than 10 per cent of zinc	Free	10 per cent
Containing 10 and less than 20 per cent of zinc	¼c. per lb.	10 per cent
Containing 20 and less than 25 per cent of zinc	½c. per lb.	10 per cent
Containing 25 per cent or more of zinc	1c. per lb.	10 per cent
Zinc:		
In blocks or pigs	1⅜c. per lb.	15 per cent
In sheets	1⅝c. per lb.	15 per cent
Manganese ore	Free	Free
Pyrites	Free	Free
Potash	Free	Free
Chromic ore	Free	Free
Graphite	Free	Free
Spiegeleisen	$2.50 per ton	Free
Cyanide of potash	25 per cent	Free
Cyanide of soda	25 per cent	Free
Arsenic	Free	Free
Asbestos	Free	Free
Bauxite, crude	$1 per ton	Free
Iron ore	15c. per ton	Free
Magnesite, crude	Free	Free
Uranium	Free	Free

To Renominate Bain as Director of Bureau of Mines

H. Foster Bain is to be renominated as Director of the bureau of Mines. As this is written, the nomination has not gone to the Senate, but it is understood that it has been approved and will go to the Senate at once. Mr. Bain was nominated by the outgoing administration, but his nomination was not confirmed by the Senate. President Harding is following the precedent of several former administrations in keeping the technical bureaus of the Government out of politics.

War Mineral Awards

Awards totaling $59,967.47 were recommended by the War Minerals Relief Commission during the week ended March 5. An award of $52,226.85 was recommended in the manganese claim of the Gloria Mining Co. This was 40 per cent of the amount claimed. An award of $6,324.86 was recommended in the chrome claim of Frank Carson. This was 69 per cent of the amount claimed. In the light of additional evidence, an award of $1,416.76 was recommended in A. W. Patton's claim.

Explosives Regulation Act Inoperative

Superseded by Transportation Act Recently Passed—Penalties Still in Force

Notice has been given by F. J. Bailey, in charge of explosives regulations for the Bureau of Mines, that the recent explosives transportation act supersedes the war-time explosives regulation act. The Bureau was charged with the administration of that act. As a result of the new legislation, all existing explosives licenses are cancelled as of March 3, 1921. All requirements under the regulations promulgated by the Bureau of Mines, under the old statute, are therefore inoperative. Mr. Bailey calls attention to the fact that no exemption from prosecution or relief from punishment for any offense committed in violation of the old act is granted by the enactment of the new statute.

Over $3,000,000 for Survey and Bureau Next Year

As finally approved in conference, the U. S. Geological Survey will receive $1,614,340 for its work during the next fiscal year. The Bureau of Mines appropriations total $1,439,300. The principal subdivisions of the appropriation of the Geological Survey are as follows: Topographic surveys, $330,000; geologic surveys, $352,000; potash research, $40,000; mineral resources, $125,000; Alaskan mineral resources, $75,000; water supply work, $180,000; geologic maps (printing), $140,000; classification of lands, $300,000; administrative salaries $29,900.

The principal subdivisions of the appropriation of the Bureau of Mines are as follows: Mine accident work, $409,065; mineral fuels, $142,510; mineral technology, $125,000; petroleum work, $135,000; mining experiment stations, $200,000; and leasing operations, $132,000.

Protection Sought for Arsenic To Aid Nevada Project

The Ways and Means Committee is being urged to place a duty on arsenic. This is being advocated particularly by those interested in the success of new developments in Nevada. Extensive arsenic deposits have been opened at Battle Mountain and at Beowall. Centrally located between these two mines, a 2,000-ton mill has been erected at Toulon, on the Union Pacific railroad. This mill has been erected at a cost of $200,000 and is one of the largest of its kind in the world. There will be no product other than arsenic. The output will be used for making insecticides.

NEWS BY MINING DISTRICTS

CANADA

Ontario

Mining Corporation, at Cobalt, Shuts Down — Labor Arbitration Board Granted — Flin Flon Option Expires This Month

Toronto—Regarding the option held on the Flin Flon property, in northern Manitoba, it is said that the Mining Corporation of Canada is ready to go ahead with the deal, but that the Thompson interests are asking for changes in view of the condition of the metal market. The option expires on the last of this month. As far as the Flin Flon owners are concerned, it is reported that if a substantial payment were made, they would give satisfactory terms for the balance of the money. According to the original option, the whole amount is payable this month.

Cobalt—The Minister of Labor has granted a Board of Conciliation and Arbitration which is expected to begin sittings in Cobalt immediately. The opinion has been expressed that no matter what the decision of the board may be, the operators will put the reduced wages into effect as soon as the board has reported its decision.

Nipissing's February production was valued at $124,391, taking silver at 54⅝c. per oz., and bullion from Nipissing and customs ore was shipped of an estimated value of $234,374. The low-grade mill treated 6,289 tons and the refinery shipped 401,111 oz. of bullion.

The Moore Filter Co. has entered an action at Ottawa against the Nipissing Mines for $600,000, alleging infringement of filter patents.

Owing to the low price of silver and the impossibility of operating at a profit under present conditions, the Mining Corporation has shut down its mine and mill. It is understood that the capacity of the mill will be enlarged to 300 tons per day, and that when this is completed, in about three months' time, operations will be resumed. In the meantime, about 200 men are thrown out of employment. Production during the last year was about 1,800,000 oz.

Porcupine — The Hollinger Consolidated has started an action against the Northern Canada Power, Ltd., for damages in connection with the power shortage, but it is unlikely that this step will be followed by the other companies in Porcupine. The Hollinger's suit is based on an original agreement dating back to the time when the Hollinger sold the Sandy Falls plant to the Northern Canada Power, Ltd., but retained certain rights and privileges exclusively to themselves. It is expected that the extremely open winter throughout northern Ontario will supply a sufficient volume of water to provide a full power load about April 1.

The management of the Beaumont Gold Mines, Ltd., formerly the North Davidson, has succeeded in having the company's stock listed in Paris, London, and Amsterdam. The managers of this company cannot be classed among the conservative operators of the camp, as they claim that this non-producing property, with only a limited amount of underground development, ranks fourth among the gold mines of Ontario. This property may be a prospect of merit, but it still has a long way to go before being classed as a mine.

It is understood that plans are being made to reopen the Murray-Mogridge. The completion of the payment on the property and the acquiring of adjoining claims practically exhausted the treasury, but it is understood that money is being raised.

Kirkland Lake—It is officially stated that the time for starting operations at the Wright-Hargreaves has been fixed for May 1. The mill is in readiness and power is available, but the management is waiting until a steady supply of the latter can be assured.

Quebec

Asbestos Operations Slowing Down Following Recent Boom—Likewise Chrome

By W. J. Woolsey

Thetford Mines West — The asbestos industry appears to relax after the maximum of effort during the last year. No apparent change has occurred in prices, but shipments are holding off and a restriction in production is evident in several quarters. The Bennett-Martin mines, at Thetford and Coleraine, have been closed since Dec. 24. The Fraser & Asbestos Mines, Ltd., at East Broughton, have likewise shut down until spring. The newly built plants of the Harris company and the Pare & Thivierge, at Coleraine, and the Berlin plant, at Robertsonville, will not start operation until spring. The Maple Leaf Asbestos Corporation has begun operation of its new plant on the old Reed property, Thetford Mines.

Considerable speculative interest is manifest over the new control of the Black Lake Asbestos & Chrome Co. by the J. A. Jacobs interests, formerly of the Jacobs Asbestos Co.

The labor contentions of last fall have become quite settled, resulting in improved organization and greater efficiency.

Chrome operations have been suspended in the Coleraine-Caribou district, owing to the slump in prices of that mineral.

British Columbia

May Double Capacity of Silversmith Mill

Sandon—Plans for doubling the capacity of the Silversmith mill during 1921 are being considered by the directors. After paying a $25,000 dividend about Jan. 1 to shareholders of record in December, 1920, the company has an estimated cash surplus of about $100,000, it is stated, which includes an accumulation of silver-zinc concentrates at a conservative valuation. Official reports are optimistic as to the future outlook for the property, ore reserves being estimated at ten years' supply at the rate of production prevailing during 1920. Since the mill was closed, about Jan. 15, 1921, about forty men have been kept on development underground. Outstanding features of the work done recently are: completion of the raises from the 10th or adit tunnel level to the 8th level and from the 8th to the 5th, with several hundred feet of drifting and crosscutting on the 8th and 5th, and connection with the old workings on the latter. A shaft has been put down from the 10th to the 11th level. Drifting on the latter level has opened up promising ground. Indications for marketing the 1921 output are somewhat improved over those of a month ago.

Three Forks—A contractors' crew is working two shifts on the 7th level of the Rambler-Cariboo, and is driving into Jennie ground, which was acquired a year and a half ago from the Alexander interests. Lack of water has made it necessary to work with hand drills, and progress is slow. Small bodies of milling ore are found at times. The labor situation is good.

Ainsworth—Several groups of lessees at the Florence mine have found themselves unable to market their output, owing to the value of their ore being chiefly in lead, with only a small amount of silver, which makes it difficult to dispose of profitably to American smelters, on account of increased freight rates. Such material could be shipped to the Trail smelters, but payment would be made only in "warehouse receipts," which are not accepted as negotiable paper by Canadian banks.

Slocan City—L. H. Bigger and L. McPhee, who have a lease and bond on Ottawa mine, expect to complete during 1921 the concentrator begun last year.

Trail—Ingot cake copper is being produced by the Consolidated. The rod mill is nearing completion, but it is stated that the company will not enter the wire production field. Unfavorable markets have resulted in an accumulation of metal. Unofficial estimates are that the value of the quantity on hand exceeds $1,000,000.

Penticton—At the annual meeting of the Associated Boards of Trade of Southern British Columbia held here during the last week in February, a resolution was adopted asking the Federal Government to purchase Canadian produced silver for two years at 80c. per ounce, and the minting of silver dollars.

MEXICO

Coahuila

Silver Currency Gradually Replacing Gold

Torreon—The gold coin which up to a few weeks past has been used almost exclusively as the circulating medium in Mexico is being gradually retired and supplanted by silver. Quite recently silver for small change was at a premium; some of the mining companies and haciendas were obliged to pay 5 or 6 per cent for silver money as small change in paying their help. Conditions are now being rapidly reversed and there is no doubt that there will be a big premium on gold within the very near future.

The Tres Estados Mining Company, operating in Coahuila, at a recent stockholders' meeting decided to levy an assessment of 50c. per share to defray current expenses for the ensuing year. Considerable development has been planned.

Pablo Neave has denounced several pertenencias in the San Lorenzo Mountains in the mining district of San Pedro.

Saltillo—The San Marcos Mining Co. at a recent meeting of stockholders in this city voted to increase its capitalization by issuing a third series of stock certificates to be sold at 25 pesos each. Ten pesos are to be paid down and the balance in three monthly installments of five pesos. The present holders of stock will be given preference is subscribing for the new issue.

Zacatecas

Zacatecas—The mines and machinery of the Cartagena y Anexas company are to be sold at public auction for indebtedness. The holdings of this company consist of two groups of mining properties, steam hoist, boilers, tools, cable, houses, etc.

CALIFORNIA

Activity in Plumas Copper Belt—Argonaut Mine Expected To Resume Production Soon

Engelmine—In spite of the low copper market, considerable activity prevails in this district. The Engels Copper Mining Co. is averaging 875 tons per day in its flotation mill. According to a recently issued report preliminary to the annual report, increased ore reserves have resulted from the development work and diamond drilling of 1920. In the underground orebreaking there is a constant gain in efficiency, this having registered over 100 per cent gain during the last five months as compared with the preceding seven months. At the Walker Mining Co. development continues, and it is reported that production may be resumed soon. The Mason Valley Mines & Smelter Co. is completing arrangements for work on its properties in the Plumas copper belt.

Sutter Creek—Local reports are that results of recent operations on the Old Eureka group by the Old Eureka Mining Co. are disappointing, and diamond-drill prospecting has now been started by the company in the hope of picking up an orebody. The Central Eureka has bonded the South Eureka.

Jackson—The Argonaut Mining Co., is making rapid progress toward rehabilitating its lower workings, and production, it is expected, will be resumed within a few weeks. The Kennedy has been unwatered to below its 3,600 level.

Grass Valley—Sinking of the main shaft of the Empire mines continues steadily. The 80-stamp mill is running to capacity, with ore from the lower levels of the Empire and Pennsylvania mines. The South Star mine, near Rough and Ready, has opened up an ore shoot recently, and preparations for further development are being made. Near Downieville, a rich gravel discovery has been made in the Mount Alta drift mine.

NEVADA

C. A. Heller Elected To Succeed Wingfield on Tonopah-Divide Directorate

Tonopah—In the Tonopah district no new discoveries are reported, with regular and satisfactory development performed. Practically all mines in the camp are operating full handed, which means production at the rate of about 35,000 tons of ore, with a gross value of over $600,000 per month. There is some activity in near-by districts, and prospectors are busy, but new finds of importance appear to be lacking. Lessees are operating the Cornforth and Sweet mine at Bellehelen, about 50 miles east of Tonopah, with fair results.

Divide—The regular annual meeting of the Tonopah Divide Mining Co. was held in Tonopah March 2. The only change in the directorate was the election of Clyde A. Heller, president of the Tonopah Belmont, to fill the vacancy caused by the resignation of George Wingfield. The officers of the company remained the same. No official report of mine conditions was made at this meeting.

Pioche—Ore shipments from Pioche for the week ended March 3 totaled 1,535 tons, the decrease being due to the temporary cessation of shipments by the Prince Consolidated. Virginia Louise shipped 715 tons, Bristol 365, Black Metals 205, Combined Metals 200, and Prince Con. only 50.

UTAH

Bingham Galena Mining Co. Organized—Utah Copper To Cut Dividend

Bingham Canyon — Directors of the Utah Copper Co. have decided to reduce the quarterly dividend to $1 a share.

Ground in Bingham lying between the Utah Copper and the United States companies' holdings, and covered by the Silver Shield, New York Bingham, and United Bingham, will probably be merged in a new company just incorporated, to be known as the Bingham Galena Mining Co. G. N. Lawrence is president of this new company.

ARIZONA

Developments at Kay Copper Property, 49 Miles North of Phoenix, Described by Company Engineer

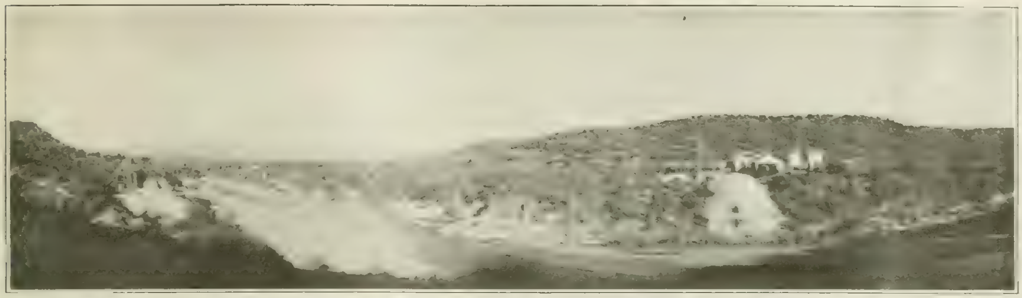
Canon — Work of installing electric power has recently been resumed at the property of the Kay Copper Co., in Yavapai County. J. R. Poss, engineer for the company, has prepared a résumé of the development work so far done by the company, the substance of which is given as follows:

The property is in Yavapai County, on the Agua Fria River, two miles north of the Yavapai-Maricopa county line. Canon, a mile distant, is the nearest post office, and Turkey, twenty-two miles northward, the nearest shipping point. The Phoenix-Prescott main highway passes within half a mile of the property, which is forty-nine miles north of Phoenix, or nearly half way between Phoenix and Prescott.

Low-lying hills of pre-Cambrian schist nestled against the massive granite of the Bradshaw Range a few miles to the west, and a broad fertile valley formed by the Agua Fria River to the east, furnish the setting for the property of the company. The elevation at the new shaft is approximately 1,900 ft.

The same broad belt of pre-Cambrian schist that has received its mineralization from the Bradshaws and its outlying phases at Jerome and also Mayer extends southward and likewise has been mineralized at Kay. Replacement has taken place chiefly in a quartz-sericite schist, believed to have been originally a quartz porphyry. A diorite mass, probably a part of the old pre-Cambrian complex, but less disturbed and inclined to be more massive, has intruded this and formed a structural basin. This diorite-schist contact strikes at an angle of 30 deg. oblique to the strike of the schist, and dips 74 deg. S.E., the schist dipping at about the same angle to the northwest. The diorite has thus formed a dam in the path of circulation of both ascending and lateral solutions, resulting in a roughly elliptical-shaped mineralized area, chiefly of iron pyrites, in which the copper orebodies occur in the form of lenses. The replacement, not being so complete in the main area as to have formed massive sulphides, resulted instead in a thorough dissemination.

A microscopic study of the various types of mineralization discloses the fact that the copper minerals, mainly chalcopyrite, have been introduced later than the iron pyrites. Erosion has followed faster than the processes of oxidation, leaching, and secondary enrichment. The ore is primary throughout and extends downward practically from the grass roots. Chalcopyrite forms the chief ore mineral associated with an appreciable percentage of tetrahedrite, in a gangue composed mainly of pyrite, quartz, and sericite, with calcite, barite, dolomite, and siderite. No high-temperature minerals are evident, which, together with the presence of the above gangue minerals, is rather indicative of the present develop-



VALLEY OF AGUA FRIA RIVER, FORTY-NINE MILES NORTH OF PHOENIX, ARIZ., SHOWING SHAFTS NOS. 1 AND 4 OF KAY COPPER CO. ON WEST (LEFT) AND EAST BANKS RESPECTIVELY

ment workings being in the upper or intermediate zones of deposition.

A typical cross-section of the orebodies shows solid bands of mixed chalcopyrite and pyrite from a fraction of an inch to 2 or 3 ft. in width, alternating with zones of impregnated schist. The sulphite bands themselves vary from being chiefly iron pyrites to those containing 24 per cent copper, the average probably being around 10 per cent copper. The average cross-section of the No. 1 orebody is, however, of slightly over 4 per cent grade. Post-mineral faulting has in places displaced the orebodies, and in the early days caused some confusion in the development of the property.

Prior to the organization of the present company, development work had been centered mainly on what is known as No. 1 shaft, located in the western portion of the main mineral area that lies adjacent to the diorite mass. The shaft had been sunk to the 350 level, and levels driven at the 85, 200, 250, 300, and 350-ft. points. Number three shaft, 2,100 ft. north of No. 1 shaft, had been sunk 180 ft., but was put aside for the more promising work at No. 1.

The work had been handicapped by the lack of the knowledge of existing geological conditions, especially the importance of the structural basin and its accompanying mineralized area, as well as the post-mineral faulting. With geological conditions and the systems of thrust faulting, which in the past had caused confusion, better understood, the present organization has been in a better position to carry on exploratory work.

Under the new management, No. 1 shaft was sunk to the 500 level, at which point considerable work was done. The orebody south of the shaft was drifted to as on the levels above. Upon reaching the fault, crosscutting with the foot wall revealed another orebody (No. 2) 15 ft. wide, and subsequent drifting across the fault picked up the displaced portion of the No. 1 orebody. Exploratory work on the north side of the shaft on the 500 level opened another lens 12 ft. wide, averaging 2.9 per cent copper, but has not been as yet satisfactorily developed elsewhere. The gold plus silver content of the ore averages close to $3; the silver $1.

The 600 level was selected as the place to concentrate further development and exploratory work. Here, as above, the No. 1 orebody was drifted to, the fault crossed, and the displaced portion picked up. The width on this level was 32 ft., widening to 40 ft. south of the fault. Considerable work was also done on the north side of the shaft, but revealed less promising ground than that south of the shaft.

Thirteen diamond drill holes, varying from 180 to 450 ft. in length, were drilled from the 600 level. Two of these holes were depressed to 45 deg., picking up the continuation of No. 1 and No. 2 orebodies, 120 ft. below the level. The rest were horizontal crosscut holes. Two such holes into the foot wall were drilled into the main mineral area, which lies mainly to the east of the No. 1 orebody, from which the holes were drilled, and showed promising mineralization for the entire distance of 450 ft. It is expected, from surface showing, that the mineralization continues on some distance further. Several interesting lenses were passed through within the area, one having a width of 40 ft.

The percentage of ore obtained was very low, averaging not over 18 per cent, due to the fissile, broken character of the schist, which also contained numerous faults resulting in caving in the hole. Sludge samples were taken every 5 ft., the slimes being collected alternately in large settling tanks. Owing to the numerous faults and cave-in spots in the holes, a large number of the sludge samples were diluted with cave material, which resulted in much uncertainty in regard to correct assay figures. It is also a question as to whether the ragged edges of the schist might not have produced riffles, causing some loss in the return of the sulphide. The sharp contrast in cutting the black sulphide bands against the light color obtained from the schist was of assistance in determining the nature of the ground cut. Drilling costs were low, for 3,000 ft. averaging $1.95 per ft., including the items of labor, carbon, power, supplies, and depreciation.

After considerable work had been done on the 600 level, increasing amounts of water and a plant unable to handle it, together with the disadvantages of the old prospect shaft, and the desire to explore the main area from a more advantageous point through a new and up-to-date shaft, led to the sinking of the new three-compartment vertical shaft. Before abandoning the old shaft, 140 ft. of drifting was done along the No. 1 orebody south of the fault, which, together with the 50 ft. north of the fault, totals 190 ft. now exposed, the southern limit still being undetermined. No. 2 orebody was shown to be in place by four crosscuts at intervals into the foot wall. The new shaft, being in an advantageous position for exploration of the main mineral area, has also been located with regard to future production of the known orebodies and those expected to be developed. Operations were suspended at the new shaft last summer pending installation of a branch power line and a new electrical compressor and hoisting plant. The installation is now completed, and sinking has been resumed, the present depth being 280 ft. The first development work will be done on the 800 level.

No. 3 shaft was sunk from 180 ft. to the 530 level, where some work was done. Operations, however, were suspended there to concentrate efforts on the more promising area at No. 1 and No. 4 (new) shafts.

George W. Long, instrumental in the discovery and success of the United Eastern, is president of the company. Parker Woodman, at one time prominent in the organization of the Copper Queen, at Bisbee, as general superintendent, has recently been given direct charge of the property, in view of probable operations on a large scale in the near future. John R. Poss, formerly in charge, continues as in the past as the company's engineer and geologist.

Cave Creek District—The Phoenix mine, belonging to the Bully Cave Co., in the Cave Creek district, is a very extensive low-grade gold property, which has had just sufficient enriched [illegible] small-scale operations. Such operations were [illegible] at considerable [illegible] compared with present methods of reducing low-grade gold ores. It can therefore be stated [illegible] of this property has been made by former operations.

As recently described in an article on the Cave Creek district by Alfred Strong Lewis, the deposits are in "the zone lying along the contact of the schist and the diorite and other igneous intrusions and in the western part of the mineralized section of the district, where there are several brecciated siliceous zones, from 50 to 300 ft. wide and of undetermined extent, which contain ore averaging $2 to $5 in gold per ton. Ore averaging as high as $12 per ton has been taken from narrower enriched channels within the main low-grade orebodies."

Bisbee—The Night Hawk Leasing Co. has made connection on its 650 level with the workings of the Boras Leasing Co. The latter company is now developing on its 700 level. During the last sixty days the shaft has been sunk 100 ft. from the 600 to the 700 level and the drift on the 700 level has been extended toward the ore country a distance of 300 ft. The Wolverine & Arizona has put on a night shift and is pushing development work.

NEW MEXICO

Work in Steeple Rock District Almost Entirely Suspended

Steeple Rock—The Steeple Rock mining district, in western New Mexico is twelve miles east of Duncan, Ariz. Nearly all work in this district has been suspended. The Norman King property is being worked by lessees. The values in the ore are chiefly gold and silver. The Carlisle mill was shut down last November. A complex ore containing lead, zinc, copper, gold, and silver was treated by concentration and flotation. The mine was kept unwatered up until the middle of February. The main shaft is down to the 500 level and a winze goes 135 ft. below this level. All rails, pipe, and the winze hoist were taken out, and pumping was discontinued the middle of February. The Nugget mine was worked until last June by lessees. The Silver Reef has not been worked since October, 1919. The Twin Peaks, Mount Royal, and Jim Crow, owned by G. F. Utter, of Long Beach, Cal., are shut down.

Lordsburg—The Co-operative mine is shipping another car of lead-silver ore to the El Paso smelter. Returns upon the car shipped in February ran 68.5 oz. silver, 9 per cent lead and $1.75 gold. A new 3½-ton truck has been purchased.

MINNESOTA

Mesabi Range

Alexandria at Chisholm Closed—Minnesota Steel Curtails—Mesabi Iron Co. Cuts Wages

Chisholm—The Alexandria mine has been closed. Curtailment of operation has been ordered at the Leonard No. 2, Leonard North Bank and Leonard South Bank.

Hibbing—The Mahoning Ore & Steel Co. has completed winter stripping at the Mahoning mine and [illegible] to do general repair work on the shovels.

The Winston-Dear Co. has been working all winter on its stripping contract at the Cleveland-Cliffs Boeing mine. Due to the mild winter this work was possible.

Marble—The equipment of A. Guthrie & Co. is rapidly being removed from the Danube mine and taken to the Hill-Trumbull mine, where the company have a large stripping contract.

Duluth — Curtailment has been inaugurated at the steel plant of the Minnesota Steel Co. Some men have been laid off and the plant put on a four-day-a-week basis.

Babbitt — The Mesabi Iron Co. has reduced wages. This reduction is in line with that made by all other operating companies on the various ranges of the Lake Superior district except the Oliver Iron Mining Co.

Eveleth — The Kingston Mining Co. has leased the Spring mine and the adjoining eighty acres to the north, known as the Silverton property. The Spring mine is partially developed as an open pit property and the present owners have explored and examined the properties to the extent that certain portions will be stripped and a washing plant erected. The properties lie near Mesabi station on the east end of the range.

Cuyuna Range

Kennedy Mine Cuts to Four Days Per Week

Crosby—The Rogers-Brown Ore Co. has suspended active mining operations at its Meacham mine, letting out from fifty to sixty men. A few mining crews were retained to continue development work on the 350 level.

The Armour No. 2 mine of the Inland Steel Co. has been closed indefinitely following a breakdown of hoisting engine equipment. This equipment will be thoroughly overhauled.

Robert M. Adams and associates of Duluth have taken a lease on the "Evergreen Forty," the SE¼ of SW¼ Sec. 2, 46-29. It is reported that a deal for sub-leasing the property is under way. This forty was drilled some years ago by the Roger Hill interests and a favorable tonnage of stripping ore developed.

Cuyuna—The Kennedy mine of the Rogers-Brown Ore Co., the only Cuyuna Range property now producing, has reduced its working schedule to four days per week.

Ironton—The George H. Crosby interests have three diamond drills operating on the NW¼ of SE¼ of Section 9, 46-29, check-drilling the Huntington mine orebody.

The new boiler plant of the Feigh mine, of M. A. Hanna & Co., was recently put in operation. The property is still idle, but steam is kept up for reserve pumping units.

Riverton — Foundations have been placed for a large machine and engine repair shop at the Sagamore mine, John A. Savage & Co. Construction will be of concrete and steel.

MICHIGAN

Menominee Range

Bengal Mine Closed—Fogarty on Half Time

Iron River—The Bengal Mine of the Pickands-Mather company has been closed, 300 men having been laid off. The Fogarty mine has been placed on half time and the Warner has stopped all work with the exception of the sinking of a shaft.

Marquette Range

Republic Mine Working Five Days Per Week

Republic — The Republic mine, the sole support of the village of Republic, is now working five days a week, with the men hoping this can be retained. The stockpiles are about filled and there is some apprehension that there may be a further decrease on this account before lake shipping starts. The Republic is working at the 20th level and is one of the deepest mines of this region.

The Michigan Verde Antique Marble Co. has added new channelers and is preparing for an active season. The product has credit for being the very finest in the verde antique list, surpassing that of Greece and Italy.

JOPLIN-MIAMI DISTRICT

Oklahoma-Kansas-Missouri

Central Relief Association Organized To Aid Unemployed Miners

Picher—With only about thirty-two mines operating where there were 125 six months ago, the problem of taking care of the unemployed miners in this district has been a difficult one this winter. Fortunately, mild weather has prevailed throughout. In the Picher camp the necessity for assistance has been greatest. It was taken care of by the local charity association until after Jan. 1, when help was asked. A Central Relief Association was thereupon organized, headed by F. C. Wallower, manager for the Golden Rod M. & S. Co., as chairman. This association, in the three weeks ended March 5, raised a total of $2,758.50 in cash, of which amount $1,010 was contributed by mining companies, $1,004 by employed miners, paying 25c. a week; and the remainder by mine supply houses and individuals. Up to the date mentioned, not quite $2,000 of the sum had been expended by way of payment for special road work in the field, the unemployed miners being given work at $2 a day. It was eagerly sought, and the plan has resulted in easing the situation and incidentally in vastly improving the roads in the camp.

Joplin — Several thousand dollars, raised by subscription, have been expended in Joplin, at the old Bullfrog mine, in an effort to recover the body of Riverton Hutchinson, who was drowned in the mine early in February. The draining work has been under the direction of Charles Keith, deputy state mine inspector, but up to date has proved in vain. It is feared the body may have been buried under considerable earth, and may never be recovered.

THE MARKET REPORT

Daily Prices of Metals

March	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
10	11.75	26.00	28.25	[illegible]	3.95@4.05	4.80
11	11.75	27.00	28.50	4.00	3.95@4.05	4.80
12	11.75	27.00	28.50	4.00	3.95@4.00	4.80
14	11.75	27.75	29.00	4.00	3.95@4.00	4.80
15	11.75	27.25	28.25	4.00	3.95@4.00	4.75
16	11.75	27.00	28.00	4.00	3.95@4.00	4.75

*These prices correspond to the following quotations for copper, "delivered": [illegible]

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

March	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
10	65⅞	66⅛	70	149½	153	[illegible]	19½	[illegible]	[illegible]
11	65¾	66¼	70	[illegible]	159½	[illegible]	19⅛	[illegible]	[illegible]
12									
14	[illegible]	[illegible]	70	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	70	157	160	[illegible]	19⅜	[illegible]	[illegible]
16	67⅛	66⅝	70½	153	156	[illegible]	[illegible]	25½	26⅛

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Mar.	Sterling Exchange	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	Mar.	[illegible]	[illegible]	Silver New York [illegible]	Silver London
10	[illegible]	99½	54½	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	54⅜	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33½
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

Metal Markets

New York, March 16, 1921

The market has again relapsed into its accustomed inactivity, the spurt in lead and tin which we mentioned last week having passed. Some small lots of all the metals have been sold to consumers, but buying has only been for immediate requirements, and no speculative activity has been in evidence. Reports from Washington state that thirty million pounds of cartridge cases have been sold to brass manufacturers in the Connecticut valley. This is the greater part of the scrap for which bids were recently asked, but which it was subsequently decided to sell privately. Settlement will be made on the basis of the market price of electrolytic copper in New York and lead in St. Louis. Some of the purchasers have had their requirements supplied from stocks of scrap for many months and have been almost entirely out of the market for virgin metal. It is encouraging to know that such scrap is gradually being consumed, but a fairly large amount is still said to be available in Europe. When these stocks are exhausted, and industrial activity begins to resume, the metal markets should be quick to respond, but when this will come cannot be predicted. Conditions are not yet at all encouraging.

Copper

[illegible] the current production of the four or five sellers who are willing to accept 12c. for their metal. Wire-drawers are the chief factors in the market. Should the demand increase, the price would almost certainly rise to the 12¾@13c. level of the large producers. As it is, copper for even second-quarter delivery can be obtained at the 12c. price. We have heard of one sale of a small quantity of copper for immediate delivery at 11⅞c. delivered, but as practically all of the business was done at the higher level we are not including it in our quotation. Foreign demand is poor, though some cash business has been done with Germany.

Lead

The official price of the American Smelting & Refining Co. continues at 4c., New York and St. Louis, and lead is being freely offered to responsible customers, for immediate shipment, at this figure.

The buying movement which took place during the first ten days of March is no more, and inquiries have been few. A local electrical company purchased a fair tonnage for forward delivery during the week, but most of the orders were only for carload lots. In general a small premium is being asked for April, May, and June lead; and some sellers are unwilling to go beyond April. Chemical lead continues to be quoted at 25@45 points premium. Cable manufacturers seem to be the most active consumers of lead at present. Quotations by metal-trade papers continue to be about 25 points above the market and are evidently made to assist dealers who laid in stocks around 4.75c.

A disposition exists in some quarters to allow foreign lead to come into the country and thus stabilize the world market as soon as possible. This would take place should the domestic price be much higher, as London parity is about [illegible], New York.

The statistical position of lead is none too good and seems to be getting worse, reliable figures indicating considerable stocks and current consumption less than production.

Zinc

The market both in London and St. Louis [illegible] rise reported last week has been almost entirely lost. Sales were light, as has been the case for months. It is reported that one sheet mill which [illegible] asked why purchases were being made, replied that although it was shut down, the price looked attractive enough to warrant accumulating a stock. The [illegible] tionably bargains, and when industrial activity begins to appear it is likely that this metal will be one of the first to strengthen. Zinc can today be obtained in St. Louis at 4.70@4.80c.; high-grade, 7c. delivered at Eastern points.

Tin

Demand for tin has fallen away, and no immediate resumption is expected, as consumers were tempted by the recent low prices to buy beyond their immediate requirements. Tin of the 99 per cent grade seems to have been a little oversold, and some sellers have not been anxious to book further business.

Straits tin for future delivery: March 10th, 28.50@29c.; 11th, 28.50@29.25c.; 12th, 28.50@29.25c.; 14th, 29.25@29.75c.; 15th, 28.25@28 75c.; 16th, 28.50@29c.

Arrivals of tin, in long tons: March 7th, Australia, 25; 11th, London, 75; 14th, Straits, 300; 15th, London, 75; Hongkong, 50.

Silver

Since our last report, continued buying on the part of the Indian bazaars and spasmodic buying for China account have advanced the London price to 33½d. At this higher level China again turned seller, with the result that spot silver in London broke sharply today to 32½d. In the absence of any special buying orders our local market has followed closely the London price, the New York quotation reaching a high of 57½c. on March 14. The Frisco market is a purely nominal one.

Mexican Dollars.—March 10th, 41¾; 11th, 41¾; 12th, 42⅞; 14th, 43¾; 15th, 43¾; 16th, 42½.

Gold

Gold in London: March 10th, 105s. 7d.; 11th, 105s. 3d.; 14th, 105s. 2d.; 15th, 105s. 6d; 16th, 105s. 1d.

Foreign Exchange

Rates on China and India have shown an upward tendency, which should encourage silver producers. On Tuesday, March 15th, francs were 6.99c.; lire, 3.69c.; and marks, 1.59c. New York funds in Montreal, 14⅝ per cent premium. Canadian exchange continues to show no improvement.

Other Metals

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 24@25c. per lb. Market quiet.

Antimony — Chinese and Japanese brands, 5⅛@5¼c.; market quiet. W.C.C. brand, 5¾@6c. per lb. Cookson's "C" grade, spot, 9⅜c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony (200 mesh), 6½@6¾c. per lb. Demand light, with heavy supplies available.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 7c.

Bismuth—$1.50@$1.65 per lb., 500-lb. lots. London price reduced Feb. 12 from 12s. 6d. to 7s. 6d., accompanied by a decline here.

Cadmium—Nominal, $1.30 per lb., in 1,000-lb. lots.

Cobalt—Metal, $4.50 per lb.; black oxide, $3@$3.10 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $250@$300 per oz.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 38@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—$72@$75 per oz. Steady.

Quicksilver—Nominally, $46@$47 per 75-lb. flask. San Francisco wires $45.50. Market dull.

[1]**Rhodium**—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 45@50c. per long ton unit, f.o.b. Atlantic ports.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $7.45; Mesabi bessemer, 55 per cent iron, $7.20; Old Range non-bessemer, 51½ per cent iron, $6.70; Mesabi non-bessemer, 51½ per cent iron, $6.55.

Magnetite Ore, f.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5.80; old bed concentrates, 63 per cent, $6.70; Harmony, cobbed, 63 per cent, $6.70; new bed low phosphorus, 65 per cent, $9.50.

Manganese Ore—35@40c. per unit, seaport; chemical ore (MnO_2) $60 per gross ton, lump; $70@$75 per net ton, powdered. Market dull.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¾@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., March 12—Zinc blende, per ton, high, $24.95; basis 60 per cent zinc, premium, $22.50; Prime Western, $21; fines and slimes, $20@$17.50; average settling price, all grades of zinc, $23.

Lead, high, $43.45; basis 80 per cent lead, $35 buying and $45@$35 settling; average price, all grades of lead, $39 per ton.

Shipments for the week: Blende, 4,495; lead, 551 tons. Value, all ores the week, $124,980.

Until Thursday noon $21 basis was the highest offering, but that price was buying very little ore. Then 500 tons was purchased $21.50, following which several thousand tons was purchased $22.50 basis up to noon Saturday.

The Grasselli Chemical Co., out of the market since last August, is again purchasing. It is reported the smelter has not been restarted, but the ore was purchased for acid, following treatment for which it will be stocked at the smelter. Production of blende continues 2,000 to 2,500 tons larger than the average demand, but active buying this week advanced sales to a figure approximately 1,000 tons in excess of the week's output.

Platteville, Wis., March 12—No market for zinc or lead ore. Shipments for the week: Blende, 772 tons. Shipments for the year: Blende, 7,965; lead, 510 tons. Shipped during the week to separating plants, 308 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $2,000@$3,000; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b.. South Carolina points. Foreign barytes, prime white material, $25 per net ton f.o.b. Atlantic seaports. Western grades, $24.50. Demand is dull.

Chalk—English, extra light, 5@5½c. Domestic light, 4½@5c.; heavy, 4@4½c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$10; washed, $10@$12; powdered, $15@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $15@$20, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30;

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

imported lump, $15@$25, f.o.b. American ports; powdered, $35@$45, f.o.b. New York.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $25 per ton, f.o.b. Illinois mines, and $25, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, $60; lump, $17.50, f.o.b. Heathden, N. M. In Canada 85 per cent calcium fluoride sells for $20 per ton, f.o.b. Madoc; output limited. Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines.

Fuller's Earth—$16 per ton, carload lots, f.o.b. mines.

Graphite—Ceylon lump, first quality, 8@9c. per lb.; chip, 7c.; dust, 5½c. No. 1 flake, 7c.; high-grade amorphous crude, 3c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$2 per net ton; 1½ in., $1.50@$2. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — High - grade caustic calcined, lump form, $30@$35 per ton, carload lots, f.o.b. California points. In Chicago district, $57.70; Atlantic seaboard, $60.

Dead - Burned — $38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); all f.o.b. New York.

[1]**Monazite**—Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock Domestic demand weak; movements of stocks into consuming channels reported slow. Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $8.35; 68 per cent, $7.85; 68@66 per cent, $7.60.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 16c., c.i.f. Atlantic seaport; furnace size, 16½c.; Spanish lump, 14@15c.; domestic fines, f.o.b. mines, Georgia, 12 @ 14c.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$40, talcum powder grade. Southern talc, powdered, carload lots, $10@$14 per ton; less than carload, $25, f.o.b. cars; freight to New York $5.25 per ton, carload lots; less than carload lots, $9.25. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 9@10c. per lb. in carload lots. Usual spring demand is not being felt for insecticides. Supplies are plentiful and market is dull.

Sodium Nitrate—$2.85@$3 per cwt. ex vessel, Atlantic ports. Market quiet.

Sodium Sulphate—For 95 per cent material, $20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; $30 per ton, New York.

Potassium Sulphate—Domestic, $220@$230 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 15c. per lb. of chromium contained; 4 to 6 per cent carbon, 14½c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $90@$95, f.o.b. furnace; resale, $90, delivered; English, $90@$95, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $35@$40, f.o.b. furnace.

[1]**Ferromolybdenum**—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $55@$60; 50 per cent, $85@$90; 75 per cent, $145@$150.

Ferrotungsten—Domestic, 70 to 80 per cent W, 50@55c. per lb. of contained tungsten, f.o.b. works. Foreign, 60c.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—Basis 30 to 40 per cent, $5 per lb. of V contained, plus 75c.@$2 differentials and according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York list price, 20¼@20¾c. per lb.; wire, 15@15½c.

Lead Sheets—Full lead sheets, 8c.; cut lead sheets, 8½c. in quantity, mill lots.

Nickel Silver — 33½c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets, 18¾c.; sheathing, 17¾c.; rods, ⅝ to 3 in., 15¾c.

Zinc Sheets—$11 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $80 per net ton, shipping point; arches, keys, wedges, $85; splits, soaps, $100.

Fire Brick—First quality, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $45@$50.

Magnesite Brick—9-in. straights, $90@$100 per net ton; 9-in. arches, wedges and keys, $105; soaps and splits, $120.

Silica Brick—9-in., per 1,000: $45@$55 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, March 15, 1921

Production of steel continues to decline, the rate now being about 40 per cent of capacity, against about 80 per cent during the period of high pressure in 1920, when there was apparently demand for more than could be produced, output then being limited by transportation conditions and other influences. The Steel Corporation's rate has declined to about 60 per cent of capacity, and independent production shows little variation, being about 25 per cent of capacity.

The Steel Corporation has not reduced its prices and shows no intention of doing so in the near future. Extreme prices quoted by independents on the various finished steel products show hardly any further decline, except in sheets, which have declined, for ordinary orders, to 3c. for blue annealed, 4c. for black, and 5.10c. for galvanized. There is a slight improvement in the volume of buying of steel products.

Pig Iron—Foundry iron has declined another 50c., the Standard Sanitary Manufacturing Co. having bought 1,000 tons on the basis of $26, Valley. At the same time the company bought for its Louisville plant 500 tons of Virginia iron at $26, furnace, and 500 tons of Birmingham iron at $25, furnace. Bessemer and basic remain nominally [illegible] and $25, Valley. A broker has [illegible] of basic at about [illegible] Valley, but no regular supplies are [illegible] price.

Coke

Connellsville—Furnace, [illegible] $4.50, foundry, $5.7[illegible]

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

The Copper Situation in Germany

Special Report From Our Vienna Correspondent

OF THE copper mined by the world during the period 1879 to 1913, Germany contributed about 4 per cent. Concerning the consumption of copper, the German brass and copper fabricators, and particularly the German electrical industry, although producing chiefly for home markets, always have manufactured a considerable quantity of copper for export. For example, 1913 statistics show that the copper exported in German wires and cables exceeded the imported copper by 27,118 tonnes. Naturally the major part of this was consumed by those German concerns manufacturing electrical goods—Allgemeine Elektricitätsgesellschaft, the Siemens-Schückert, and the Lahmeyer-Felten-Guilleaume companies. English electrical and other copper-fabricating industries were wholly unable to keep up with this German development.

Today general consumption of copper by Germany is down to barely more than half of that of the last antebellum year, because of the present production crisis, the coal shortage, and the continual labor difficulties.

In Germany at the outbreak of war copper cost about 114 marks per 100 kg., but during the war a maximum price was fixed. After this was removed on Nov. 1, 1919, official trade prices were reported, and the price of electrolytic copper rose to about 4,700 marks in the middle of February, 1920. Soon thereafter the demand for raw material changed into an offering of raw materials.

After the close of the Spa conference the world's markets waited in vain for large German buying orders for copper. As the freight from New York to Hamburg was not less than $15 per tonne, and even from London to Hamburg was 30s., it was to be expected that German metal products containing considerable copper would be higher priced on the world market than American, at least by the amount of the heavy freight rate plus insurance and costs. This circumstance carried all the more weight, as the German price of copper was already considerably above the world-market par. Subsequently a very pleasing marked decrease in international freight rates occurred. Furthermore, the summer saw a decrease in the export business in most branches of industry, owing to the rise in German exchange. As a result of the market conditions mentioned, the German quotation on electrolytic was 2,655 marks in the middle of April, fell to 2,088 marks by the middle of May, and to 1,609 marks by the end of that month. Since then, within the limits of fluctuations in exchange, the quotations have remained at about 2,000 marks. Taking into account the risks necessarily associated with the purchase of copper and sales of fabrications, the present increased price of the electrical manufactures involved, as compared with pre-war prices, corresponds to the rise in the price of copper.

Naturally, the copper-producing countries suffer most from the fall in the price of copper, although because they have large export trade balances their exchange rate is high. Germany, however, could derive but a disproportionately small advantage from the fall in international prices, or none at all, by reason of the continued decline in the exchange rate. On the other hand, the copper-producing countries may have laid up sufficient reserves during their high-level period in the war to tide over this inevitable reaction, whereas low German exchange presents a not inconsiderable export premium for German export business.

Under the persisting inflation and existing economic situation, which precludes a fall in prices for the German consumer in the international markets, even the granting of American credits would scarcely put Germany in a position to import very much more copper. Therefore it seems that in view of America's dominant position in copper it would be more appropriate to make foreign loans in copper than in money, the copper to be manufactured and then reexported, thus escaping the risk of exchange and transportation in the far from adequately traveled path of manufacturing credits. At present the world crisis seems to be increasing, so that it is likely we shall have to reckon with later effects on the copper market.

Metal, Mineral, and Ore Prices During 1920

	Place	Jan. 2	High		Low		Dec. 31
[illegible]	New York	33	35.1	Aug.-Sept.	28 4	Dec.	28 4
Antimony, Chinese ordinary, c. per lb.	New York	9 825	11 75	Feb. 13-25	5 325	Dec. 23-31	5.325
[illegible]	New York	2 65	2 85	May-June	2 40	Nov.-Dec.	2 40
[illegible]	Joplin, Mo.	59 60	61 50	Jan. 15-21	35 25	Dec. 2-8	36.95
[illegible]	Platteville, Wis.	55.50	61 00	Jan. 8-14	37 00	Dec. 16-22	No mkt.
[illegible]	New York	1 45	1 45	Jan.-Nov.	1 40	Dec.	1 40
[illegible]	Joplin, Mo.	35 00	39 35	May 13-19	20 00	Dec.	20 00
[illegible]	New York	18 725	19 05	Jan. 8-14	12 125	Dec. 31	12 125
[illegible]	New York	28 50	33 50	Aug.	21 50	Dec.	21.50
Copper, wire, c. per lb.	New York	22 75	32 50	July	16 50	Dec.	16 50
Copper, spot, standard, £ per long ton	London	116	122	Feb. 25	71 75	Dec. 31	71 75
[illegible]	London	118 25	124 5	Feb. 25	72 25	Dec. 29	72 875
Copper, spot, electrolytic, £ per long ton	London	124	128	Feb.-Mar.	80	Dec. 30-31	80
[illegible]	New York	145	250	Apr.-May	122 50	Dec.	122 50
[illegible]	London	109	127 4	Feb. [illegible]	102 7	Apr. 9	116 1
[illegible]	New York	300	425	Oct.	300	Jan.-July	325
Iron, basic, pig, $ per ton	Valley	35 50	48 50	Sept.	30	Dec.	30
Iron, bessemer, pig, $ per ton	Valley	36 50	48 50	Sept. [illegible]	32	Dec.	32
Iron, foundry, pig, $ per ton	Valley	38 50	[illegible]	Aug.-Oct.	33	Dec.	33
[illegible]	New York	8 25	9 375	Jan. 12-13	4 50	Dec. 15-22	4 75
[illegible]	St. Louis	8 00	9 0625	Mar. 4-11	4 50	Dec. 18-22	4 65
Lead, spot, £ per long ton	London	45 75	52 375	Feb. 19-20	21 50	Dec. 16-23-28	23 50
[illegible]	London	46 25	53 375	Feb. 19-20	22 50	Dec. 22	24 25
Lead, ore, high, $ per ton	Joplin, Mo.	93 65	115 60	Oct. 14-20	58 05	Dec. 30-31	58 05
Lead, ore, 80 per cent, $ per ton	Joplin, Mo.	92 50	111 25	Sept. 2-8	51 25	Dec. 16-31	51 25
[illegible]	Platteville, Wis.	87 00	110	Sept. 2-8	75	Oct. 7-20	No mkt.
[illegible]	[illegible]	75	100	July [illegible]	[illegible]	[illegible]	57 [illegible]
[illegible]	New York	43	[illegible]	Jan.-Dec.	[illegible]	Jan.-Dec.	43
[illegible]	New York	[illegible]	45	Jan.-Dec.	[illegible]	Jan.-Dec.	[illegible]
[illegible]	[illegible]	[illegible]	3 925	[illegible]	[illegible]	[illegible]	[illegible]
Platinum, $ per troy oz	New York	[illegible]	[illegible]	Jan.-Feb.	[illegible]	Dec.	75
[illegible]	[illegible]	[illegible]	17 50	Aug.-Sept.	[illegible]	[illegible] 22-28	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	Apr. [illegible]	[illegible]	[illegible]	[illegible]
[illegible]	San Francisco	[illegible]	[illegible]	Apr.-May	[illegible]	[illegible] 16-22	[illegible]
[illegible]	New York	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	130 5	[illegible]	[illegible]	[illegible]	[illegible]	64 25
[illegible]	London	75 875	89 50	Feb. [illegible]	[illegible]	[illegible]	40 875
[illegible]	Furnace	[illegible]	83 75	Oct. [illegible]	[illegible]	[illegible]	60
Sterling Exchange, c. per £	[illegible]	377 5	403 25	Apr. [illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	18
[illegible]	[illegible]	[illegible]	63 75	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	London	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Dec. [illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]-June-July	[illegible]	Dec. [illegible]	[illegible] 50
[illegible]	St. Louis	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] 1-27	[illegible]
Zinc, spot, £ per long ton	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	London	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	New York	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

COMPANY REPORTS

Portland Gold Mining Co.'s Surplus Decreases

Gold; Colorado

The twenty-seventh annual report of the Portland Gold Mining Co. for the calendar year 1920 states that the gross value of the ore mined and shipped amounted to $887,533.04, and that the values recovered by mills totaled an additional $663,107.62. Net cost of mining and milling was $1,474,100.35, leaving a net profit of $76,540.31 from the operation of mines and mills.

Cash receipts totaled $1,309,024.28, and disbursements, including a dividend of $195,000, amounted to $1,359,759.48. Surplus balance on Jan. 1, 1920, stood at $103,087.85; on Jan. 1, 1921, at $52,352.95.

Profit and loss account follows:

Debits		
Net profit from operation		$76,540.31
Interest on bank balances		1,354.09
Interest on corporation bonds owned		300.00
Interest on bills receivable		2,380.00
Interest on open accounts		1,493.38
Interest on Liberty bonds		942.04
Discount		998.46
Registration fees		25.10
Net loss to surplus		442,094.72
Total		$526,128.10
Credits		
Interest on notes payable		$ 187.[illegible]
Discount on Liberty bonds sold		1,62[illegible]
Depreciation:		
Permanent equipment	$27,648.64	
Independence mill	92,390.73	
Furniture and fixtures	333.78	120,373.15
Depletion		199,059.10
Loss on sale of Colorado Springs mill		119,362.86
Loss on sale of Victor mill		85,516.16
Total		$526,128.10
Surplus balance Jan. 1, 1920		$819,531.97
Net loss for 1920	$442,094.72	
Dividends	195,000.00	637,094.72
Surplus balance Jan. 1, 1921		$182,437.25

Exploration Company Earns Substantial Profit

Gold; Mexico

A report of the Exploration Company, Ltd., for the year ending Dec. 31, 1920, shows a net realized profit of £57,162 2s. 5d., which, added to the balance of £87,384 10s. 4d., brought forward from the preceding year, makes a total of £144,546 12s. 9d. to the credit of profit and loss account. From this sum £20,000 has been deducted to provide for depreciation on the company's investments, and out of the remaining £124,546 12s. 9d. the directors have recommended the payment of a dividend of 10 per cent, being 1s. per share, free of income tax, leaving a balance of £87,046 12s. 9d. to be carried forward.

The shares and interests of the company in various subsidiary and other companies stand in the balance sheet at £266,5[illegible] 4s. 2d., being their value on Dec. 31, [illegible] at market price for quoted and the directors' valuation for unquoted securities. The appreciation in value of the American dollar early in the year enabled the directors to [illegible] of nearly all of the company's investments in the United States to advantage.

The subsidiary companies in the United States and Mexico have maintained operations [illegible] but net results have been adversely affected by the increased cost of labor and supplies, [illegible] conditions, and the fall in the prices of silver and lead. The [illegible] Mining Co. in Mexico has made an issue of [illegible] notes to provide funds for carrying out an extensive scheme of development, and this company [illegible] the issue.

New Idria Quicksilver Has Large Deficit

The annual report of the New Idria Quicksilver Mining Co. for the year 1920 states that the company has passed through the most serious period since its incorporation. During the early part of the year the outlook was promising. On June 20, a fire destroyed a large portion of the plant, warehouse, supplies, and a large amount of quicksilver in process. The heavy expenses during reconstruction, with no production for several months, used up available cash assets, and with a stagnant market and the low price of quicksilver in the fall, the plant, which had been running at partial capacity in September and October, was closed down on Nov. 1, and all expenses were reduced to a minimum.

The low price of quicksilver prevailing since September was caused by the dumping of large quantities of foreign quicksilver from Europe, over 16,000 flasks having been imported in 1920, against a normal import of 6,000 flasks. Some of this imported quicksilver has been sold as low as $35 per flask. These large importations, and low prices, which are much below the cost of American production, demoralized the home market, and resulted in closing down not only the company's mine but nearly every other quicksilver property in the United States.

It was deemed expedient to consent to the appointment of a receiver in order to preserve the assets and property of the company in behalf of the creditors and the stockholders and await a more favorable time to re-finance. James D. Colt, of Boston, was appointed receiver on Dec. 20, 1920.

The indebtedness of the company, as shown on the balance sheet, will have to be liquidated before the receivership can be terminated and the company placed in a position to operate. It will therefore be necessary to re-finance the company if it is to continue as an operating company.

The condensed balance sheet of Dec. 20, 1920, follows:

ASSETS	
Plant	$685,470.6[illegible]
Mine development	3,38[illegible],108.[illegible]
Cash	11,[illegible]03.08
Accounts receivable	2,07[illegible]
Quicksilver and supplies	163,[illegible]
Deficit	29[illegible],363.0[illegible]
	$4,[illegible]43,826.2[illegible]
LIABILITIES	
Capital	$500,000.00
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	210,[illegible]
	3,818,315.14
	$4,[illegible]

Montana-Bingham Consolidated Mining Co.

Copper, Lead; Utah

A report of operations of the Montana-Bingham Consolidated Mining Co. for the year ended Dec. 31, 1920, states that production amounted to [illegible] lb. copper, [illegible] lb. lead, [illegible] oz. silver, and [illegible] oz. gold, from a total shipment of 1,660.6 tons of copper and lead ore. Smelter returns amounted to $[illegible]. Operating profit and loss statement follows:

[illegible]

Surplus balance on Dec. [illegible]

MINING STOCKS

Week Ended March 12, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Adventure	Boston	*70	*65	*65	....	
Ahmeek	Boston	48	47	47	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	$\frac{9}{16}$	⅜	½	....	....
Allouez	Boston	21½	21	21	Mar. '19	1.00
Anaconda	New York	38½	34¼	35⅜	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2½	2½	2½	....	
Ariz. Com'l.	Boston	8½	8	8	Oct. '18,	.50
Big Ledge	N. Y. Curb	$\frac{5}{16}$	¼	$\frac{5}{16}$	....	
Bingham Mines	Boston	8¼	8¼	8¼	Sept. '19, Q	25
Calumet & Arizona	Boston	47	45	45	Dec. '20, Q	1.00
Calumet & Hecla	Boston	237	225½	227	June '20, Q	5.00
Canada Copper	N. Y. Curb			*13	....	....
Centennial	Boston	9	9	9	Dec. '18, SA	1.00
Cerro de Pasco	New York	27⅛	23	24¼	Mar. '21, Q	.50
Chile Copper	New York	11¼	9	9¾	....	....
Chino	New York	21¼	19¾	20	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	30	30	*30	....	....
Con. Arizona	N. Y. Curb	....	....	$\frac{1}{16}$	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	2	1¼	1⅞	....	....
Copper Range	Boston	34¼	31¼	32½	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*36	*30	*31	....	....
Davis-Daly	Boston	6¼	5¾	5¾	Mar. '20, Q	.25
East Butte	Boston	8½	8	8⅛	Dec. '19, A	.50
First National	Boston Curb	*85	*75	*75	Feb. '19, SA	.15
Franklin	Boston	....	....	2¼	....	....
Gadsden Copper	N. Y. Curb			*25	....	....
Granby Consol.	New York	18¼	18¼	18¼	May '19, Q	1.25
Greene-Cananea	New York	21½	18¼	18¼	Nov. '20, Q	.50
Hancock	Boston	3	3	3	....	....
Howe Sound	N. Y. Curb	2⅝	2⅛	2¼	Jan. '21, Q	.05
Inspiration Consol.	New York	33⅞	29⅝	30⅝	Oct. '20, Q	1.00
Iron Cap	Boston Curb	6⅛	6	6	Sept. '20, K	.25
Isle Royale	Boston	20	20	20	Sept. '19, SA	.50
Kennecott	New York	17⅝	16	16¼	Dec. '20, Q	.50
Keweenaw	Boston	....	....	1½	....	....
Lake Copper	Boston	3	2½	2½	....	....
La Salle	Boston	2¼	2¼	2¼	....	....
Magma Chief	N. Y. Curb	...	...	*21	....	....
Magma Copper	N. Y. Curb	21	18½	18½	Jan. '19, Q	.50
Majestic	Boston Curb	....	....	*10	....	....
Mason Valley	Boston	1½	1¼	1¼	....	....
Mass Consolidated	Boston	2¼	1⅞	1⅞	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	4⅛	3¾	3¼	....	....
Miami Copper	New York	18¼	16½	16⅝	Feb. '21, Q	.50
Michigan	Boston	2⅞	2⅞	2⅞	....	....
Mohawk	Boston	48	45	46	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5¼	5	5	....	....
Nevada Consol.	New York	10¼	9⅛	9¼	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3	....	....
New Cornelia	Boston	14	13½	14	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb			*5	....	....
North Butte	Boston	11	9⅞	10¼	Oct. '18, Q	.25
North Lake	Boston	*25	*25	*25	....	....
Ohio Copper	N. Y. Curb			$\frac{9}{16}$	....	....
Old Dominion	Boston	18½	17	17	Dec. '18, Q	1.00
Osceola	Boston	27	25	25	June '20, Q	.50
Phelps Dodge	Open Mar.	†180	....	....	Jan. '21, Q	2.50
Quincy	Boston	40	38	38	Mar. '20, Q	1.00
Ray Consolidated	New York	12¼	11	11⅛	Dec. '20, Q	.25
Ray Hercules	Boston Curb	*50	*25	*25	....	....
St. Mary's Min. Ld.	Boston	30½	28½	30	June '20, K	2.00
Seneca Copper	Boston	15¼	12⅞	13	....	....
Shannon	Boston	1	1	1	Nov. '17, Q	.25
Shattuck Arizona	New York	6¼	5½	5½	June '20, Q	.25
South Lake	Boston	1½	1⅜	1½	....	....
Superior Copper	Boston	.	....	4	Apr. '17,	1.00
Superior & Boston	Boston	2	1¾	1¾	....	....
Tenn. C. & C. cfs.	New York	8½	7	7½	May '18, I	1.00
Tuolumne	Boston	*50	*50	*50	May '13,	.10
United Verde Ex.	Boston Curb	27	24	25	Feb. '21, Q	.50
Utah Consol.	Boston	4½	4¼	4½	Sept. '18,	.25
Utah Copper	New York	51	46½	47¼	Dec. '20, Q	1.50
Utah M. & T.	Boston	1½	1⅛	1¼	Dec. '17,	.30
Victoria	Boston	1¼	1	1½	....	....
Winona	Boston	*50	*50	*50	....	....
Wolverine	Boston	11½	11¼	11½	....	....
		NICKEL-COPPER				
Internat. Nickel	New York	15¼	13½	14	Mar. '19,	.50
Internat. Nickel, pf.	New York	80	80	80	Feb. '21, Q	1.50
		LEAD				
National Lead	New York	72	70¼	71	Dec. '20, Q	1.50
National Lead, pfd.	New York	....	....	105	Dec. '20, Q	1.75
St. Joseph Lead	New York	11¼	11¼	11½	Dec. '20, QX	.50
Stewart Mining	Boston Curb			*6	Dec. '15,	.05
		ZINC				
Am. Z. L. & S.	New York	8½	8	8	May '20,	1.00
Am. Z. L. & S., pfd.	New York	28	26	26	Nov. '20, Q	1.50
Butte C. & Z.	New York	[illegible]	4	4	June '18,	.50
Butte & Superior	New York	12½	10½	10½	Sept. '20,	1.25
Callahan Zn-Ld	New York	[illegible]	4¼	[illegible]	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb	[illegible]	139	139	Feb. '21, Q	2.00
Success	N. Y. Curb	*4	*2	*4	Jan. '16,	.03
Yellow Pine	Los Angeles	[illegible]	*40	*50	Sept. '20, Q	.03

Stock	Exch.	High	Low	Last	Last Div.	
		GOLD				
Alaska Gold	New York	1¼	1	1	....	..
Alaska Juneau	New York	1	1⅛	1½	....	..
Carson Hill	N. Y. Curb	....	....	22½	....	....
Cresson Consol. G.	N. Y. Curb	1¼	1$\frac{3}{16}$	1$\frac{1}{16}$	June '20, Q	$0.10
Dome Extension	Toronto	*53	*53	*53		
Dome Mines	New York	15⅝	14½	15¼	Jan. '21, Q	.25
Golden Cycle	Colo. Sprgs.	†*66	†*64	*65	Dec. '20, Q	.02
Goldfield Consol.	N. Y. Curb	*9	*7	*8	Dec. '19,	.05
Hollinger Consol.	Toronto	6.65	6.65	6.65	Feb. '21, M	.05
Homestake Mining	New York	50½	50	50½	Sept. '19,	.50
Kirkland Lake	Toronto	*50	*49	*49	....	....
Lake Shore	Toronto	..		1.16	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	1.99	1.99	1.99	Jan. '21, K	.05
Porcupine Crown	Toronto			*21	July '17,	.03
Portland	Colo. Sprgs.	*45	*44	*45	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*5½	*4	*5	May '19,	.05
Silver Pick	N. Y. Curb	*6½	*5	*6	....	....
Teck Hughes	Toronto	*10	*9	*10	....	....
Tom Reed	Los Angeles	1.28	1.15	1.20	Dec. '19,	.02
United Eastern	N. Y. Curb	2	2⅜	2½	Jan. '21, Q	.15
Vindicator Consol.	Colo. Sprgs	†*20	†*18	*19	Jan. '20 Q	.01
West Dome Consol.	Toronto	*7	*6	*6¼	....	....
White Caps Mining	N. Y. Curb	*10	*8	*8½	....	....
Yukon Gold	N. Y. Curb	1¼	1	1	June '18,	02½
		SILVER				
Arizona Silver	Boston Curb	*17	*13	*14	Apr. '20, M	.03
Batopilas Mining	New York	¾	¾	¾	Dec. '07, I	.12½
Beaver Consol.	Toronto	*39	*38	*38¼	May '20, K	.03
Coniagas	Toronto	2.00	2.00	2.00	Nov. '20, Q	12½
Crown Reserve	Toronto	*16	*16	*16	Jan. '17,	.05
Kerr Lake	Boston	2¾	2⅝	2¾	Jan. '21, Q	.12½
La Rose	Toronto	*24	*22	*23	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto		.	*30	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.05	*95	*95	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	8	7	7⅝	Jan. '21, QX	.50
Ontario Silver	New York	4⅞	4½	4⅞	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	1⅝	1½	1$\frac{9}{16}$	Jan. '12,	10
Peterson Lake	Toronto	*9	*9	*9	Jan. '17,	.01¼
Temiskaming	Toronto	*25	*25	*25	Jan. '20, K	.04
Trethewey	Toronto	*16	*16	*16	Jan. '19,	.05
		GOLD AND SILVER				
Atlanta	N. Y. Curb	*2	*1	*2	....	....
Barnes-King	Butte	‡	....	1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*70	*64	*70	....	....
Cashboy	N. Y. Curb	*8	*6	*7½	....	....
El Salvador	N. Y. Curb	$\frac{5}{16}$	¼	¼	....	....
Jim Butler	N. Y. Curb	*16	*15	*16	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*9	*7	*9	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	¼	....	....
MacNamara M. & M.	N. Y. Curb	*15	*14	*14	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1⅝	1½	1$\frac{9}{16}$	Jan. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1⅜	1$\frac{1}{16}$	1$\frac{5}{16}$	....	....
Tonopah-Extension	N. Y. Curb	1	1⅜	1$\frac{7}{16}$	Jan. '21, Q	.05
Tonopah Mining	N. Y. Curb	1⅝	1⅝	1⅝	Oct. '20, SA	.05
West End Consol.	N. Y. Curb	1$\frac{1}{16}$	⅞	1	Dec. '19, SA	.05
		SILVER-LEAD				
Caledonia	N.Y. Curb	*13½	*11	*11½	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	1.15	1.10	1.10	Dec. '20,	.15
Chief Consolidated	Boston Curb	2$\frac{11}{16}$	2⅜	2⅜	Feb. '21, Q	.05
Consol. M. & S.	Montreal	18½	18	18½	Oct. '20, Q	.62½
Daly Mining	Salt Lake	....	....	2.50	July '20, Q	.10
Daly-West	Boston	3	2⅝	2¾	Dec. '20, Q	25
Eagle & Blue Bell	Boston Curb	....	....	2¼	Dec. '20, K	25
Electric Point	Spokane	*7½	*7	*7	May '20, SA	03
Federal M. & S.	New York	6	5⅛	5⅞	Jan. '09,	1.50
Federal M. & S., pfd.	New York	25	24	24	Dec. '20, Q	1.75
Florence Silver	Spokane	*16	*15	*16	Apr. '19,	.01¼
Grand Central	Salt Lake	....	....	*37½	June '20, K	.03
Hecla Mining	N. Y. Curb	4⅛	3¾	3$\frac{13}{16}$	Dec. '20, QX	.15
Iron Blossom	N. Y. Curb	$\frac{3}{16}$	⅛	$\frac{1}{16}$	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	....	....	3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*8	*7	*8	....	....
Prince Consol.	N. Y. Curb	⅜	½	¼	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*7	*6	*6½	Feb. '19,	01
Rex Consol.	N. Y. Curb	*8½	*7	*8	....	....
South Hecla	Salt Lake	*63	*53	*53	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	$\frac{3}{16}$	$\frac{3}{16}$	$\frac{3}{16}$	Oct. '17,	.05
Tamarack-Custer	Spokane	1.80	1.50	1.75	Jan. '21, K	.04
Tintic Standard	Salt Lake	3.22½	3.20	3.22½	June '20, Q	.10
Utah Apex	Boston	2½	2⅛	2⅛	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*4	*3	*3½	Nov. '17,	.01
		QUICKSILVER				
New Idria	Boston	...	....	*95	Jan. '19,	.25
		VANADIUM				
Vanadium Corp.	New York	34	29	30¼	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal	176	73	80½	Jan. '21, QX	3.50
Asbestos Corp., pfd.	Montreal	91½	90	91½	Jan. '21, QX	3.75
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref.	New York	41½	36¼	37	Dec. '20, Q	1.00
Amer. Sm. & Ref. pf.	New York	79	73¼	74	Mar. '21, Q	1.75
Am. Sm. pf. A	New York	65	64½	64½	Jan. '21, Q	1.50
U. S. Sm. R. & M.	New York	32¼	29¼	31	Jan. '21, Q	.50
U. S. Sm. R. & M. pf.	Boston	43½	41¼	42	Jan. '21, Q	.87½

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bimonthly. K, Irregular. I, Initial. X, Includes extra.

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The Mining Engineering Standard

WE ARE FAR FROM WISHING to terminate the interest in the discussion as to the education of the mining engineer which has been aroused by our phrase "only a correspondence school engineer." There have arisen a number of thoughtful persons who take the view that the mining engineer is born and not educated; and that it makes no difference whether he attends the best mining school, gets his schooling by correspondence, or does not get any schooling at all.

We want to range ourselves once for all against this shallowest of fallacies. Mining engineering is an elevated profession, and must be made so that it will stand as the full peer of the other learned professions, which to date have been medicine, the bar, and the clergy. It does not yet do that; and the main reason is the abovenamed foolish laxity as to education and qualification. The strict educational and other requirements necessary before a doctor or a lawyer can practice do not eliminate the variations in human nature, or entirely guard us against the incompetent and the shyster: but how much more rankly these would flourish if the educational qualifications were dispensed with! None of our liberal-minded mining men would employ a doctor or a lawyer who had not gone through the prescribed amount of scholastic training; and we know how to appreciate those whose training has been unusually good.

It is recognized, among doctors and lawyers, and by their clients, that certain schools of law and medicine give their students a much more thorough training than do the rest. We must also recognize this very difficulty for the mining engineer. There are, unless we mistake, too many mining engineers, good, bad, and indifferent, in the country today: many of them are out of a job. There are, as we know of a certainty, too many mining geologists in the country. They are, as we happen to know, mostly bad or indifferent; and we wish that more of them were out of a job than is the case. The reason is faulty training. A man takes a summer school course in petroleum geology at some college, and sets up as an oil geologist. Who is there to say him nay?

The Society of Economic Geologists has established a high standard—yet not too rigorous—for membership, and it is safe to say that any economic geologist even fairly well qualified for professional work will soon be found among its members. Outside, however, will still be hundreds of the summer school and correspondence school and no school variety. The Mining and Metallurgical Society of America has a moderately high standard of membership for mining engineers, but there are many equally well qualified who are not members of the society. The American Institute of Mining and Metallurgical Engineers has at present also a moderately high standard; but whereas the first named society had its standard from the start, and has a uniform grade of membership, the high standard of the latter society was an afterthought, and was put into effect after most of us had slipped in, in the good old days when about the only qualification was to be free, white, and twenty-one, and have ten dollars.

We hope in the future, for the good of the profession and of mining, that the lines will be more sharply drawn. There are in Washington a type of physicians called "sun-down" doctors—men employed in the Government departments who take their medical course in the evening classes offered in that city. On account of this training, there is a legend that their curative powers come to them only after sundown. Possibly it would be a fair regulation if correspondence school mining engineers should be restricted in their practice to engineering by correspondence.

What and How Many Foreigners Shall We Admit?

THE MINING INDUSTRY is one of the largest employers of unskilled and semi-skilled foreign laborers, and is therefore directly interested in immigration problems. During the war a growing scarcity of this type of worker became manifest, and many employers expected post-war conditions would be worse, considering the expressed intention of many of those whose homes were in southern Europe to return thence as soon as the war was over. This emigration actually did take place to a certain extent. However, when these men saw the generally wretched conditions which obtained in their homeland, they not only showed a disposition to return to America but also persuaded others to come too. Thus, coincident with the present depressed industrial condition of this country, inevitably resulting in a domestic oversupply of the more inefficient workers, we are confronted with vast hordes of foreigners clamoring for admission to our ports.

The Dillingham bill, limiting immigration to the United States, for fifteen months, to 3 per cent of the number of each nationality in the United States, was designed as a restrictive measure, but received a "pocket veto" at the hands of President Wilson. There is likelihood, however, that it will again be offered to President Harding, a fact which has brought out so little opposition to its provisions. It is argued that the bill is opposed to the traditional American policy of affording opportunities to the foreigner and assimilating him into our civilization; that it will prevent relatives of foreign-born residents from coming to this country, and will thereby encourage emigration of trained workers; that it will discriminate against certain nationalities which have only recently begun coming to this country in numbers; and that it will cause a great deal of international misunderstanding. Inasmuch as the legislation is intended to cover only a fifteen-month period, it would seem that no serious objection could be made on the basis of most of these points. Misunderstanding of the law and its motives, however, would no doubt last longer than this, and possibly the principal objection to the legislation can be made on this ground.

It is regrettable that some intelligent selection cannot be made of those wishing to come to the United States. Since the war we have been forced to take immigrants of the lowest character, diseased mentally, morally and physically, who have swamped our immigration facilities at Ellis Island and elsewhere. Typhus fever has developed in many immigrants after admission, and we know not how many political and social troublemakers have taken advantage of our hospitality. Intelligent selection should not only keep such classes out, but should take some cognizance of the demands of our industries. Employers could assist materially by a close co-operation with the Government in indicating in which lines assimilation can best be made. Then can our immigration be regarded with the old sense of satisfaction, rather than as a menace.

Our Champions in Mexico

A NEW ORGANIZATION to look after the rights of American citizens in Mexico has been formed under the name of the American Association of Mexico, with headquarters in New York. Its purpose, as announced in its circular, is to work "for the settlement of the difficulties between the Mexican government and American citizens, for a redress of past wrongs, and for a restoration of rights under which Americans became the dominating influence in the development of Mexico's resources and in the promotion of the welfare of her people." The organizers further promise that this association will seek to combat all propaganda to the effect that Mexico's problems have been solved, to make the proper representations to the Government at Washington, and to co-operate with the Government and its officials in securing an adjustment of international difficulties.

One such association, already in existence, namely the National Association for the Protection of American Rights in Mexico, should be enough, if it were really on the job and if the State Department really needed the aid of such an auxiliary. The name of the latter association has become familiar, but if it has accomplished anything the fact is not so well known. In short, the National Association has successfully hidden its light under a bushel, despite spending a large sum on publicity.

But all is not to be harmony between the two associations. The American Association, just organized, says that its principal reason for organizing is that the National Association is not a national association at all, but an instrument of the oil companies that have financed it and directed its policy. "The Americans who have formed the American Association of Mexico," it accuses, "have endeavored for more than a year to induce the so-called National Association to champion the rights of all Americans in Mexico, to announce a policy and to fight for this policy in the open. Having failed to secure such action, they have adopted the alternative of organizing an association that will represent all Americans in Mexico without regard to the nature or amount of their investments." Of the more than 4,000 members of the National Association, 3,800 have no voice in its direction, the circular asserts.

There may have been need of a private association to champion the cause of Americans in Mexico, when they had a cause, during the last eight years. Whether the need still exists remains to be seen. Perhaps our new Government at Washington intends to protect its nationals and their rights abroad. But surely two such organizations vying with each other as champions of American rights in Mexico will not be productive of good results, even though one be sincere and the other selfish or hypocritical. What can be accomplished depends on the State Department, and if this be efficient the need of private associations, whether their names be long or short, will disappear.

Petroleum and the Colombian Treaty

> "Senators Find Americans Own Colombian Oil—Government Report Shows Extensive Holdings—Fact To Be Utilized To Justify Opposition to Treaty—Selfish Interest Charged—Pittsburgh Concern, Later Merged With Standard, Controls Big Concession."

THE ABOVE is an accurate copy of a "scare head" in the *New York Tribune* of a recent date, covering a point of interest in regard to the pending Colombian treaty. To those like ourselves, who have made some study of the foreign mineral problem, and the advisable and even necessary foreign mining policy which the United States should pursue, such headlines give a shock, as we realize that neither the Senate nor the Press is as yet fully emancipated from provincialism and ignorance, and the dissemination of injurious error.

Certain Senators, it appears, have unearthed some apparently damning evidence to the effect that certain oil lands in Colombia are controlled by American capital. "Therefore," they reason, "there are Americans who would be benefited by the establishment of more cordial relations between the United States and Colombia. Ah ha! According to the vote-bidding Congressional tradition and the subscriber-bidding journalistic tradition, here is the best of all reasons why the treaty should not be passed! When the Great American People find out that American petroleum interests would be benefited by the handshake between the two countries, it will demand that the breach shall be widened, and we—the certain Senators—shall be praised for having dug up the damning evidence."

The trail of evidence which the Senators have dug up, according to the dispatch, was not deeply buried. In fact, it consisted of a published report of the Bureau of Foreign and Domestic Commerce, whose object it is to encourage American commerce and industry abroad, as is the object of the State Department, the executive functions of the Government in general, and every clear-thinking American, even if he be Senator or journalist.

It has been the aim of the intelligent element in the national Government for some years now to extend American ownership of petroleum production throughout the world. The campaign of England and of France (as a dissatisfied side-partner) for the maximum possession of the world's petroleum resources has been governmentally conducted for years, the government working in close co-operation with the great petroleum-producing companies. This campaign has determined many of England's political moves during the war and after. Our State Department and our Bureau of Mines and our Bureau of Foreign and Domestic Commerce have become more and more exercised over this policy of "grab and exclude," which, taking advantage of the traditional American attitude of hostility toward "special interests," has threatened to leave the United States short of the most essential mineral product in the world, within a decade or two.

What the opposition Senators allege as a reason against ratifying the treaty is an overwhelming argument in favor of confirming it at once. They would find this out if they would stop to investigate. There will, of course, by our system (the best the world has yet devised) always be an uninformed and wild-eyed element in the Government; and this element will be far more noticeable in the legislative branch than elsewhere. Positions in the executive departments are filled with considerations only of special fitness for the place; but the Congressman or Senator is often shot on unexpectedly to Congress because he has made a convincing roar about going to clean up the graft when he gets to Washington, and that he will get a big special appropriation out of the pork barrel for his district or state.

Foreign trade is one thing and foreign mining another; although they are perhaps not unremotely related. We will not touch upon the former: it seems to have champions enough. But foreign mining is misunderstood, underrated, abused. A good many politicians still hold the view that an American dollar invested in Colombia is a Colombian dollar, and, therefore, not to be protected: if anything, to be injured, as an evidence of the utterest lack of interest. England, however, holds that an English pound invested in Colombia is an English pound, and therefore, to be protected; if she had not had this policy she would not be the power she is.

Nor shall we fulfil our destiny to protect ourselves, to withstand invasion, to work out our ideals of humanity, without a governmental policy to aid those adventurers who go to foreign shores to provide for our country that which she does not have in sufficient abundance. Most critical among these things are mineral supplies, which are hidden treasures, and do not grow. Of these the most necessary is petroleum, and our Government should aid in every way the securing by American capital of all the foreign petroleum which is possible.

The Secretary of State (Colby) recently served notice on the British and French governments that the United States Government would not stand for the partition of Mesopotamian oil between England and France, to the exclusion of American interests; and it is understood that the present Secretary (Hughes) will continue the same policy. How much more important is it for American capital to secure petroleum in the Western Hemisphere! Our Senators and our journalists, if they were only moderately enlightened, far from being shocked at the discovery (the fact of its being news to them shows their need of schooling in matters of common knowledge), should be shocked if they discovered that any but American and Colombian capital controlled the oil of Colombia!

We hope that some Elementary School in Foreign Mining Policy may be established for certain Senators and the like. We must believe, of course, that the great majority of the Senate, and of the Press, are better informed. The American Mining Congress has decided to establish a Foreign Mining Division, in the capable hands of Mr. Henry C. Morris; and one of the features of its work will be educational. The Mining and Metallurgical Society of America also has formed a strong committee on Foreign Mining Policy, under the chairmanship of Dr. C. K. Leith, and through this committee the views and influence of the mining engineer will doubtless become effectual.

Introducing Heterophemy

WE SUPPOSE it was heterophemy, which is defined by Webster as the unconscious saying of words other than those intended, that was responsible for the early press dispatch stating that the U. S. Supreme Court had upheld the decision of the Court of Appeals in the Conkling-Silver King Coalition lawsuit, when the truth was that the decision had been reversed. The judgment of the latter court for $570,000, awarded the Conkling for ore taken from ground claimed by both mining companies, was set aside. He laughs best who laughs last, and the Coalition may, for a while at least, enjoy itself. But apparently the lawyers laugh all the time where mining litigation is concerned. This case which has dragged so long is once more back where it started, except for the fact that in the meantime two decisions have been handed down, one reversing the other and demonstrating the mathematical truism that one minus one is naught.

But to turn from blasphemy to heterophemy, the description of the disputed ground as given in the patent said one thing, whereas it really meant another. That is, there was a discrepancy between the length of the Conkling claim as given in the patent and as marked by the location posts. The Conkling company claimed the ore-bearing ground according to the patent, and the Coalition based its claim on the position of the location posts. To determine this question of the priority of patent over location the Government intervened in the last suit, and it was ruled, to quote our correspondent, that the size of a claim is determined from the survey as marked by the location posts, and not by the figures as given in the patent when there is variance between the two. Thus another point of the mining law is decided, and, having contributed to this end, the Conkling company will not regret the expenses its suit entailed, and the Silver King Coalition will count well spent the money required to defend the property which the decision of the court just handed down has held to be its own.

Aiding the Unemployed Miner

AN EXAMPLE of practical welfare work that benefited the community in more ways than one has recently been afforded in the zinc-lead district of Oklahoma. Nowhere else has the mining industry been harder hit by present conditions than there, three-quarters of the mines being closed down. The resultant unemployment has presented a serious problem to the community, though things would have been much worse and the problem of relief more urgent had the winter been more severe.

At Picher, where the need was greatest, a Central Relief Association was organized, with F. C. Wallower, of the Golden Rod Mining & Smelting Co., as chairman. In the three weeks ended March 5 this organization raised over $2,700, of which the mining companies gave $1,000 and the employed miners an equal amount by paying 25c. per week each, the balance coming from mine supply houses and individuals. Unemployed miners were given work on the local roads at $[illegible] per day, in this fashion about $2,000 being spent by the association by March 5. The resultant improvement in roads is marked, it is said, conditions are [illegible] better for the men themselves and a distressing situation that threatened the welfare of the community is being eased.

WHAT OTHERS THINK

Men vs. Schools and Education

I have been much interested in the discussions of the question of the "Correspondence School Mining Engineer" in several issues of *Engineering and Mining Journal*, and while I have taken work in both the leading resident and correspondence schools, I am inclined to take a different view of the question from some of your correspondents, as well as yourself.

Your illustration of the negro vainly striving at college to assimilate the sciences, battling against an infinitely ancient unfavorable line of ancestry, gives us the starting point in this discussion. Did it ever occur to you that there are many men of the white race battling against the very same unfavorable conditions of pre-natal influences?

The man as he came into this world represents the sum total of his line of ancestry, and it must be admitted that man is born and not manufactured at any particular college or university; yet this condition of man is graduated on a scale from zero to the highest order of intelligence. The point on the scale at which the man under discussion would register is another very important point in our discussion, and the fact that our presentation of this problem tends to one of the whole scale makes it very difficult of solution.

The fact that we can count many failures in both classes of schools is nothing against either method of instruction. The fault is with the man. We all know that some of the greatest men the world has ever produced had the advantages of neither, which almost amounts to a demonstration of this statement.

It is perfectly true that each man succeeds in this life according to his natural ability and proclivities for any particular line of work, and, taking a given sample of man, it would naturally follow that the most favorable circumstances in which he might be placed to acquire knowledge would give the greatest results in the quickest possible time.

Now, as to the proposition of schools, both resident and correspondence, it might be said that as time passes on they are getting closer together. Many of the leading universities of the country have within the last few years extended their work by adding correspondence courses to their regular curriculum, and the student taking these correspondence courses is given credit for the same as though he had been present at the time the work was taken. There have been 290 high schools, colleges, and technical schools of the United States, Canada, and many foreign countries that have adopted the books of one single correspondence school, not mentioning the fact that the same set of books have been accepted by the United States Government for the use of sailors and marines. This certainly speaks something in favor of the correspondence methods, and I have had many students in resident colleges inform me that they have got better ideas from the use of these books than from any other set of books in college work, including the lectures as presented by some very learned college professors.

It is an evident fact that the correspondence school method has come to stay, and we will gain nothing by trying to underrate it. We must admit that it is reaching many men who would never acquire the knowledge they do without it.

You state in your last editorial that "The recognition of the schooling as an essential part of education—which is axiomatic—may be easily and logically followed further, to the recognition that the highest example of the regular mining schools turns out, as a class, men who will be, in the end, better mining engineers than those who attend inferior schools."

Your statement is more dogmatic than axiomatic, for the simple reason that neither superior or inferior schools ever produced great men, or men of any kind.

Inverness, Fla. STRAUSS L. LLOYD.

Engineering vs. Surgery

I have read in Dec. 25 issue of *Engineering and Mining Journal* your editorial "Lennine and Wahington B. Vanderlip" and am somewaht surprised at the statement that Mr. Vanderlip is only a "correspondence engineer." This would infur that one who gains his knowledge throught that method of teaching is not a desirable member of the profession, and infornce, that seems very narrow, and one that we would not look for from a publication of the standing of the E. & M. J.

If a man has the knowledge and ability to follow and line of work and get results, does it matter where he acquired that knowledge? And is it a guarantee because a man has a "sheepskin" form one of the many institutions of learning that he is capable? There are many graduates in the varoius lines that are not able to make a living in the line that they chose, or circumstances throwed them in when the time of choosing an education arrieved.

It would seem to me that the results that are obtained, rather than the school attended should be used in judging a man's capabilities.

If a man were to make a millon dollars by mining iron, would we say that the money was no good because he did not happen to make it mining gold, or some other metal that we were inganged in the production of?

Again if a physician was called on to attend a case of smallpox, and he learned from the patient that it was contracted, in a pool room, would the physician say that it was not small pox because it was not contracted in a comercial club, or some other gathering.

Let us be fair minded enough to judge a man by his works. J. F. INGLIS.

The question raised in this and other correspondence is treated editorially in this issue and was thus discussed in the March 5 number. We should not call in a physician who had only taken a correspondence course in medicine and surgery.—EDITOR.

Concerning Engineering Societies Publications

Referring to my letter printed in *Engineering and Mining Journal* of March 12, the words "engineering foundation" in the last paragraph should have been spelled with lower-case initials. I was referring to engineering foundations in general, and not to the Engineering Foundation of which Charles F. Rand is president. DONALD M. LIDDELL.

New York.

TIMBER STATION AT 2,800-FT LEVEL OF SPECULATOR MINE, BUTTE, MONT

The Application of Cement Mixtures by Machinery

Summary of Properties and Examples of Use of "Gunite" in the Mining and Metallurgical Industry   Fireproofing of Underground Timber and Surface Structures   Prevention of "Slabbing" by Sealing Rock Surfaces and Obviating Action by Air and Moisture

BY GEORGE J. YOUNG
Written for Engineering and Mining Journal

THE INTRODUCTION and general acceptance by the mining industry of tools or appliances constructed for specific purposes has been in progress since systematic mining began. The acetylene lamp, the oxygen helmet, the stoper, the hand-held drilling machine, the acetylene torch, and the arc-welding apparatus have won widespread acceptance, and their use excites no special interest. Most mining men can remember when they were introduced.

The invention of a new appliance and the prospect of its acceptance are, however, of considerable interest. During the last six years the cement-gun method of placing cement-sand mixtures in different structures has proved useful in mining operations, both below and above ground. It may fairly be said that it has won a place in the tool rack of the miner as well as in that of the repair and construction workers. More than thirty mining and metallurgical companies have placed this equipment in the hands of their operating crews. The Anaconda Copper Mining Co. is making extensive use of "gunite" for fireproofing mine shafts in the Butte district.

The name "gunite," although first used as a trade name by the manufacturers of the cement gun, has now received general acceptance. There is no equivalent single word to convey the idea of mixtures of fine sand and cement pneumatically deposited in place. As compared with concrete, in kind of mixtures, method of placing, and physical properties, there are many differences. The nearest analogue is "cement plaster." Although there are similarities, there are also differences. Cement plaster is mixed wet and troweled on. Vertical walls and ceiling work entail a considerable amount of skill and muscular exertion. Floor work is more easily done. In wall and ceiling work, troweling is impracticable unless the surface is an approximate plane. The practical difficulty in most plastering or "layer work" has been to secure a close enough bond to the wall or other surface to prevent peeling or flaking off. Mainly because of poor bonds and excessive hand labor, the use of thin layers or coatings of plastic sand-cement mixtures has not found application in mining, where it was obvious that they would be useful.

George S. Rice, of the U. S. Bureau of Mines, used the cement gun in 1914 to place a coating of "gunite" over the walls of an explosion chamber in the Bureau's experimental mine at Bruceton, near Pittsburgh. This same authority advocated the use of a coating of cement as a preventive of "slacking" of the walls of mine openings, and, as ordinary methods of applying such a coating were impracticable for reasons already stated, the proposed method did not meet general acceptation. The advent of the cement gun has brought about a change in practice, however, as by its use a compact, closely adhering layer can be placed upon irregular surfaces.

CEMENT-TREATED TIMBER IN A CROSSCUT

About six years ago coal mining engineers became convinced that there were important advantages in the use of "gunite," and since then there has been steady increase in its application in the coal-mining field. In a paper presented to the Coal Mining Institute on Dec. 6, 1917, Mr. Rice described the utility of "gunite" in coal mines.[1] In the various applications, in widely different fields, descriptions have appeared in sufficient number to make possible a fairly accurate summary of the properties of this material, its use, and an analysis of cost details.

The cement gun has been described so many times that it is unnecessary to describe it here. By the use of this appliance a uniform stream of sand, thoroughly mixed with a given proportion of cement in suspension in air under pressure, passes through a rubber hose and is discharged through a nozzle, in which a uniform flow of water is admitted, upon the surface that it is desired to coat. The flow of water is so adjusted that there is just sufficient to wet all the particles and hydrate the cement. The velocity of travel of the mixture in the hose is sufficient to prevent any settlement. The nozzle discharge velocity is high, one writer stating that it reaches 300 ft. per second.

WATER PRESSURE SHOULD BE GREATER THAN THAT OF AIR

It is obvious that the wetted mixture is driven by impact into place and that a dense layer necessarily results. A certain amount of the sand grains rebound, the proportion being variously stated as ranging from 10 to 20 per cent. Both the flow of the mixture and the water must be constant or as nearly so as practicable. It is recommended that the water be delivered under a pressure 20 lb. in excess of the air pressure, which ranges from 40 to 75 lb. This is necessary, so that the water can overcome the air pressure within, as it enters within and not without the nozzle.

The proportion of rebound material diminishes from a maximum at the start of placing a layer to a minimum as the layer reaches a limit thickness. The skin adhering to a wall or other surface has a proportionally greater amount of cement than the outer part of the layer, due to the rebound rejection being greater. The sand which rebounds is stated to be remarkably clean, or free from adhering cement. The first or skin layer is thus of greater plasticity and serves as a bed to receive the stream of material.

In placing a layer upon a floor there is no particular limit to the thickness, but, except in special instances—as, for example, waterproofing—there is no advantage in using "gunite" for floor work, as the ordinary methods are cheaper and more simple of application. For wall work there is a limit to the thickness of the layer, as thick layers show a tendency to slough off before the cement sets. In work of this kind several successive layers are placed until the desired thickness has been attained. In roof work, the tendency to slough is even more marked, and a greater number of successive layers is necessary. There is also a greater proportion of rebound material on roof work, and on the whole this kind of work is much more difficult than wall work. Reinforcement is used in probably the majority of applications, and where this is done the first layer on wall work can be built out to a thickness of 1½ in. (including the reinforcement) and an additional layer of ½ in. applied, making a 2-in. layer in all. This was done in the construction of a flume by "gunite" described by Stephen E. Kieffer. The flume side walls were 4 ft. in height.

DRY MIXTURES AND DRY AIR NECESSARY

The compressed air should be dry and the sand used in "gunite" should comply with the specifications for sand used in concrete. The usual maximum size limitation is one-quarter inch. Clean, dry[2] sand free from humus, and screened, is necessary. Mr. Kieffer, in describing the construction of the flume mentioned before, found it necessary to slightly moisten the sand under excessively dry and hot weather conditions before charging it into the gun.

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[1] [illegible] *Engineering and Mining Journal*, Vol. 105, p. [illegible]

[2] "Dry" is used in a relative sense. There should be a low moisture content, as it is difficult to wet the mixture thoroughly if the sand is excessively dry. The sand should be dry enough not to adhere in clots. About 6 per cent moisture is stated to be sufficient.

I have not found any description of the cement used, but the presumption is that the usual kinds employed in concrete work suffice, although it would appear to me that a quick-setting cement would be highly desirable. It is necessary to screen the cement before use. The proportions of cement and sand vary. The extreme ratio is 1:5. Mixtures of 1:3, 1:3½, 1:4 and 1:4½ have been used. E. M. Norris states that for coatings of ¾ in. or less in thickness a mixture of 1:3 was most satisfactory. Mr. Rice states that a 1:3 mixture, due to the rebound material, approximated a 1:2½ when in place. For a 1:4½ mixture, one bag of cement (1 cu.ft.) is stated to be sufficient for 32 sq.ft. of "gunite," 1 in. thick; for a 1:3 mixture the area is 22 sq.ft., 1 in. thick. Approximately 1 cu.yd. of mixture will equal 0.6 cu.yd. "gunite." The amount of free air per minute is estimated at 110 cu.ft. for the N-0 machine, 150 for the N-1, and 225 for the N-2, the three sizes of machines manufactured.

The important characteristics of "gunite" are its compactness and high degree of imperviousness. Mr. Rice quotes Westinghouse, Church, Kerr & Co., to the effect that "gunite" is superior to hand-made products of the same kind. Tensile and compressive strength are exceeded by "gunite." The surface permeability is 7/10 to 1/20 as much water per hour as similar hand-made surfaces. Hand-made mortars absorb 1.4 to 5.3 times as much as "gunite"-made mortars. The proportion of voids is frcm 52 to 72 per cent of that of the hand-made product, and adhesion is 27 per cent better. Many applications of "gunite" have demonstrated its adhesive qualities and its imperviousness to both air and water.

MACHINE-PLACED STRONGER THAN HAND-PLACED MORTAR

Byron C. Collier presented a comprehensive paper on the application and uses of the cement gun before the Municipal Engineers of the City of New York, Dec. 23, 1918. Respecting the most advantageous mixtures he said that 1:2½ is most suitable for work demanding high water-resisting qualities, and 1:3 for ordinary conditions. There was no advantage in using an aggregate in excess of ¼-in. size if a well-graded mixture is used. Tests made with ordinary river sand in which no attempt at grading was made gave excellent satisfaction. As a result of tests he states that it is a safe assumption that 1:2½ "gunite" will have an ultimate compressive strength of 4,500 lb. per sq.in.; 1:3, 4,000 lb. per sq.in. Compared to this a 1:3 gravel concrete averaged on tests 3,038 lb. per sq.in. Between hand-placed concrete and "gunite," the "gunite" proved to be in almost every case 30 per cent stronger than the concrete.

Experimental research has been made upon the properties of reinforced "gunite" slabs for roof and floor construction, and various reports have been published in which data for their design may be found. It is not the purpose of this article to go into the applicability of "gunite" for building operations, but rather to limit its scope to those applications peculiar to the metal-mining industry. Nevertheless, the engineer who specializes in mine building and smelter construction will find it worth while to investigate the advantages that may accrue from its use in this field.

Three sizes of machines are made, commercially designated as the N-0, N-1, and N-2. The cubic contents of the three sizes are, respectively, 3, 4, and 5 cu.ft. of dry, loose material. The respective weights are 900, 1,400, and 1,475 lb., complete with standard equipment. The sizes of the material, air, and water hose are respectively 1 in., ¾ in., and ½ in.; 1¼ in., 1¼ in., ½ in., and 1⅜ in., 1¼ in., ½ in. for the three sizes. A variety of nozzles and tips are provided for specific purposes. I find, in several descriptions, that a 1½-in. material hose has been used. It is highly desirable to place the machines as close to the work to be done as possible. In using a 50-ft. hose length, the capacity of the machine was increased 15 per cent as compared with a 100-ft. hose length. The limiting distance has been stated to be 500 ft., but 200 ft. would be better. E. M. Norris found in shaft work that with air pressures of 75 lb. the nozzle could be satisfactorily used at 200 ft. above and 75 ft. below the gun. These are given as maximum vertical distances.

From a number of descriptions of actual work, I have selected six and have summarized each as follows:

I. Waterproofing a Reservoir; *Engineering News-Record*, Nov. 25, 1920, p. 1043. Four guns were used. A 2-in. reinforced layer was placed. Mixture, 1:3. Gravelly sand of ¼ in. maximum size was used; about one bag of cement to from 14 to 15 sq.ft.; gage pressure, 80-85 lb. per sq.in. at compressors; 30 lb. at gun nozzles; maximum hose length 200 ft.; reinforcement two layers of wire mesh in which sheets were placed at right angles; reinforcement amounting to 0.3 per cent. Four guns placed 8,000 sq.ft. of 2-in. lining per day of 8½ hours; or at the rate of 2,000 sq.ft. per gun (333⅓ cu.ft. per day per machine). The cost was 49c. per sq.ft. The greater part was floor work, with some sloping sides.

II. M. S. Sloman described in *Coal Age*, Dec. 26, 1918, p. 1158 (article originally printed in *Mine and Quarry*), the coating of a coal mine slope with "gunite." The surface was first cleaned and scaled. No reinforcement was used and the coating averaged ½ in. in thickness, 1:3 mixture. Timbers were covered with ½-in. wire mesh. The slope was 12 x 12 x 6,250 ft. The total cost was $7,488.58, or 30c. per sq.yd. (3.3c. per sq.ft.). A 900-ft. section of this slope required 13½ 8-hour shifts for a working crew of eight men; 2,376 sq.ft., or approximately 100 cu.ft., was averaged per shift. Materials required were 540 sacks cement at 60c. and 1,620 sacks sand at 12c. per sack. The working crew comprised one mechanic, one engineer on hoist, one operator on cement gun, two mixers, one nozzle man, one man drying sand, and the part time of one man hauling sand. No mention is made of power cost.

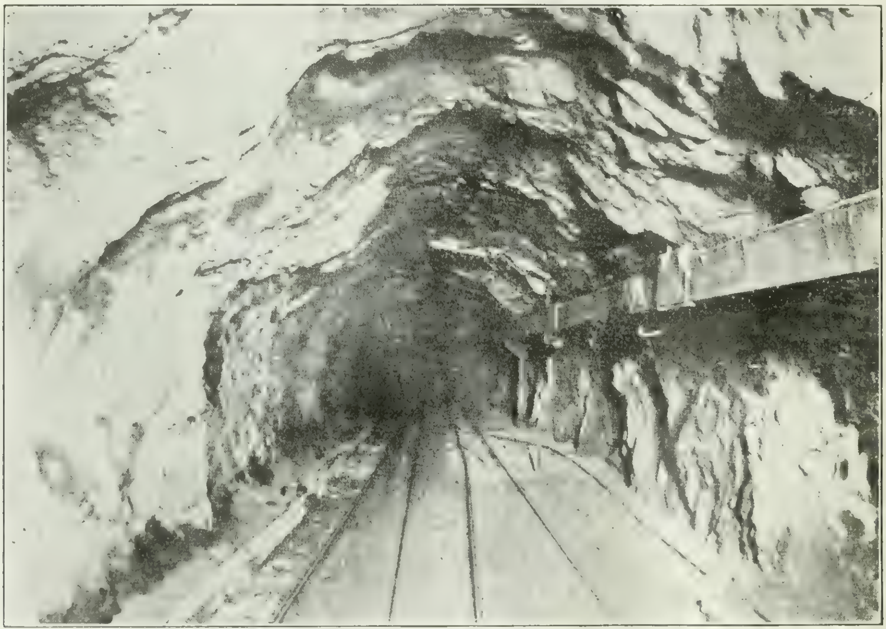
III. E. M. Norris described the fireproofing of the mine shafts of the Anaconda Copper Mining Co., in Butte, before the A. I. M. E., in September, 1918. In this work, "gunite" was placed as a coating on the shaft timbers and lagging after lathing them with 27-gage diamond mesh metal lath, 24 x 96 in. In placing the lathing material 225 sq.ft. per man per 8-hour shift was the labor ratio and a gun crew placed "gunite" on 800 to 1,200 sq.ft. in an 8-hour shift. The coating was applied in two successive layers each ⅜ in. thick, and the finished thickness was presumably ¾ in. For "guniting" 2,000 ft. of four compartment shaft, 175,465 sq.ft. of surface covered required 6,102 sacks of cement, 1,500 tons of sand, 165,495 sq.ft. of lathing, 2,600 lb. nails and staples and 94 days' time for an average of 54 men employed, including superintendence and all surface labor connected with the job. On the basis of a square foot of lining, the quantities for this work are 3.2 lb. cement, 17.1 lb. sand, 0.015 lb. nails and staples, 0.94 sq.ft. lathing and 0.23 man-hours. Two cement guns were employed [illegible] each crew consisted of four men, two feeding the gun [illegible] two at the nozzle. Nozzlemen worked [illegible] were provided with rubber gloves, safety [illegible] pirators. The surface to be coated [illegible] oughly with water sprays, and "gunite" [illegible]

[illegible] appears to be [illegible] It would appear that the [illegible] work.

successive layers each ¼ in. thick. After the coating had become firm, it was sprinkled often enough to keep it damp for several days. The cost of the work was not given.

IV. Stephen Royce[4] described the use of "gunite" at the Cary "A" shaft at Hurley, Wis. This is a steel, five-compartment shaft with the steel sets blocked in place with wooden blocking and lagging of 3-in. tamarack planks wedged into the flanges of the I-beams. "Gunite" was applied to fireproof the lathing and wooden blocking and to protect the lagging from decay by keeping it from contact with air; also to prevent corrosion of shaft sets and waterproof the shaft. The surface to be covered was cleaned thoroughly. This was done partly with water under heavy compressed air pressure, partly by sand blasting, and partly by chipping the rust and accumulated coating from the steel. Reinforcement consisted of No. 7, A. S. & W. Co.'s triangular-mesh reinforcing wire for the side walls. This was stapled directly to the I-beams and to the lagging at intervals. To keep the wire mesh about one-eighth of an inch away from the surface to be covered was accomplished by stapling the reinforcing wire on with nails underneath it. The I-beams, before the cement was applied, were covered with 1½-in. mesh chicken wire, clamped on with wire clamps. The total area of wall surface was 14,260.9 sq.ft.; of steel covered 3,749.96 sq.ft., or a combined total of 18,010 sq.ft. The materials required were sand, 102.5 cu.yd.; cement, 173 bbl.; reinforcing, 14,260.9 sq.ft., and chicken wire, 3,750 sq. ft. Linear feet of shaft was 263.13. The work required one foreman and six men for thirty-two working days. The cost was given as $9.30 per linear foot of shaft. As the area per linear foot equaled 68.4 sq.ft., the per-square-foot cost is found by calculation to be 13.6c. The thickness of the coating was given as 1½ in. The "gunite" was applied in from one to three coats.

V. In the Michigan College of Mines *Alumnus* for December, 1920, John Knox and Ocha Potter describe the use of "gunite" upon the 81st level of the Calumet & Hecla conglomerate mine. In driving a main haulageway in the foot wall in a barren amygdaloid vein, "slabbing" began on an extensive scale. There were no air blasts nor big caves, but ground that had been barred for loose would again become dangerous, frequently in a few days. "This finally became so serious that it was realized that the expense of timbering, with the probable continuous upkeep cost, might jeopardize the success of the entire plan." The plan referred to in the quotation provided for the duplication of the surface layout of a mine at the 81st level, excepting rock crushers and air compressors; a hoist to reach an additional depth of 3,000 ft., and an electric haulage system three miles long. Supplies were to be delivered through No. 12 shaft at the south end of the Calumet & Hecla property, and the copper rock was to be hoisted through the vertical Red Jacket shaft, 5,000 ft. deep. Work was begun on the project in January, 1918. A careful study of the "slabbing" resulted in the conclusion that it was not due to rock movement but rather to the action of air and moisture. Drawing upon the experience in coal mining, where similar problems had been solved by the application of "gunite," experiments were made upon several hundred feet in February, 1919. "Slabbing" stopped at once, and the "gunite" layer remained unbroken. After an interval of several months, the "gunite," which had been put on in one coat, dropped off in a few places where the original coat had been too thick to set properly and its weight had pulled it away slightly from the rock surface, thus leaving small air spaces. These formed blisters, and small slabs of "gunite" fell, exposing the rock surface again. The difficulty was overcome by putting on two thin coats, usually one coat on one shift, followed by another coat on the succeeding shift. By Dec. 4, 1920, 8,772 ft. had been coated with "gunite." Trouble from "slabbing" in a section of No. 4 shaft of the North Kearsage mine was remedied by "gunning." As a result of this work, the engineers in charge are of the opinion that hundreds of thousands of feet of mine openings should be "gunned" instead of timbered.


(From the M. C. M. Alumnus)

A DRIFT IN THE CALUMET & HECLA AFTER "GUNNING"

The detail given is as follows: "The 'gunite' mixture used consisted of 1:2½; sand was screened through $\frac{3}{16}$-in. mesh; air pressure, 65 lb., and water pressure, 40-50 lb. Four men were employed on each shift on 'gun' work, two charging the gun and two men who alternated at the nozzle. These men did their own barring and trimming and applied one coat of 'gunite' over a length of 50 ft. of 9 ft. x 12 ft. tunnel, or an average of 6½ linear feet per man per shift for a double coat. The average thickness of one coat varied from ⅛ in. to ¼ in. on a smooth rock surface. For two coats the thickness was from ¼ in. to ⅜ in. Crevices and hollow spots were filled, and at these points the thickness of coat varied materially. About 28,000 lb. of 'gunite' mixture is used to complete 100 ft. of tunnel. Approximately 20 per cent of the sand rebounded from the rock and fell to the floor. This was, of course, wasted. Wire mesh reinforcing was tried at first but was very expensive, difficult to apply, wasteful of 'gunite' and finally found to be entirely unnecessary. It proved convenient to dry and mix the sand and cement on surface and to bring it to the operators in packages, each of which contained a full charge for the gun. However, when this plan was followed, it became necessary to add a very small quantity of water when mixing, to prevent a separation of sand and cement during transit."

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[4] [illegible]

VI. E. Court Eaton described, in the *Engineering News-Record* of Aug. 21, 1919, the construction by "gunite" of a six-mile flume: "The flume is 5.75 ft. wide at the bottom, 4 ft. deep, laid on a grade of .5 ft. per mile. It is of reinforced 'gunite' construction, with 2-in. side walls, the whole surmounted by a 4 x 6 in. rectangular beam, the beams on each side being tied together with ⅜-in. bars. The forms consisted of 1-in. tongued-and-grooved flooring, kept thoroughly oiled, braced with 2 x 2-in. bracing. A set of 700 ft. of forms, with slight repairs, lasted the whole job. The side walls were shot on in two layers, the first being 1½ in. thick, up to the reinforcement. After about fifteen minutes the final ½ in. was applied. The reinforcement was held the required distance from the inside face with spacing bars. These bars were removed as sufficient concrete had been shot on to insure the mesh having its proper position in the structure.

"An attempt was made to 'gunite' the 4 by 6-in. beam on the top without forms, but it was found that unless this were done in several layers, with sufficient time interval to allow partial settling, the mass was so heavy that it sagged forward and broke away. Small forms were placed above the side walls immediately after they had been completed, and the rebound from 'guniting,' which had been caught on canvas, was used in pouring these beams. Ten per cent of cement was added to this material before placing.

"For the most part, the flume was constructed during hot weather, with temperature from 100 deg. to 125 deg. F. Immediately after the construction of a section of side wall, burlap was hung from the beam over the sides, and the walls were then kept thoroughly wetted for twenty-four hours. After this period, the flume was kept filled with water. The mix was 1 part cement to 4½ parts of sand, with lime in the proportion of 10 per cent of the cement added.

"The average rate of progress was 140 linear feet per day, with a construction crew as follows:

1 Foreman	$5.00
1 Nozzleman	5.00
1 [illegible]	[illegible]
1 Compressor operator	[illegible]
1 [illegible]	2.75
1 [illegible]	2.75
4 [illegible] at $2.75	11.00
10 [illegible]	[illegible]
3 [illegible] at $4	12.00
4 [illegible] at $2.75	11.00
[illegible] per day	$[illegible]

"Assuming ten men for mixing and placing the 'gunite,' an average of 31.9 sq.ft. per man hour, or 299 cu.ft. 'gunite' per day, was placed per day."

DIFFICULTIES OF ADHESION TO WET SURFACES

Stephen Royce says: "If the cement can once be applied and can harden, no amount of water will make any difficulty thereafter, but there are considerable difficulties in making the coating stick to a wet surface. In coating a wet shaft for a large southern Illinois coal company, water was diverted from a wet point in the shaft to the sump below by means of permanent drains. Sometimes bleeder pipes are introduced into wet strata and later sealed after the concrete lining has hardened. In some cases it was necessary to drill through the wooden lagging and with iron rods clear the mud which sometimes accumulates, and so allow the water to drain down to a lower point in the shaft. In some places a waterproof felt sheathing was placed between the cement and wood of the shaft lining; the water drains down between the felt and lagging, and the outer surface is kept dry for the application of the cement coating. This felt, being waterproof and rotproof, and being completely incased between the cement and wood, is a perfectly solid part of the shaft lining."

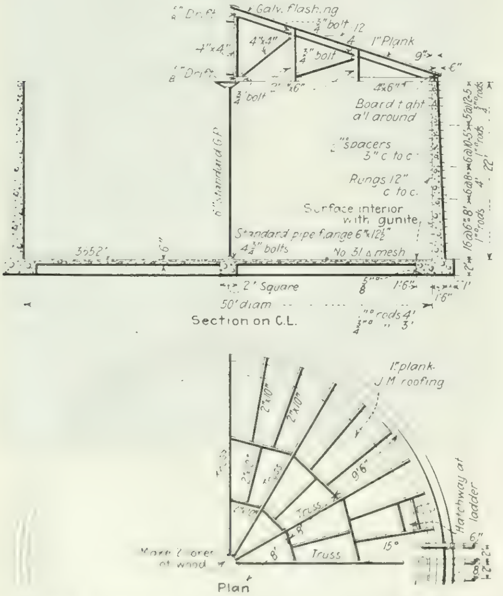
FUNGUS GROWTH ON UNDERGROUND TIMBER

In Bulletin 114 of the Cement Gun Co., Inc., attention is called to the desirability, where "gunite" is applied to wood surfaces, of covering the wood with paper prior to attaching the reinforcing mesh; otherwise not only does the wood tend to absorb the moisture from the "gunite" prior to its getting a set, but also the wood shrinks away from the "gunite" as its accustomed moisture is excluded. Tar paper is used for this purpose, and is drawn tight and firmly fastened. E. M. Norris, in describing the work at Butte, says that "Experiments were made to determine whether reinforcing material was necessary to hold the [illegible] to the timber and, if so, what kind of material was best. It was found that if the timbers were wet down thoroughly the concrete would stick without [illegible], but subsequent distortion of the timbers caused the concrete coating to shell off in large slabs."

For an effective seal on rock surfaces, "gunite" must be well applied and excess water avoided, as otherwise the skin of "gunite" will not be impervious and slow action may ensue, with subsequent flaking off of the layer. It is obvious, also, that rock surfaces must be clean and free from loose, weak portions. "Gunite" is not effective where ground is on the move. In no sense is it a support of the ground. Its only function is to seal the rock surface from atmospheric action. How effective "gunite" is in preventing deterioration of timbers by rotting where they are sealed from the air by a protecting layer of reinforced "gunite" remains to be seen. Superficially it would appear that dry rot would be retarded if not entirely stopped. There is, however, no specific information on this point.

COST ANALYSIS

In the examples given, details of cost such as are available have been presented, and are incomplete, in that power and replacements are usually omitted. In the cement gun itself the gaskets for the cone valves require replacement from time to time, as does the outlet-valve body liner. Liners are used for the nozzles. Compressed air and water hose are subject to the wear which comes from frequent handling, and would require replacement no more frequently than drill hose. The material hose is subjected to considerable wear. Estimates of its life range from four to six months with continuous use. Nozzle liners last eight days and cost 80c. for renewal. I am reliably informed that the upkeep cost on the work in the Anaconda properties at Butte amounted to 50c. per eight-hour shift per machine operated.



"GUNITE" SURFACED WATER TANK AT UNITED VERDE EXTENSION MINING CO., CLEMENCEAU, ARIZ.

The elements of cost of a single job in summary are:

1. Assembly of machine, compressed air and water piping, materials, mixing apparatus.

2. Preparatory cleaning of surfaces, placing wire reinforcing, staging.

3. "Guniting": Labor, power, water, cement, sand, lubricants.

4. Wear and replacement of liners, gaskets, hose, gun parts.

5. Tearing down, cleaning up and removal of apparatus.

H. V. Croll has given me the cost data shown in the table. In this example "gunite" was used to prevent the walls of a mine "tunnel" from slaking.

COST DATA OF PLACING "GUNITE" IN TUNNEL AT UNITED VERDE EXTENSION MINING CO., JEROME, ARIZ.

1 Gun man, also motorman	$7 00	
1 Nozzleman	5 60	
1 Man holding light	5 60	
1 Man loading gun	5 60	
1 Man cleaning roof	5.60	
3 Men mixing at $5.60	16 80	
Total labor		$46 20
Cement, 77 bags at $1		77 00
Sand, 9 cu.yd. at $1		9 00
Air and supplies		10 00
Superintendence		5 00
Total		$147 20

3,750 sq ft at $147 20 = 4c per sq ft

Above crew placed 125 running feet of tunnel in one 8-hour shift, equivalent to 3,750 sq.ft.; average thickness ½ in.

SUMMARY OF USES IN MINING

In underground mining, in order of importance, "gunite" is used for fireproofing shaft and station structures where timber is extensively employed; for surfacing rock surfaces that are susceptible to disintegration due to the action of air and moisture; for making air-tight timber stoppings and brattices and making leak-proof sumps and water bulkheads. A minor although important use is in the protection of steel plate and girder construction underground from corrosion produced by damp air. It is problematical whether "gunite" affords any more than temporary protection where acid waters come in contact with such structures.

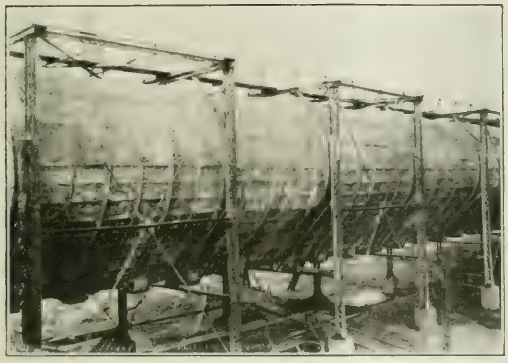
The most extensive use of "gunite" for fireproofing shafts has been made by the Anaconda Copper Mining Co., at Butte, Mont. According to H. J. Rahilly, mine fire superintendent of the Anaconda, "places that are most susceptible to fire, such as working shafts, stations, crosscuts, and drifts having high-tension wires in them, motor, fan and transformer stations, oil houses and powder magazines, are covered with 'gunite' or cement mortar, so as to make it difficult for a fire to start."

Mr. Rahilly, in the *Anode*, describes the construction of brattices: "These brattices are made of 1-in. boards covered with metal lath and coated with 'gunite,' or they are made of burlap over which 1-in. mesh chicken wire is stretched, and then 'gunited.'"

At the Butte & Superior mines "gunite" has been used in covering the timbered stations and approaches to the stations on various levels. In some cases it has been applied to the rock itself. Generally it has been successful, although in some applications it is not absolutely perfect.

E. E. Whitely, superintendent of mines of the Calumet & Arizona Mining Co., at Bisbee, states that "gunite" has been used to seal air from drifts that tend to air slake. For this purpose a coating ½ in. to ¾ in. thick is used. The surface was first washed down and the "gunite" applied in two coats. The gun was also used in the construction of bulkheads in raises and to make ordinary bulkheads airtight. In starting to sink the junction shaft deeper, the sump on the bottom level was made waterproof by a 2-in. layer of "gunite."

N. B. Braly, general manager of the North Butte Mining Co., says with regard to the use of a cement gun at this property: "Results show that material hose will last from sixty to ninety days, compressed-air hose about twelve months, and water hose about twelve months. We have found that the most efficient way to operate the 'gunite' machine on big jobs is with three men. On smaller work two men are sufficient, as the man operating the machine can also dump in the 'gunite.' The only difficulty in operating the machine is that the rubber outlet valve will last only from fourteen to eighteen days. This hose is tapped and is 9 in. long. We find that the 'gunite' machine will fail only when the compressed air is wet; it must have dry air to operate properly. The repairs are small. In 'guniting' with 50-ft. material hose, 5 to 7 lb. of compressed air is best; with 100-ft. material hose, 10 to 12 lb., and for overhead or shaft work, 15 to 18 lb. of compressed air."



REPAIR OF FLUE BY "GUNITE" AT U. S. SMELTING, REFINING & MINING CO., MIDVALE, UTAH

In surface plants, "gunite" has found a number of applications. Apart from its use in building and in fireproofing of cribbing and roofing, it has also been used in the construction of large settling tanks and for water tanks. A 50 x 22-ft. water tank was constructed by the United Verde Extension Mining Co. at Clemenceau. For waterproofing ditches and reservoirs "gunite" is especially valuable. For flume construction in placer mining operations where wood is unobtainable or high in cost, the application of "gunite" might well be considered.

At the Butte & Superior, in Butte, Charles Bocking, manager, informs me that "gunite" fireproofing on surface structures such as coal bins has remained in place, in some cases, for about three years, with no sign of cracking or coming off.

At the Midvale plant of the United States Smelting, Refining & Mining Co. a large balloon flue showed signs of failure due to corrosion. It was covered with chicken-wire netting and "gunited." The result was to considerably prolong the life of the flue. At the El Paso Smelting Works an acid-proof mortar was applied to the interior of the roaster flue by means of the cement gun—a [illegible]-in. layer of mortar consisting of 50 per cent siliceous tailing, 35 per cent siliceous clay and 15 per cent cement. An examination made recently, about three years after the lining had been put into place, showed the flue to be in good condition. R. S. Moore, chief engineer, informs me, however, that the acid action is not severe in this flue and that no serious trouble from acid action on the brickwork of the roaster flues, even where unprotected, has been noted. The cost of this lining was less than for coating an ordinary wall with "gunite."

Steel beams and other structural parts free from vibration or not subjected to repeated loads can be protected from corrosion by a thin layer of "gunite" $\frac{1}{8}$ in. to $\frac{3}{16}$ in. thick. There are usually a number of places in and about smelters where such use could be made. Mr. Croll called my attention to a limited use of "gunite" lining for small tanks holding acid solutions. He mentioned one case in which a 2-in. lining of "gunite" had been applied on a tank which was used to hold an 8 per cent sulphuric-acid solution. The lining had been in use for 2½ years without serious deterioration.

In building construction at the plant of the Southern Gypsum Co., at North Holstein, Va., the hoist house, machine shop, and stock room were constructed of wooden framing with galvanized metal on the outside. Gypsum plaster, reinforced by chicken-wire netting, was put on with a cement gun as an interior lining. It would thus appear that clay mixtures and gypsum plaster can be applied by the cement gun more readily than by hand work.

Sharp Decline in Quicksilver Production in 1920

Preliminary figures showing the production of quicksilver in the United States in 1920, according to the U. S. Geological Survey, give a total of 13,070 flasks (75 lb. each), compared with 21,348 flasks in 1919. Of this output 9,366 flasks is credited to California, 3,601 flasks to Texas, 79 flasks to Nevada, and 24 flasks to Oregon. So far as is known neither Idaho nor Arizona produced any quicksilver.

In California ten mines were reported as productive; in Texas, two; and in Nevada and Oregon one each. In California the New Idria, Cloverdale, New Guadalupe, Oceanic, Carson, and Oat Hill mines were closed during the later part of the year, most of them with the expectation that work will be resumed when the conditions for mining and marketing quicksilver have improved. The largest producer, the New Idria, lost its reduction plant and a considerable quantity of quicksilver by fire on June 20. Operations were resumed at about half capacity in September, but ceased entirely in November. In Texas the Chisos mine has been continuously productive, but the Big Bend was closed on the first of November. In Oregon the War Eagle Mining Co. reports the completion of a twenty-five-ton Scott furnace, which will not be placed in operation, however, under existing conditions.

The year 1920 was a discouraging one to quicksilver mine operators, who had to face a decline in prices consequent upon a decreased demand for their product and found little relief from the prevailing high cost of labor and supplies. Such demand as there was for the metal was met from surplus stocks accumulated during the war, from quicksilver originally sold abroad but subsequently resold in this country, and, in [illegible] from imports.

The average price of quicksilver in 1920 per flask of 75 lb. at New York was $81.123. The highest monthly average price was in April, [illegible]; the lowest in December, $49 577.

South American Mining Fields and Practice

Manganese Ore Occurs as Replacement and Alteration of Iron-Bearing Schists in the Bomfim District of Brazil—At Morro da Mina, in Minas Geraes, a System of Mule Training Makes Cheap Transportation Possible

By W. H. Staver

Written for Engineering and Mining Journal

I HAVE JUST RECEIVED a copy of the work on political and commercial geology edited by J. E. Spurr. I find it fascinating, especially as my experience has taken me to a number of foreign places which he describes. In a friendly way, I wish to add my feeble word to his compilations. Of the need of such a work there can be little argument. I wish it might be expanded into many volumes, to be revised from time to time, like an encyclopedia. I shall try to base my criticisms on my own experience and on knowledge obtained from what I consider reliable sources, which sources I shall give when possible.

Petroleum and Oil Shale

Brazil is not mentioned under this head. As you will note by F. Lynwood Garrison's article on Brazil in the Jan. 22 number of *Engineering and Mining Journal*, it may be considered as a future factor in oil shales and possibly in oil production. A Rumanian chemist distilled oil from Brazilian shales during the war, and sold his unrefined mixture to users of crude oil for power purposes. I believe he sold his oil in Bahia. He made his own stills, and was immensely pleased with himself and his product when I saw him in the interior of Bahia in 1918. He procured his shales from Maceio, in the State of Alagoas, he said. I believe that Brazilian oil shales will soon command more attention than they have previously, because of their probable richness and extent. The Standard Oil Co. of Indiana has been in Bolivia for some years and has not been alone. Lewis Emory, Jr., of Bradford, Pa., who owns gold mines and rubber lands, is interested in oil in Peru.

Many tests have been made on the coal from southern Brazil. This coal is not especially inaccessible. The fault is with the impurities in the coal. Briquetting, pulverizing, washing, picking, and like industrial operations have been tried. The experiments have been done by good men under the observation of graduates of American institutions which own the steamships on which the coal would logically be used, viz., the Loge Brothers, of Rio.

Iron and Manganese Ores in Brazil

There are considerable deposits of iron ore in the State of Bahia, quite like those of Minas Geraes, that have not been mentioned in the technical press, as far as I know. Most of them are in isolated places, and transportation will be difficult.

I consider myself capable of discussing manganese ores to a greater extent than most of your readers, as I mined these ores from Bomfim, Bahia, and from the district of Saude, near by, which has never been mentioned in any technical magazine, as far as I have observed. Most articles dealing with Bahian manganese ores state that manganese mines exist at Nazareth and that manganese ore was shipped from Bomfim during the war.

In 1917 George Lavino, for E. J. Lavino & Co., bought three mines at Nazareth and paid five hundred dontos de reis (about $125,000) cash for them. This was while I was going to Bahia from New York in March, 1917. I looked over these mines, laid out a line of work for reopening them, and then, after many delays, went to the district of Bomfim to take charge of the alleged mines opened up by F. N. Mainetty, an Antwerp ore buyer—a Greek or an Italian, I think. I found that several thousand tons of mixed iron and manganese ore had been mined. After Mainetty had left, and I was in charge, I opened up about fifteen different manganese ore deposits, optioned others, abandoned some, and in a year had fifteen thousand tons of ore piled at the railroad, the railroad overtaxed, and much more ore ready to ship to the railroad when it seemed best. All this from the district of Bomfim, on the railroad from Bahia to Joazeiro.

The ore occurs as a replacement and alteration of iron-bearing schists, like the schists called "itaberite" in Minas Geraes. There is a short range of mountains near Bomfim rising 1,000 ft. abruptly from the nearly level, semi-arid plains below. There are three distinct repetitions of these iron-bearing schists in the Bomfim district, and perhaps three more in the Lamarão district, to the south, which has been little prospected. Still farther to the south and nearer the railroad from Bomfim, past Missão, Lamarão, and now at Jacobina, is the Saude district, from which I mined a lot of fine ore, before the railroad was completed, in 1918. Then comes the Jacobina district, then the Canna Brava, and others. There is a necklace of districts of manganiferous ore probably extending to Goyez and to Minas Geraes.

Climate Variable

There are also manganese districts in Bahia, nearer the coast and connecting Nazareth and Cajoeira with the interior. The climate at Nazareth is very moist, though at Bomfim it is as dry as Nevada.

The manganese mines of Minas Geraes are barely known, even by name, at least to the public. In order of importance they ranked, in 1918, about this way: Morro da Mina, Cocoruto, Santa Mathilda, São Gonsalvo, and the mines at La Fayette and vicinity.

The Morro da Mina had a simple system of mining, top benches, exposed to the weather, with an irregular lot of tunnels for wet weather work, about 200 ft. below the top works. At the top, where the chain of orebodies, hundreds of feet wide and thousands long, was exposed, there were no cars and no rails, save those of the broad-gage railroad leading to Rio de Janeiro. Perfectly level floors were gradually made, mules and two-wheeled dump carts carrying the broken ore, much of which was soft and none of which was crushed by machinery, to chutes leading to small bins from which the railroad cars could be filled. The carts and mules cost two milreis per day, ($2), the repairs falling to the man who owned them.

Thus a man could earn 50c. for a mule and cart, and many such units were used per human employee, as the mules were trained to form a line of carts that looked like a circus making a one-day jump. They would back up to the ore pile, wait for the cart to be filled, then start off for the procession leading to the ore chutes perhaps five hundred feet away, turn around, let the ore be dumped and start back on the run for another load.

The Morro da Mina mine has probably five million tons of marketable ore, the Cocoruto has shipped 300,000 tons or more and has nearly as much left, and the São Gonsalvo has a record of 200,000 tons, and its future will depend on the cost of mining its caved ground.

The topography and geology of Minas Geraes and the mountains of Bahia suggest Virginia, and the climate, though milder than that of Virginia, and with less rainfall, is similar.

The mines of La Fayette, of Miguel Burnier, and of Ouro Preto are all that are usually described by writers of Brazilian manganese ores. In addition, there are huge deposits in Goyaz, Matto Grosso, and elsewhere in Minas Geraes and Bahia. Thus Brazil can supply the world with manganese, and of varying qualities, including crystalline pyrolusite, which has often been shipped as furnace ore, but has been used to make batteries or in other chemical applications.

CHROMITE IN BAHIA

The chromite deposits of Brazil have not yet been described by any one, being mentioned only by name. I notice Mr. Garrison says in a recent article that he discovered them. No doubt he refers to his examination of them in 1916 for E. J. Lavino & Co. and associates. The deposits are situated in the State of Bahia, about two and a half kilometers west of the station of Santa Luzia. I first saw them in 1917, in May or June, in company with George Lavino and E. J. Huffard. There were two three-foot pits and a lot of black boulders visible in the thick undergrowth of oak, thorny trees, and underbrush, impenetrable save for the irregular paths taken by Mr. Garrison, which were visible.

I ordered a fifty-foot swath cut along the probable line of the ore and later another at right angles to the first. Finally all the growth over an area of half a square kilometer was cut off. I dug thirty-two pits and extracted 10,000 tons of ore before I knew the extent of the deposits. Suffice it to say I ran two inclines, mined over 30,000 tons of 38 to 47 per cent chromic oxide in the form of chromite, and left over double that in the mine for the future.

The mine, which was leased by E. J. Lavino & Co. from Newman & Co., an American firm of New York and Brazil, was known for years as "Pedras Pretas," or black rocks. Coronel Leopoldino Leitão, an agent of Newman in the hide business, sent the rocks to Newman, who sent them to his brother in New York, who had them analyzed, finding chromite. There are at least two other localities in Bahia that show chromite, and one of these should yield to development.

It cost $2 to mine the ore and put it on cars, $2 to pay Newman, and a scattering expense for freight, export tax, and ocean carriage, making the ore cost $20 to $25 per ton in New York, f.a.s., or f.o.b., or f.o.g.—meaning free of graft.

As to the geology of the chromite, I collected a set of specimens and made several cross sections, and they have not been delivered to me as yet, as they are among my private effects which were delayed in Bahia. There is little serpentine near the chromite. The chromite is in three stages of alteration or replacement. One stage is chromite, another disseminated chromite in silica, and another a chromite-hornblende combination, which is hard and of variable composition. Bands of segregated material lie along the line of weakness evident in the complex of granites, gniesses, and other materials that are common in the vicinity. These materials include serpentine, quartz, hornblendic rocks, and iron ore (indicated on surface). Quartz is perhaps equal in quantity to the hornblendic rocks. There is some kaolinization, but it is more marked along a later fracture, also mineralized, and at an angle of seventy degrees or so with the line of the chromite deposits first mentioned. There is much more chromite in this segregated district than anything else. One hundred feet or so under the original surface the orebodies are nearly one hundred feet thick and contain 80 per cent ore at least. It is chromite, mixed chromite and hornblende, and disseminated chromite. The surface near the chromite deposit is only slightly elevated, the slope being eight degrees. The prospecting was like looking for ore in a wooded cow pasture.

There are countless cliffs of titaniferous iron along the coast in Brazil, not yet visited by many Americans, and still open for location, I think.

Copper occurs in several known districts in the north of Brazil, but there are no operations for its recovery at this time. I opened up four pits in the Carahyba mines, seventy-six kilometers west of Angico, between Bomfim and Joazeiro. I took out four thousand tons of 4 per cent ore and piled it neatly and precisely near the pit. Several dozen pits two meters square and four meters deep were dug at the intersection of hundred meter squares. The copper occurs along a northeast line and can be found at points 100 miles apart. I should like to prospect the whole belt. It is a nearly arid country, slightly wooded. A valuable fibre was shipped from this section during the war.

There are a few graphite deposits, slightly worked, in Bahia. They are not far from Santa Luzia, where the chromite occurs. There are several places in Bahia and more in Minas Geraes where commercial mica is found, in several colors. Muscovite is not as common, in my experience there, as other forms.

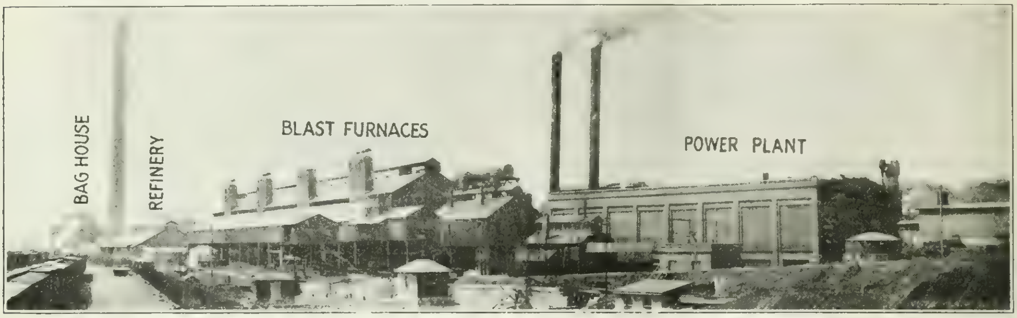
Bahia has a number of nitrate deposits, usually very small and with potassium nitrate rather than sodium nitrate. We made gunpowder from it for our mining purposes, when dynamite became too high in price.

I notice that "Political and Commercial Geology" keeps off Ecuador. The South American Mines Co. owns the South American Development Co., which operates the only gold lode mines in Ecuador. The company makes money and has only one possible rival, an adjacent property controlled by Frenchmen.

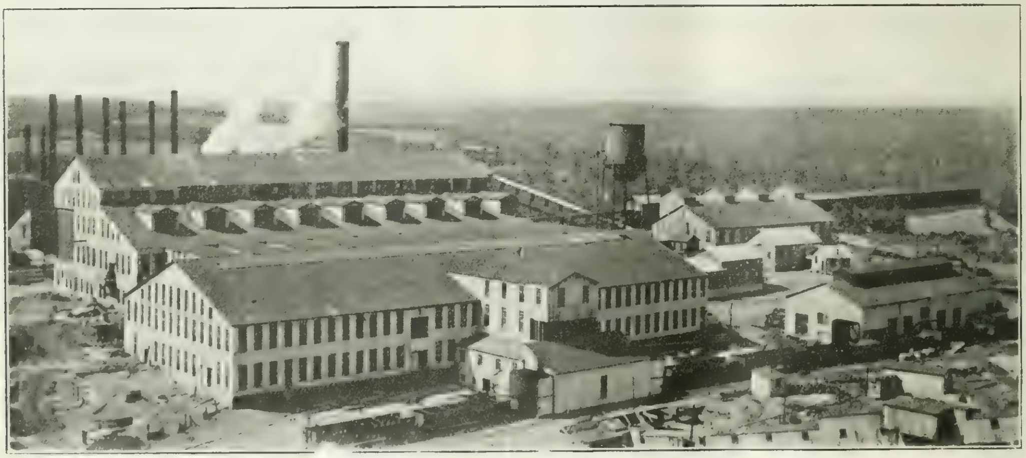
Queensland's Gold-Mining Activities

Gold was naturally the first of the minerals to be exploited in Queensland, Australia, according to Trade Commissioner Ferrin in *Commerce* [illegible] production showed an accelerating [illegible] 589 fine ounces in 1868, the first year in which it exceeded 100,000 ounces, to 676,[illegible] since which time production has been steadily declining, and at present is under 150,000 ounces.

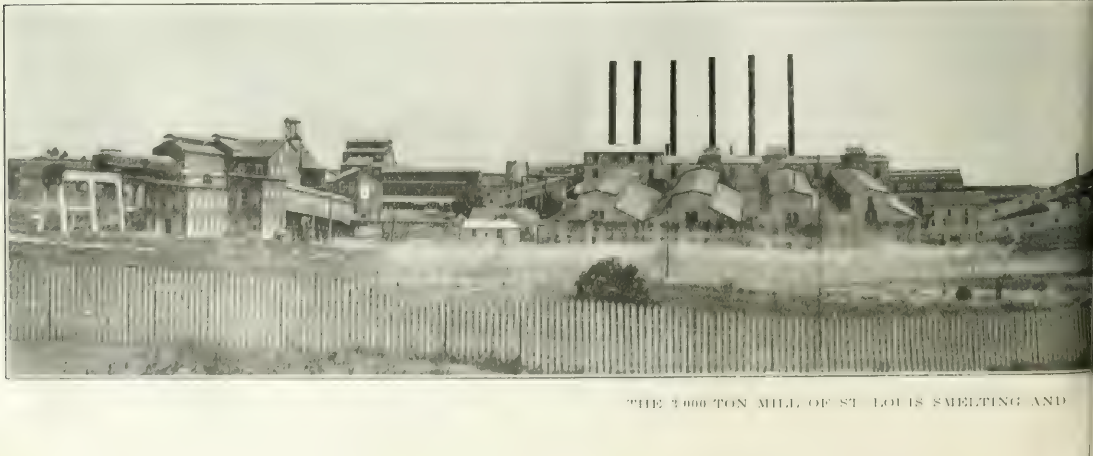
Lead Mills and Smelters in Southeast Missouri



HERCULANEUM SMELTER OF ST. JOSEPH LEAD CO. AT HERCULANEUM, MO.



NO. 4 MILL (5,000 TONS' CAPACITY) OF FEDERAL LEAD CO., NEAR FLAT RIVER, MO.



THE 3,000-TON MILL OF ST. LOUIS SMELTING AND

NO. 3 MILL (5,000 TONS' CAPACITY) OF ST. JOSEPH LEAD CO., NEAR ELVINS, MO.

MATTE SINTERING

SLAG SINTERING

AT HERCULANEUM SMELTER OF ST. JOSEPH LEAD CO., HERCULANEUM, MO.

EFINING WORKS OF NATIONAL LEAD CO., ST. FRANCOIS, MO.

A Cement Gravel Gold Mine in British Columbia

Trommel and Spray Sufficient To Break Up Formation, Releasing Metal—Waugh Clipper Drills Give Satisfactory Service

BY DONALD D. FRASER

Written for *Engineering and Mining Journal*

THE Tertiary Mining Co. is operating a cement gravel mine at the foot of the Cottonwood Canyon of the Fraser River about twenty mines north of the town of Quesnel, B. C. Cement gravel can be traced along the river from Fort George to Soda Creek, over 120 miles. As one travels up the Cottonwood River, also, cement gravel can be seen exposed for a number of miles. The binding material is, in part at least, lime. The formation is apparently Recent. It is probable that the cementing material was introduced during or following volcanic action which took place in Recent time.

MILL BUILDING, TERTIARY MINING CO., NEAR QUESNEL, B. C.

The mine is situated on an old channel which cuts across the Fraser River in a southerly direction. At the point of intersection the channel is nearly 200 ft. wide. Years ago it is said that Chinamen worked the exposed face and ran coyote holes near the bedrock. Afterward it was held by two white men, who made good wages drifting. They did their mining in the winter and dumped the gravel near the mouth of the tunnel. There the frost and the air partly slaked it. During the spring freshet it was shoveled into sluice boxes. Although the major portion of the cement was slaked, there must have been a very appreciable loss of gold through the unslaked material. Some of the material lies on the old dump, still cemented as tightly as it was originally.

After considerable experimenting, a revolving trommel was adopted by the company now operating the mine. It is a machine 16 ft. long and 4 ft. in diameter built up of ½-in. boiler plate and punched with ¾-in. holes. A spray pipe was installed along its axis of rotation. The gravel is dumped from the mine cars into a receiving bin, from which it is fed to the revolving trommel. As the material works through the trommel, its own grinding action scours the boulders as clean as possible. The water from the spray pipe keeps the boulders washed clean.

At first some trouble was experienced because the material passed too quickly through the trommel. Even though the trommel was leveled to a nearly horizontal position, this difficulty continued. It was finally overcome by placing three sets of 8-in. baffles in the trommel. These held back the material and made a bed which gave an increased grinding medium. The boulders from the machine were sent to the waste dump. The material washed through the openings in the trommel enters a line of 12-in. sluice boxes. The gold is heavy, and most of it is caught in the first two boxes.

This is a very simple flow sheet, and little power is needed. Unless gravel is met which is cemented so tightly as to be almost a conglomerate, this method should be the most economical one possible. It may be that a deposit is so tightly cemented that it will not be amenable to this method. The alternative is a stamp mill, which will cost more to install and be more expensive to maintain.

I have seen a ball mill used in connection with a Blake crusher. On the face of it, this is absurd. Anyone who has had anything to do with a ball mill knows what will happen when it is fed with a large percentage of extremely hard oversize. The oversize builds up in the mill, gradually cutting down its capacity. It seems almost that no amount of grinding will reduce this oversize. It must be dumped out of the mill. The boulders found in a placer mine are the remnants of material washed by the stream and are naturally very hard. When fed into the ball mill they make good grinding material, but do not work through. Boulders are waste, and the sooner they are eliminated the better.

It may be of interest to note that the drilling underground was done by Waugh Clipper drills. The drifts are run about 6.5 ft. high, of which one foot is in bedrock. The bedrock is a greatly decomposed micaceous schist. Two lifters are put into the bedrock; two breast holes and two uppers in the cemented gravel.

Before giving the machine drills a trial, failure was predicted by nearly all. The boulders are extremely hard, and of diorite, granite and quartz, and the binding material and sediment are brittle and friable. It was thought that the drill would "run" between the boulders and that it would be impossible to keep a hole. The first trial proved that the drills would work satisfactorily. Some trouble was experienced, but no more than is usually expected in rock mines where fissures are prevalent. As the sediment around the boulders is heavy, considerable water is required to keep the holes clean.

To Promote Prosperity of Asbestos Producers

A central research bureau for asbestos producers was advocated by J. G. Ross in a talk before the members of the Canadian Institute of Mining and Metallurgy at the Montreal meeting (March 2-4, 1921). New uses should be investigated and publicity campaigns planned to market the contemplated increase in production during the coming year. Such a bureau could also investigate milling methods and establish definite grades for the product. At present, crude No. 1 and No. 2 are the only grades which can be easily defined; the mill stocks vary, and sales are made by sample rather than by specification. There is also a tendency for various mills to adopt a common method of treatment, which often results in inefficiency, because the best method to use on one type of rock is likely to require considerable modification in operations on rock of a different nature.

Prominent Mining Engineers

C. V. Corless

WHEN THE TIME CAME for decision as to what line should run at the top of this page, some doubt entered our mind. Is Mr. Corless a mining engineer or a metallurgical engineer, or does he belong in some of the newer classes such as "human" engineers or educational engineers? He qualifies for any of these titles, but we thought that "mining engineer" was the most all-embracing. Mr. Corless is another one of those Canadians: he was born on an Ontario farm in 1868, and has spent most of his life in his native country. His early years of manhood were occupied in teaching in preparatory schools, where he gained a reputation for his work in natural science, particularly biology. At the age of thirty, however, he had become convinced that progress along the lines which he had been following, and the fruition of his desires, required a separate income, which he did not command. No doubt feeling, therefore, as so many of us have, that digging gold out of the ground was a good way to acquire it, he decided on a course in mining and metallurgy at McGill University, in Montreal. In 1902, he was graduated with high honors, including a medal and a fellowship, and received the degree of B.Sc. in Mining.

C. V. CORLESS

In Canada, the summer vacations are longer than in this country, and the mining students almost invariably spend this time in practical work. One summer, Mr. Corless worked under W. A. Carlyle at the Le Roi mine at Rossland, B. C.; another was spent in the coal mines of Crow's Nest Pass; and his last "vacation" was spent in an inspection trip, with other students of his class, of the mines and metallurgical works of British Columbia, and in the preparation of a thesis on the geology and ore deposits of southern British Columbia. The year 1903 was devoted to graduate work under the Dawson fellowship, which he had received, the subject of his research being "Free Fall of Bodies in Water," a topic of great importance in the concentration and classification of ore pulps. For this work he won a Master's degree.

After leaving the university, Mr. Corless held his first position for only ten days. This was not because he was fired, however. The work he had accepted had been the inspection of railroad shops, and when he had the opportunity of examining some coal properties he lost no times in turning to his chosen profession. Many of our readers have heard the story of the man who was hired to kill some beavers which were damaging his employer's property. Joe had been on the job for some days with gun in hand, when friend Bill happened by to keep him company. Bill's bright eyes soon saw a beaver, but Joe was unmoved. "There he is, Joe; why don't you shoot?" he asked. "What do you think I am, Bill?" he replied, "that's the last beaver; and if I kill him I'm out of a job." Now, Mr. Corless, when he went to the given spot in British Columbia, had no trouble in deciding that coal was present, for he could see it; also that the seam was not workable, for that was equally evident. However, he lost no time in reporting his conclusions, and in a few days was again out of a job. This state of affairs was soon remedied, however, when he was offered an assistantship in the mining department of McGill. This was not exceedingly remunerative, but offered further opportunities for study.

A year later, in 1904, Mr. Corless, through his university friends, was given a position as mine superintendent for the Mond Nickel Co., the world's second largest nickel producer, and his connection with that company has continued to the present day. In 1908, he was made director and manager, and since that time has been actively in charge of hydro-electric development as well as the construction and operation of the Coniston smelter and an experimental flotation mill.

Besides his engineering activities, Mr. Corless has achieved a reputation as an educator and a welfare worker, and has contributed many constructive papers to scientific societies and technical journals on these subjects. The latest honor accorded Mr. Corless is that of the presidency of the Canadian Institute of Mining and Metallurgy, a position which he assumed at the Montreal meeting early in March.

CONSULTATION

Metallurgy of Ferro-Uranium

"Will you give me through the pages of *Engineering and Mining Journal* some information relative to the ferro-alloys ferro-uranium and ferro-vanadium? Is it an expensive or difficult process to reduce the above-mentioned minerals to the ferro state? Also, if you have the data at hand, give me the radium content of carnotite, and assuming the radium is in equilibrium with the uranium."

We have no cost data on the reduction of vanadium ores, but the problem has been found rather difficult of solution on account of the high temperature required and the speed with which the reaction must take place. The crude ore runs about 25 per cent V_2O_5. This is calcined and then smelted in an electric furnace with carbon or silicon as a reducing agent. An older process, though still widely used, employed aluminum as the reducing agent in an open-hearth or crucible furnace. The aluminum, added in the form of shot, is slagged off, the addition of carbonate of soda or fluorspar being made for this purpose.

In the manufacture of ferro-uranium it is necessary to subject the carnotite ore, which is the principal source of uranium, to wet treatment, which has as its object the extraction of radium with uranium oxide, vanadium oxide, or iron vanadate as byproducts. Ferro-uranium was developed as a ferro-alloy more because a large amount of sodium uranate, $Na_2U_2O_7$, accumulated as a byproduct of radium production, than for any special necessity for the use of uranium in alloy-steel manufacture. According to Keeney, as the reduction temperature of uranium oxide by carbon is 1490 deg. C. the electric furnace is the only available means for performing the operation in quantity.

One of the chief chemical considerations in the smelting of ferro-uranium is the strong affinity of uranium for carbon, its tendency to form carbides, and the fact that no fluxing material except fluorspar can be used with sodium uranate, as the addition of lime or silica results in keeping the uranium in the slag, with practically no reduction. In practice, steel turnings, uranium oxide, petroleum coke, and fluorspar are mixed in the proper proportions and charged slowly at a rate dependent upon the size of the furnace and grade of alloy to be made. The reaction involved is a simple reduction, the carbon reducing the uranium, which alloys with the steel turnings to form ferro-uranium. All the ingredients in the charge should be as pure as possible, and especially free of silica.

Standard commercial ferro-uranium contains 35 to 50 per cent uranium and 1.5 to 4 per cent carbon. It is brittle and has a high density.

A large amount of data on the subjects mentioned is given in R. M. Keeney's paper "Manufacture of Ferro-Alloys in the Electric Furnace," which appeared in Vol. 62 of the *Transactions* of the American Institute of Mining Engineers.

The output of uranium and vanadium ores in 1918, the latest figures compiled by the U. S. Geological Survey, amounted to about 18,860 tons, which contained 89.5 tons of uranium (105.5 tons of U_3O_8) and 27.1 grams of radium. This will give an idea of the ratio of radium to uranium in domestic ores as mined. The carnotite ore of Colorado supplies the domestic raw material in this country for the manufacture of ferro-uranium.

Blowing White Metal to Blister

In our issue of Jan. 29, one of our correspondents presented the problem of treating a combined mass of shot copper and high-grade matte in converters, to obtain the usual blister copper product. C. D. Demond, of the Anaconda Copper Mining Co., has been kind enough to contribute the following comment on the problem.

"It is quite out of the question to treat the high-grade reverberatory product, mentioned by the correspondent from Rosita, directly in a converter, because it would not develop enough heat to prevent freezing the charge; and it seems unlikely that any feasible method of preheating the converter can be devised. If a heating material is to be used, and if iron pyrite is available (preferably carrying some copper, in order to make it pay its way), the best practice may be to add this to the reverberatory, first thoroughly mixing it with the rest of the charge. But this would yield a considerable amount of converter slag, carrying so much copper that it would have to be re-treated.

"It is probable that the cheapest and best method will be, as suggested by Patrick Dalton, the long-experienced converter foreman at Anaconda, to skim off the reverberatory slag and then bring the high-grade matte to blister copper by blowing air into it through iron pipes plunged into the bath, while continuing a moderate coal fire in the furnace. After tapping the copper, a fresh ore charge would be introduced. Or, the blowing-up might be done in a special small reverberatory furnace.

"Referring to the 0.2 to 0.3 per cent of copper in reverberatory slag, it would be of a good deal of interest to know the analysis and mineral content of the charge, and the analysis of the slag. Is the ore self-fluxing? If not, what materials go into the reverberatory, in what proportions, in how large pieces, and how thoroughly are they mixed?"

Ninety-nine and One-Half Cent Silver

"We are writing to inquire how you arrive at the quotation of 99½c. for domestic silver. All the smelters are settling for silver at 99⅝c., and it seems that this is the price agreed upon between the Mint officials and the smelters and refineries on June 16, 1920, as reported in the newspapers the following day. This would mean that producers are to be paid $1 per oz. for silver, less ⅜c. for transportation and the difference due to adjustment on the basis of 1,000 fine, as against the commercial 999 fine."

The 99⅝c. silver quotation made by the Western smelters does not include a ⅛c. commission charge, which Handy & Harman and possibly other silver dealers compute in effecting sales of silver. As the *Engineering and Mining Journal* accepts Handy & Harman's silver quotations as accurate, the 99½c. quotation is given preference. The price of 99½c. is a buying price for domes- the silver at 999 fine, and allows a commission for handling the business and disposing of the silver to the Government on a basis of $1 per oz. 1,000 fine.

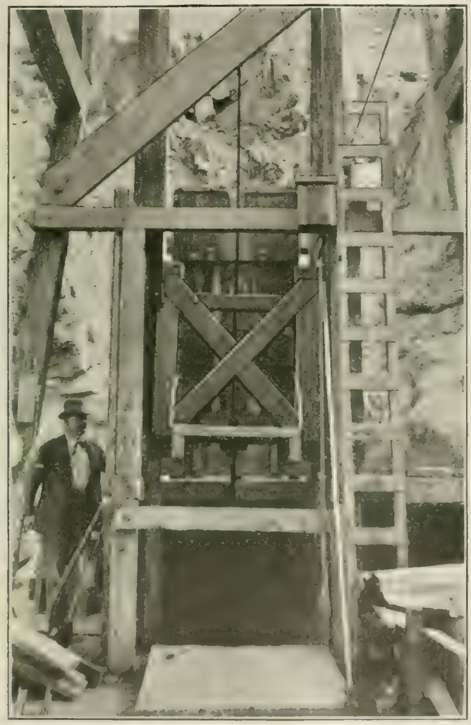
HANDY KNOWLEDGE

Crosshead for Prospecting Shafts

BY LEROY A. PALMER

Written for *Engineering and Mining Journal*

The attached illustration is self-explanatory. It shows a crosshead used in development work which provides a platform on which the men ride instead of on the bucket. The crosshead is about 4 ft. high and the platform is built about a foot from the bottom, projecting about 2 ft. each side of the crosshead proper and well braced to it at top and bottom. This gives standing room for four men and brings the top of the device at a convenient height for them to hold on to while in motion. The photograph was taken at the Big Jim shaft at Oatman, Ariz.



CROSSHEAD WITH HOISTING PLATFORM

Further Kinks in Surveying

BY J. F. HANST

Written for *Engineering and Mining Journal*

I was much interested in an article which appeared in Vol. 111, No. 9, under the date of Feb. 26, pp. 390 and 391, and entitled "Dodges Useful in Surveying," by H. L. Thackwell. I have a few comments and suggestions to make, particularly on items 1, 6 and 8, which I shall take up under the same headings.

1. How To Get Along Without a Back Flagman

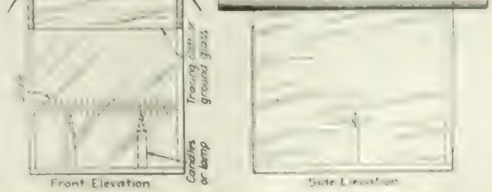
Mr. Thackwell's suggestion is all very well for settled country, but for work in the woods or wild country where it is difficult to see even prominent natural objects, from one station to another, it becomes absolutely useless. The most simple and obvious solution is of course to have the head chainman give the first backsight. When he has given that backsight it is an easy matter to rest a pole across the line and set a backsight by hanging a plumb line from the pole in the correct position, weighting the line with a rock. A piece of white paper strung on the line aids the instrument man to locate it easily. If the country at the backsight is too open to make convenient use of trees or other objects, on which to rest the pole, a rough tripod can be made out of poles, cut from saplings, or from any convenient materials.

Of course, any of these methods slow up the work, but the particular method which I have described, and which I have used on many occasions, is not subject to error, as in Mr. Thackwell's method. It is impossible to triangulate distant objects in relation to a short and comparatively inaccurate base line without introducing serious errors in the work.

6. Sighting Box for Tunnel Work

The apparatus described by Mr. Thackwell is quite ingenious, but it seems to me that it is much more elaborate than necessary. Most mining engineers are accustomed to using stations set in the roof of the tunnel or drift, and not floor stations. When roof stations are used, with the plumb bob hanging from a spad, a square of tracing cloth, held behind the string and illuminated by a light held behind the tracing cloth, is all that is necessary in the performance of the most accurate work.

For shaft plumbing, an apparatus similar to Mr. Thackwell's, but much simpler, is used. This apparatus consists of a box with a door at the rear. At the front of the box is a piece of ground glass or tracing cloth, on which a graduated scale is ruled in ordinary India ink. Two candle stubs, or an acetylene lamp, are placed in the box for illuminating purposes, and the apparatus is placed behind the plumbing wires. A tin "roof" on the box protects the lights from water and permits the escape of smoke and heat. The graduated scale enables the transitman quickly and accurately to bisect the



SIGHTING DEVICE FOR TUNNEL WORK

swing of the plumbing wire. A sketch of this sighting device is appended.

8. *Projecting Accurate Lines*

Mr. Thackwell's suggestion is all right as far as it goes, but it does not go far enough. It is admitted by all experienced engineers that one of the hardest things which a surveyor has to do is to run a perfectly accurate straight line. As most maps of mine properties today are laid out on a co-ordinate system, some companies, notably the Cleveland Cliffs Iron Co., of Ishpeming, Mich., use the co-ordinate lines as a basis for the actual field work. On this system, the co-ordinate lines are laid out in the field from two main or zero lines, one running due east and west, the other intersecting at the origin of co-ordinates, running due north and south. All stations, then, become expressions of co-ordinates, and are designated thus: N 400 x 800 E, or S 2,400 x 1,200 W. An intermediate or "plus" station, if on a principal line, becomes, for example, N 1,600 x 819.25 W, or similarly S 3,216.49 x 1,200 E. Permanent stations, consisting of 1-in. round iron stakes about 24 in. long, are set on each principal line at every 800-ft. intersection and also at such points on the line that a permanent backsight and foresight may be seen from each permanent station. At intervals of 200 ft. wooden stakes are set to line. Every 800-ft. "iron pin" line or principal co-ordinate line is run complete throughout the entire length of the area it is desired to survey. Intermediate 200-ft. lines are only chopped out wide enough to set whatever stadia stations are necessary to take all of the topography within an 800-ft. square.

In running these long principal lines, extreme accuracy is necessary, as the principal lines must intersect at exactly 90 deg., and measurements must check both ways. All measuring is done at short intervals with "measuring" stakes set on line, and, except on very level ground, all measurements are taken from the head of the transit and the vertical angle read off and noted. Two measurements, one forward and one back, can be taken each time the instrument is set over a measuring stake. This setting need not be particularly accurate, the only requirement being that the transit head is on the line of sight. Measurements are taken with a 200-ft. steel tape graduated to feet and hundredths, and reductions are made on the ground from a table of corrections for all probable vertical angles and distances, or from an ordinary table of cosines.

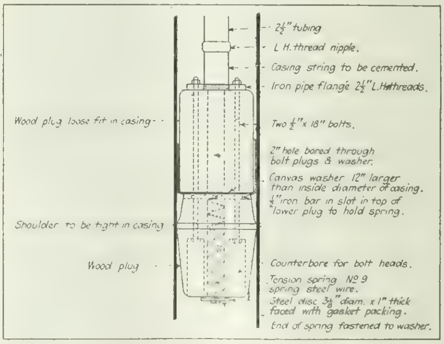
In projecting the lines ahead, the transit is accurately set up over an "iron pin" or principal station. The vernier is clamped in any position and a direct sight taken on the backsight. The telescope is then reversed on its axis and a point set on line at the foresight. With the telescope still reversed, the plate is unclamped and another sight taken on the backsight. The telescope is now reversed again, bringing it to its normal position, and another point set at the foresight. If the instrument is in absolutely perfect adjustment, these points will coincide and the line is correctly projected. If the instrument is out of adjustment, these points will be separated, and the true line is midway between. A tack or mark is set at this midpoint and the transit sighted in it for the location of any intermediate points.

With this method, all errors of the transit are eliminated, and there is no necessity to turn an angle of 180 deg., which introduces a personal error. In fact, it is possible to run very long lines by this method with an absolute minimum of error. It is particularly applicable to rough country, although, of course, the longer the sights the more accurate will be the work. It is very necessary that the instrument be set exactly over the point at each principal set-up; otherwise, an error is introduced which may or may not be compensating.

Wooden Plug for Placing Cement Through Tubing

An ingenious and inexpensive outfit for placing cement in a well is described by H. B. Thomson, in "Summary of Operations—California Oil Fields," and is illustrated by the accompanying sketch. This device is original with H. S. Williams, superintendent of the Timber Canyon Oil Co., and was successfully used in cementing 9⅝-in. casing in the company's well No. 3, Sec. 18—4—20, S. B. B. and M., Santa Paula field, Ventura County, Cal. It consists of an upper and lower wooden plug with a canvas washer of large diameter between, and bolted together through an iron pipe flange on top with two long bolts. The pipe flange is threaded with left-hand thread to fit a short nipple having left-hand threads on one end and screwing into a standard threaded string of tubing on the other end.

Two and one-half inch tubing was used, and a 2-in. hole bored through both plugs and canvas washer. It will be noted that the top plug is somewhat smaller than the outside diameter of the casing, and the shoulder on the lower plug should be a drive fit. A valve was made for the outlet at bottom by facing a flat steel disk with gasket packing, and attaching to a coil spring, No. 9 steel wire being used, and coiled to a diameter to fit the bored hole in the plug. The other end of the wire was attached to a bolt set in a slot in the top of the lower plug.


2½" tubing
L H. thread nipple.
Casing string to be cemented.
Iron pipe flange 2½" L.H. threads.
Wood plug loose fit in casing
Two ½" x 18" bolts.
2" hole bored through bolt plugs & washer.
Canvas washer 12" larger than inside diameter of casing.
½" iron bar in slot in top of lower plug to hold spring.
Shoulder to be tight in casing
Wood plug
Counterbore for bolt heads.
Tension spring No 9 spring steel wire.
Steel disc 3⅜" diam. x 1" thick faced with gasket packing.
End of spring fastened to washer.

WOODEN PLUG FOR CEMENTING OIL WELL CASING

In placing the cement, the casing is lifted off bottom, and plug run in on the end of tubing string. When the plug passes out of the shoe the canvas washer spreads out, and prevents the return of the plug. With the bottom located in this manner the cement is pumped into the well through the tubing and plug, the valve on bottom preventing its return after the pressure is taken off. When the necessary amount of cement has been placed, as indicated, the tubing is unscrewed and pulled out, the casing lowered to bottom with the plug in place, and the cement allowed to set before drilling out plug.

The outfit, as described, exclusive of tubing, costs altogether $6.50 to make up, the plugs being turned in a local mill from 10-in. x 10-in blocks at a charge of 60c. each for turning.

THE PETROLEUM INDUSTRY

Oil Possibilities of the Mackenzie—A Warning

THE RECENT PUBLICITY given to the discovery of oil by Imperial Oil, Ltd., near Fort Norman, in northwestern Canada, and to the excitement caused by the strike, has evoked comment[1] that is of much timely interest, warning against undue haste on the part of oil prospectors in acting on the news. Those who participated in the unwise and unprofitable rush to Calgary, Alberta, some years ago, will partly understand the necessity of weighing all facts relative to geology, geography, transportation, climate, and other conditions before acting.

The excitement has been caused by items appearing in the daily press and trade journals, of which the following is a conservative sample:

> Chatham, Ont., Oct. 16, 1920.—Reports have reached Edmonton from Port McMurray that an important oil strike has been made by Imperial Oil, Ltd., in the Far North. These reports state that on Aug. 25 the Imperial well at Oil Creek, below Fort Norman, struck a gusher production at 850 ft., estimated between 1,000 and 1,500 bbl. a day, and that when the well came in the oil shot 15 ft. above the top of the derrick.

A report of this sort from an easily accessible region might wisely be investigated by the oil fraternity, with the intention of investing if found favorable. But the fact remains that the majority of such reports have not materialized in anything like the originally reported production. For instance, various wildcat wells in western Texas have been reported with great productions; yet when carefully investigated the production was found less than five barrels per day. Of course, it is far more necessary to consider carefully all factors before accepting similar reports when the locality they concern is 1,200 miles from the nearest railroad and less than 300 miles from the Arctic Ocean.

The facts concerning the Fort Norman well are said to have been stated by C. O. Stillman, president of Imperial Oil, Ltd., as follows:

> On Aug. 25, at a depth of 783 ft., oil was encountered, which flowed out of the 6-in. pipe for thirty minutes, when the well was capped and shut in. Any estimate as to the amount of oil this well would produce is only a guess, as there was no tankage available, and an accurate test could not be made.

Mackenzie is one of the three districts known collectively as Northwest Territories. The oil strike that has caused such a stir is in this district, forty-five miles below Fort Norman, on the east bank of Mackenzie River and only a few rods from the river. The nearest railroad point is Fort McMurray, about 1,200 miles distant by river. The scene of the strike is 1,500 miles by the nearest route of travel from Edmonton, Alberta, the nearest city.

Access is mainly by way of either the Athabaska or Peace river to the Slave River, and thence northwestward via the Slave and Mackenzie rivers. Shallow-draft boats must be used. Cargo must be unloaded and carried around the rapids at Fort Fitzgerald, if going via Fort McMurray, and around Peace River rapids in addition in traveling via Peace River. The rapids would present a serious obstacle to returning upstream with oil. The rivers are frozen for eight months of the year. Access may also be had via Dawson and the Yukon, but by these routes it is likewise difficult.

Knowledge of the existence of petroleum in the lower Mackenzie region is not new. R. G. McConnell stated many years ago that:

> The Devonian rocks throughout the Mackenzie Valley are nearly everywhere more or less petroliferous, and over large areas afford promising indications of the presence of oil in workable quantities. The rock is in several places around the western arm of Great Slave Lake highly charged with bituminous matter and on the north shore tar exudes from the surface and forms springs and pools at several points. (R. G. McConnell, "An Exploration in the Yukon and Mackenzie Basins, N. W. T."; Geol. Survey of Canada Rept., New Series, Vol. 4, Pt. D., pp. 21, 75, 76.)

In 1912 samples of oil were brought to Edmonton from the vicinity of the present Fort Norman well. Alfred W. G. Wilson reviewed these and other evidences in 1915 in Frederick G. Clapp's "Petroleum and Natural Gas Resources of Canada."[2] In that report the statement is made that "the most promising region in the Northwest Territories for the devlopment of a producing field appears to be along the Mackenzie, although the evidence is by no means conclusive." However, little importance was attached to that prospective field compared with the rest of western Canada, as may be judged by the fact that the report allotted only twelve pages to Yukon and the Northwest Territories (including the Mackenzie basin) out of a total of 131 pages describing oil and gas possibilities in western Canada as a whole.

FORT NORMAN GEOLOGICAL CONDITIONS NOT PARTICULARLY FAVORABLE

Notwithstanding the glowing reports received at various times, geological conditions in the Fort Norman region are not entirely favorable. It should be realized by prospectors that to assure a profitable field something more is needed than mere seepages, petroliferous strata, and reports of oil in shallow wells. The strata of the Mackenzie region are in general of Devonian age, and the commercial oil possibilities of the Devonian rocks have by no means been demonstrated. Indeed, in this valley they appear to be underlain at comparatively shallow depth by pre-Cambrian metamorphic or igneous rocks, which are, of course, absolutely unfavorable for oil.

Again, the Fort Norman area appears to lie in the center of a geosyncline or great basin, and for this reason also is not highly favorable for the existence of an important oil field. It is true that certain oil pools in other parts of the world occur on the monoclinal or anticlinal flanks of geosynclines, and many small pools occur in minor monoclines where the rocks are barren of water or devoid of artesian pressure; but the fact remains that few important oil fields have been found in the central portions of geosynclines under conditions such as those that obtain in the Fort Norman area. Some structurally favorable areas do exist; yet even these other conditions, less favorable, may offset the favorableness of structure.

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[1] Abstract of Bulletin No. 6 of The [illegible] Petroleum Engineers, [illegible] Broadway, New York. Frederick G. Clapp chief geologist.

[2] Canada Department of Mines [illegible] 291, Vol. 2, pp. [illegible]-263.

OIL DISSIPATION HAS TAKEN PLACE

The region is several hundred miles northwest of Great Slave Lake, where the seepages exist which were mentioned by McConnell and later explorers. Furthermore, along Athabaska River, between Fort McMurray and Lake Athabaska, a number of wells drilled to depths varying from 100 to 1,200 ft. yielded only small quantities of oil and generally finished in granitic rock. The presence of the "tar sand" outcrops along Athabaska River above Fort McMurray in northern Alberta affords no indication that tar or oil will be found farther north. The reason is that these "tar sands" are in the outcrop of the Dakota formation, of Cretaceous age, which does not reappear in large masses farther north until near the Arctic Ocean, about 200 miles beyond Fort Norman.

The entire Devonian system of rocks between Fort McMurray and the Arctic Ocean may be considered as an outcrop of the formations which are deeply buried farther south. Thus the coming to the surface of Devonian beds in the Mackenzie region has given the oil an opportunity to leak out along outcropping porous strata. In other words, an immense amount of oil has disappeared during the ages since the Devonian was eroded, and there are not to be expected any remaining reservoirs of oil, such, for instance, as those in California and Mexico, where the rocks are far younger geologically and there has been less time for the dissipation of the oil.

It must be recognized, therefore, that, whereas great prospects of oil exist in western Canada, the most favorable regions are not along the Mackenzie but in certain areas which are structurally, stratigraphically, and in other respects favorable at considerable distances from the outcrop of the formation which carries the oil.

A geologic parallel to the Mackenzie conditions may be found in Ontario, where the regions of good surface indications in Devonian rocks on Manitoulin Island and elsewhere are not in regions of oil in commercial quantity. On the contrary, the productive localities of Ontario are farther south, where the deposits are thick enough to have retained oil in quantity throughout the ages.

COMMERCIAL ASPECTS OF FORT NORMAN OIL

Even were the geology favorable, it does not follow that oil development in Mackenzie could be made commercially successful. The localities are many hundreds of miles from the nearest railroad, in a region of deep snow and extreme cold for about two-thirds of the year, and where transportation of supplies is very costly. It is a much more serious matter, for instance, than prospecting for oil in Colombia, South America, for there the great distance from the coast is offset somewhat by the mildness of the climate and the fact that the commercial development of the country may reasonably be expected to follow oil development.

From Fort McMurray three boats operate as far north as Fort Fitzgerald. They are owned, respectively, by the Hudson's Bay Company, the Northern Trading Company, and Lamson & Hubbard. It is rumored that Lamson & Hubbard are negotiating a sale of their boat to one of the oil companies. Small boats are operated below the rapids. In 1920 the total freight capacity of the three boats mentioned is reported scarcely to have exceeded 300 tons per trip, of which usually only three are made in a season. The boats were generally loaded to capacity with supplies for their owners, and could not possibly handle much drilling material or supplies for oil men. Passenger accommodations this year will be slight, if, indeed, passage can be secured at all. Oil-well supplies used in the district to date have been floated down on scows.

TRANSPORTATION A SERIOUS PROBLEM

The problem of transporting oil out of the Mackenzie region, if oil be discovered in quantity, may be considered a serious aspect of the situation. Northwestern Canada is one of the most difficult of regions in which to build a pipe line. A line for which estimates[3] were made some years ago, and covering less than 15 per cent of the necessary distance, was found to involve an expense of nearly $5,000,000 under conditions then prevailing.

In 1920, it is reported, three trains a week were operated from Edmonton to the crest of the plateau above Peace River Crossing and another train was run from Edmonton to within twenty-three miles of Fort McMurray. However, the roadbeds are bad, and the Fort McMurray line is said to be impassable for months at a time, despite the attractive railroad schedules. With the extension of the railroad northward into the Mackenzie region in future years, interest in prospective oil fields should increase.

In the face of the tremendous uncertainties now existing, there is no sound inducement for prospectors to brave the rigors of the wilderness of the North. Northern Canada is still much more attractive from the standpoint of ore deposits than from that of oil production.

January Production Shows Decrease In Several States

PRODUCTION OF PETROLEUM in the United States during January, 1921, according to the U. S. Geological Survey, amounted to 38,271,000 bbl., which was 690,000 bbl. less than during December, 1920, but was more than four million barrels greater than during January a year ago. Imports, which amounted to 13,193,000 bbl., were the greatest ever recorded in any one month and were 347,000 bbl. more than in December and more than twice those in January, 1920. Estimated consumption of domestic and imported petroleum, the quantity delivered to consumers, chiefly refineries, amounted to 49,651,000 bbl. Stocks of domestic and foreign petroleum were increased by 1,077,000 bbl.

A halt to the long-continued decrease of stocks in California is shown by a reported increase of 331,000 bbl. held in storage in that state. Net stocks of domestic petroleum east of California increased 450,000 bbl., and stocks of Mexican petroleum held by importers in the United States increased 296,000 bbl.

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[3] Report on the "Gas Fields of Northern Alberta Available for Supplying Edmonton," by The Associated Geological Engineers.

Production decreased in Oklahoma, Kansas, Texas, and West Virginia more than a million barrels and fell off slightly in Ohio, Pennsylvania, and Montana. Increases are reported for the other states. Louisiana in January ranked fourth among the producing states, surpassing Kansas by a small margin, and Kentucky advanced from ninth to seventh place, surpassing West Virginia and Illinois.

The following figures, compiled from company reports, show the quantity of petroleum removed from producing properties. Oil consumed on the leases and net changes in producers' storage are not included except for California. These figures are obtained by annual canvass and will be included in the final statistics of production for the year.

PETROLEUM PRODUCED IN THE UNITED STATES IN DECEMBER, 1920, JANUARY, 1921, AND JANUARY, 1920

(Barrels of 42 U. S. Gallons)

State	December, 1920 Total	December, 1920 Daily Average	January, 1921 Total	January, 1921 Daily Average	January, 1920 Total	January, 1920 Daily Average
California	10,038,000	323,806	10,177,000	328,290	8,488,000	273,807
Central and Northern Texas	6,749,000	217,710	6,462,000	208,452	5,778,000	186,387
Coastal Texas	2,517,000	81,193	2,616,000	84,387	1,441,000	46,484
Oklahoma	8,742,000	282,000	8,299,000	267,710	7,958,000	256,710
Northern Louisiana	2,434,000	78,516	2,524,000	81,419	2,400,000	77,419
Coastal Louisiana	164,000	5,290	156,000	5,032	167,000	5,387
Kansas	3,044,000	88,194	2,664,000	85,935	2,969,000	95,774
Wyoming	1,424,000	45,936	1,464,000	47,226	1,169,000	37,710
Kentucky	740,000	23,871	905,500	29,210	634,000	20,452
Illinois	840,000	27,097	852,000	27,484	887,000	28,613
West Virginia	748,000	24,129	645,000	20,806	678,000	21,871
Central and Northern Ohio	466,000	15,032	434,000	14,000	396,000	12,774
Northwestern Ohio	172,000	5,548	186,000	6,000	135,000	4,355
Pennsylvania	624,400	20,142	619,000	19,968	534,000	17,226
Indiana	84,000	2,710	95,000	3,065	67,000	2,161
New York	79,000	2,549	84,000	2,710	56,000	1,806
Montana	86,000	2,774	78,000	2,516	6,000	194
Colorado	9,000	290	9,000	290	10,000	322
Tennessee	600	19	1,500	48	1,000	32
Totals	38,961,000	1,256,806	38,271,000	1,234,548	33,774,000	1,089,484

Oil Boring in the United Kingdom In 1920

The Petroleum Department of the British government, according to *Commerce Reports*, has recently published a statement that in the oil-drilling operations in the United Kingdom during 1920 progress has been satisfactory, considering the great depths which most of the wells have reached, a total of 7,670 ft. having been drilled. Drilling operations are in progress in Derbyshire, North Staffordshire, and in Scotland.

It is stated that six wells have reached a depth of 3,000 ft. or over, one (Ironville No. 2) being 4,006 ft., and three others are approaching that depth. Pending developments of results with Ironville No. 1, Ironville No. 2 was closed down last May. Apedale No. 1 was abandoned in June, 1920, and No. 2 started in September. The latter had reached a depth of 1,350 ft. by the end of the year. The well at Ridgeway was shut down in January, 1920, as large quantities of hot water were met at a depth of 2,890 ft.

At Hardstoft the uniform rate is about one ton per day, or 50 bbl. per week. Total production since the well was brought in, to December 31, 1920, reached 4,575 bbl., or 590 tons. In 1920, production was 2,909 bbl., or 375 tons.

During the year, 500 tons of oil in storage was sold by tender, and this quantity was eventually purchased by the Anglo-American Oil Co. at £22 10s. per ton. By Dec. 31, 325 tons of oil had been transferred for delivery to the company's refinery. The oil is stated to be of exceptionally high grade.

The expenditure in 1920 for oil operations amounted to £126,065.

Federal Reserve Board on Petroleum Price Cuts

In analyzing the February reports of its member banks, the Federal Reserve Board has the following to say in regard to the petroleum situation:

Decreased consumption has resulted in a considerable drop in the price of crude petroleum. At the close of January, Kansas and Oklahoma crude oil was selling at $2.50 per bbl., a decrease of $1 per bbl. from the price prevailing at the opening of January, and further cuts in the first part of February reduced the price to $2 and in some transactions $1.75. Reductions in prices announced in January by purchasing companies in the major fields of District No. 11 (Dallas) brought prices down from $3.50 per bbl. to $2, and early in February there was a further cut of 25c.

In sympathy with the price declines in crude oil, refined products and fuel oil showed substantial declines in District No. 11 (Dallas) during the last thirty days. Production of crude petroleum likewise fell off during January. In District No. 11 (Dallas) the output was 12,746,315 bbl., which was 87,259 bbl. less than the December figure. The January production in Oklahoma and Kansas was 10,710,500 bbl. In California, however, production during January established a new high record for the fifth successive month, and for the second time since July, 1919, monthly output exceeded consumption, and stored stocks were consequently increased.

Refiners' operation in Districts No. 10 (Kansas City) and 11 (Dallas) likewise showed a decrease. In Kansas and Oklahoma it is reported that they have been reduced about 40 per cent, a number of the smaller refineries being shut down entirely, and others operating on shorter time. Pipe-line purchases in most fields in District No. 11 (Dallas) were restricted to 50 per cent of the output. Field forces are being reduced by nearly all the large operators in the district, and, as a result, drilling operations have slowed up, particularly in North Texas. A decrease was likewise noted in Kansas, Oklahoma and Wyoming drilling operations during January, but the number of wells completed increased in California, and the initial daily production almost doubled.

Oil-Well Machinery Exports Show Increase In January, 1921

Exports of oil-well machinery during January, according to returns to the Bureau of Foreign and Domestic Commerce, were valued at $1,449,013. Other types of mining machinery exported were valued at $1,302,705. The exports of pumps and pumping machinery amounted to $2,634,300. This is a decided increase over the exports in January, 1920, when the value was as follows: Oil-well machinery, $145,310; other mining machinery, $645,395; pumps and pumping machinery, $800,307.

Book Reviews

Corundum in the Northern and Eastern Transvaal. By A. L. Hall. Union of South Africa, Department of Mines and Industries, Geological Survey, Memoir 15. Pp. 223; 6 x 9½; 33 figures, 21 plates, 3 maps. Pretoria, 1920.

This latest addition to the series of economic memoirs measures up to the high standard set by those on mica and asbestos. The corundum deposits of the northeastern Transvaal, covering an area of at least fifty-four by thirty-three miles, are the largest and most important yet discovered in the world, and thus constitute a fitting subject for study. Prior to 1914 there was a small production, but the demands of the war resulted in a maximum production in 1918 of 3,875 tons. The first chapter of the memoir is devoted to a review of the extent and situation of the deposits and the varieties mined, followed by a list of the corundum-bearing localities of the country.

Corundum occurs in the plateau region served by the Messina railway, and in the low country from which transportation is afforded by the Selati railway. Granitic and gneissic rocks constitute the chief formations, and in them are numerous, though relatively small, masses of basic magnesian rocks, such as serpentine, pyroxenite, and peridotite, in which the corundum occurs. A detailed study of the geology of the chief deposits indicates that the corundum is closely associated with the basic rocks at their contact with the more acid intruded types.

From the geological relationships it is concluded that the corundum has originated from an excess of alumina occasioned by absorption of silica from the granitic rocks, forming a talcose rock from the ultrabasic minerals which are low in silica. Instances are noted where an instrusive granite shows quartz and feldspar at the center, feldspar only in a succeeding zone, and, where a further absorption of silica has taken place, an outside zone of feldspar associated with corundum, the latter formed from the excess of alumina. This corundum-feldspar zone is termed "plumasite," and by subsequent pneumatolitic changes margarite is developed, forming a margarite-corundum termed "marundite." Plumasite is characteristic of the plateau region, and marundite of the low country.

Following a description of the varieties and physical properties of corundum, the methods of mining and treatment are given in detail. Practically all the corundum mined in the Transvaal is obtained from shallow open-pit workings in "eluvial" deposits. The various operations include cobbing, screening, washing and bagging. Many details are given of methods of making abrasion tests, qualities of corundum and artificial abrasives, uses of corundum, and statistics of world production. A two and one-half page summary is an addition that will be appreciated by the busy reader. A feature of special economic value is an appendix giving the names of producers, buyers, and users of corundum who are interested in the South African product. O. B.

The Mining Manual and Mining Year Book for 1921. By Walter R. Skinner. Cloth; 5½ x 8½; pp. 931. Published by Walter R. Skinner, 11-12 Clements Lane, London E.C. 4, England. Price, 21s. 6d. abroad.

The 1921 edition of Mr. Skinner's handbook has just been published. This year's issue contains full particulars of 1,430 mining companies, gold, diamond, silver, copper, tin, iron, and coal; also exploration and mining investment companies, arranged in alphabetical order. The particulars of each company given include the names of the directors and other officials, date of establishment, seat of operations, description of property, the purchase consideration, plant erected or in course of erection, present working results, ore reserves, details of capital, calls, dividends paid, and the financial position as disclosed by the latest accounts. The book is unlike Weed's handbook in that it is prepared from the standpoint of the financier and investor rather than as a reference volume for the technologist.

Export Register of the Federation of British Industries, 1920. Cloth; 7 x 10; pp. 328 with pp. 312 advts. Published by the Federation of British Industries, 39 St. James' St., London, S. W. 1, England.

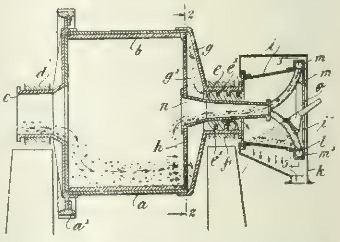
This book is similar to commercial registers published in this country, except that it is intended chiefly as a reference for foreign buyers. The principal lists are two in number, one being alphabetically arranged as to products, giving the names of British manufacturers, and the other giving a list of companies and their overseas agents. No price is given, but it is likely that the book would be sent free of charge to possible buyers.

Road Building — Mining companies are usually vitally interested in having good roads to their properties. The use of the motor truck has made such roads particularly necessary. Furthermore, greater care must be used in building them than formerly, as the service is heavy. "Modern Road Building and Maintenance," just issued by the Hercules Powder Co., and obtainable on request from that company, at Wilmington, Del., is a 146-page book which should be in the library of everyone interested in the subject. It is written by A. P. Anderson, highway engineer of the U. S. Bureau of Public Roads, and is free from advertising matter, with the exception of the final pages. Sections are devoted to planning the road, road materials, road construction, road maintenance and repair, and the use of explosives. Excellent typography and attractive photographs add considerably to the interest of the book and invite even the lay reader.

Recent Patents

Chloridizing Roasting and Volatilization—Robert H. Bradford, Salt Lake City, Utah. A cyclic process of chloridizing the copper content of ores, which comprises mixing the copper ore with an alkaline-earth-metal chloride in such proportions that the copper is capable of chemically combining with the chlorine to produce cupric chloride, heating the mixture in a non-reducing atmosphere to a temperature of approximately 800 deg. C., whereby substantially the entire quantity of copper is converted into cupric chloride, which is volatilized, collecting the cupric chloride fume in a dry state, mixing it with an alkaline-earth material and a carbonaceous reducing agent and heating to somewhat above the melting point of copper, whereby metallic copper is produced and the alkaline-earth-metal chloride regenerated for reuse in the first part of the process, and whereby the copper is caused to separate in a molten condition from the chloride slag. Patent No. 1,368,885.

Ball Mill—No. 1,368,739. P. T. Lindhard, Brooklyn, N. Y., assignor to F. L. Smidth & Co., New York, N. Y. A ball mill with grate discharge, the ground material, after passing through the trunnion, falling on a screen from which the oversize is automatically conducted back into the mill.



Hydrometallurgy—No. 1,361,459. G. T. Hansen, Salt Lake City, Utah. A method of extracting gold, silver, and copper from their ores, by leaching with a cyanide solution at ordinary temperatures, heating the solution to 90 deg. F. or higher, and precipitating the copper with zinc or aluminum.

Jig—No. 1,361,171. Carl Nielsen and Olav Helleland, Lillebö Gruber, Norway, assignors to A/S Stordö Kisgruber, Lillebö Gruber, Norway. An improvement in jig construction which permits a rapid discharge of the concentrates.

Hammer Drill—No. 1,368,470. William T. Ayer, Dover, N. J., assignor to McKiernan-Terry Drill Co., Dover, N. J. The valve design is of interest.

Chloridizing—No. 1,368,973. W. A. Schmidt, Los Angeles, Cal., assignor to International Precipitation Co., Los Angeles, Cal. A process of chloridizing roasting, thereby volatilizing the valuable metals.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

San Francisco Section, A. I. M. E., Discusses Mining Geology

Application of the Science Quantitatively Needed in Studying Ore Deposits—Ore Hunting Must Be Developed as a Science

At the meeting of the San Francisco Section of the A. I. M. E. on March 8, C. H. White and Augustus Locke presented a joint paper on the "Need of the Quantitative Method in Mining Geology." Mr. White introduced the subject, and by a number of illustrations showed how slow the science of geology was in developing quantitative methods. The value of the services of a mining geologist increases as quantitative methods are developed. As an example he quoted the various descriptions of the outcrop of the Miami deposit and showed how they lacked specific characterization. He advocated the use of the Maxwell color wheel for determining the proportion of color constituents of specimens taken from significant areas, and according to his experiments definite results could be obtained by this method.

The inadequacy of studies of outcrops was discussed, and in Mr. White's opinion every possible variety of measurement should be applied in such studies. He said that too often geology served as the oxygen tank to expiring mining enterprises and that more and more research along quantitative lines was required if mining geology was to continue its usefulness to the industry and to the country.

Mr. Locke said that the profession of ore hunting was potentially important, but before it could win a place it was necessary to develop a technique and a method of applying this technique. In his opinion it was good business policy for the mining companies to spend considerable sums for research in this particular subject. The science of ore hunting was in its beginning stages and required persistent development. His plea for quantitative geology was for the invention of specific terms, the reduction of observations to quantitative statements, the development of keener observation, and the interpretation of the subtle phases of economic geology in such specific terms that they would be of service in ore hunting in the field.

As an example of some of the work he had done, Mr. Locke discussed an attempt to devise a method to discriminate between the outcrops over lean pyrite deposits of a disseminated nature and those enriched by the presence of copper sulphides. Two areas were taken, one over disseminated pyrite and one over a disseminated copper-pyrite orebody. About 250 specimens were collected from the surface of each area and numbered. All the specimens were mixed together and an attempt was made to separate the groups of specimens by a study of their superficial characteristics. Although experienced men made the attempt, the result was inconclusive. Another attempt was made by definitely deciding upon points of comparison such as degree of acid action, amount of limonite, kaolin, sericite, quartz, pyrite, and other materials. Visual estimation of these superficial characteristics was made, and the result was more promising. At least one observer was successful in discriminating between the two groups of specimens.

The members present were much interested in the subjects under consideration, and a general discussion resulted. In the opinion of J. M. Hill, Mr. White and Mr. Locke have brought to the attention of the section and the industry something that will be recognized as important. Mr. Hill commented on the need for accurate descriptions of outcrops and stated that generally these were not given.

Materials-Testing Laboratory at Columbia University Reports a Busy Year

More than 3,500 tests were made during 1920 in the materials-testing laboratories at Columbia University, according to a statement by Dean George B. Pegram, of the Schools of Mines, Engineering, and Chemistry, who, in making public a report of Albin H. Beyer, chairman of the University committee on testing, said that the slump after the armistice was signed had been overcome and that the laboratories were again being worked to their capacity. The number of tests made last year exceeded by nearly a thousand the number made during 1919.

According to Dean Pegram, the recent tests were not only more extensive but more valuable than those made during the preceding period. In order that the high standard of the laboratory may be maintained, additional laboratory equipment is urgently needed. Fewer tests, however, were made at the fire testing station at Greenpoint, Brooklyn, which has been made an adjunct to the testing laboratories at Columbia.

The tests made during the year cover a wide range of industrial products, including leather, cement, brick, concrete, sheet steel, pipe, mortar, plaster, hollow tile, hose clamps, rock, boiler plate, bronze, and granite. Hundreds of tests were conducted for the city of New York. They embrace toughness tests on wood and rock, and abrasion tests on rock and brick.

National Safety Council and Bureau of Mines Create a New Position

While John Barton Payne was still Secretary of the Interior he approved an agreement between the National Safety Council and the U. S. Bureau of Mines, providing for a traveling mine safety engineer whose salary is to be paid by the Bureau, and *Engineering and Mining Journal* recently recorded the assignment of C. J. Colburn to this position. The text of the agreement, recently published by the *National Safety News*, reads in part as follows:

> The National Safety Council will make the necessary arrangements whereby this engineer may take up to the best advantage with the mining company membership of the National Safety Council the matter of the technical safety service to be rendered to such companies and to other mining companies and individuals.

Concerning the general methods to be employed in carrying on this work:

> This engineer will visit the headquarters of the National Safety Council and become familiar with the work of its Mining Section; visit the mining company members of the National Safety Council and acquaint such companies with the scope of the technical safety service available to them through this co-operative arrangement; familiarize himself with the best methods of preventing accidents as demonstrated by the mining companies who are most advanced in this respect; establish cordial relations with the mine superintendents and foremen at the operations he visits and as occasion permits, disseminate suggestions looking to improved practices, which shall be free from criticism of the practices he finds; collect photographs, blueprints, sketches, and other information suitable for the preparation of "Safe Practices" leaflets of the National Safety Council and bulletins, technical papers, and other publications of the Bureau of Mines; coordinate and develop the safety work of the Mining Section of the National Safety Council with the safety work of the Bureau of Mines; disseminate among the operators, foremen and workmen in the mining industry, by personal visits and orally, with more concrete application and detail than written communications would probably provide, the arguments for and against increased or new activity along any line of endeavor or research, looking to increased safety in the mining industry.

"Geological Magazine" Needs Help

The *Geological Magazine* of England is still in financial straits and struggling to maintain its existence. Any readers wishing to help keep alive this old and excellent magazine, while securing a valuable professional journal at advantageous rates, may do so by sending a subscription to E. O. Hovey, American Museum of Natural History, New York City. At the present rate of exchange the subscription rate is only $5.75.

MEN YOU SHOULD KNOW ABOUT

F. J. Bourne, general manager of the Bailey Silver Mines, Ltd., has resigned.

H. H. Knox, mining engineer, of New York City, is away on professional business.

E. A. Holbrook, assistant director of U. S. Bureau of Mines, has returned to Washington from his tour of the western experiment stations.

Milton McLain, formerly mine manager of the Phelps Dodge Corporation's Morenci branch, is in Morenci, Ariz., looking after his various interests there.

N. J. Evered has resigned as manager for the Davidson Consolidated Gold Mines, Ltd., at South Porcupine, Ont. His present address is care of Hotel Elliott, Toronto.

M. M. Makeever, of New York, in company with a party of Winnipeg capitalists, is examining the Rex and Bingo properties in the Herb Lake gold area of Manitoba.

Mark R. Lamb, of New York City, is in Rio Janeiro adjusting some commercial accounts for several New York banking organizations. He expects to return the first week in April.

George A. Sharpe, of Alabama, member of American Mining Congress, was elected permanent head of the minerals section of the Southern Tariff Congress at its recent session in Atlanta, Ga.

G. C. Bateman, general manager of the La Rose Mines, Ltd., has been appointed consulting engineer for the Bailey Silver Mines, Ltd., and will have charge of the mine and customs mill.

L. P. Anderson, chief divisional geologist for the Montana-Wyoming division of the Carter Oil Co., is moving with the divisional headquarters from Casper, Wyo., to Continental Building, Denver, Col.

George S. Rice, chief mining engineer of the U. S. Bureau of Mines, will proceed early in April to Arizona, where he will visit several of the camps to gather first-hand data with regard to ventilation problems.

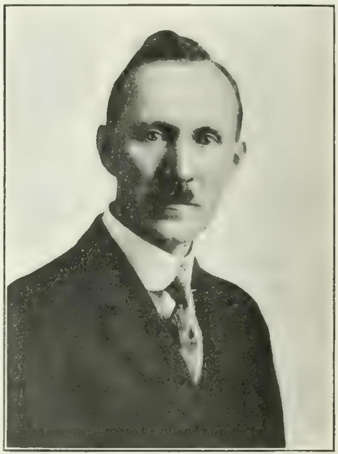
Karl Baumgarten, mining engineer, examiner for the War Minerals Relief Commission, Washington, D. C., has been transferred to the Mississippi Valley experiment station of the U. S. Bureau of Mines at St. Louis, Mo.

S. C. Lind, superintendent of the Reno, Nev., station of the U. S. Bureau of Mines, has been visiting the Seattle, Wash., station of that bureau. While in Seattle he gave a lecture on rare metals before the students of the Washington College of Mines.

John D. Northrop, former petroleum expert for the U. S. Geological Survey, and with the Royal Dutch Shell Company since January, 1919, left the Peruvian field in January of this year. He is now working in Ecuador, and may be addressed in care of the U. S. Consul, Guayaquil.

J. A. T. Robertson recently resigned as metallurgist with the Missouri Cobalt Co., Ltd., at Fredericktown, Mo. He has taken a position with the Yunnan Ming Hsing Mining Co., Ltd., at Tengyueh, Yunnan, China, and expects to sail in March. Mr. Robertson was professor of mining and metallurgy in the technical college at Cheng Tu, Szechuan, China, from 1912 to 1916.

Prof. J. Volney Lewis, head of the department of geology of Rutgers College, New Brunswick, N. J., was elected first secretary and treasurer of the Society of Economic Geologists at its constituting meeting last December. He has just issued an outline report of the proceedings of that meeting.



Champlain Studios, Inc.

J. VOLNEY LEWIS

Rolland Craten Allen, vice-president of the Lake Superior Iron Ore Association, has resigned, his resignation to become effective Sept. 1, and thereafter will be with the mining department of Oglebay, Norton & Co., with headquarters at Cleveland, Ohio.

Mr. Allen was appointed vice-president of the Iron Ore Association in the fall of 1919, and has had active charge of important work in connection with taxation and rate matters pertaining to the interests represented in the association. He is a geologist and engineer of broad training and experience. After being graduated from the University of Wisconsin in 1905 he spent three years in graduate study and field work for the U. S. Geological Survey and private interests in the West, Canada, and the Lake Superior iron ranges. From 1908 to 1913 he was special lecturer in mining geology in the University of Michigan, from 1909 to 1919 state geologist of Michigan, and from 1913 to 1919 appraiser of mines for the State of Michigan and technical advisor to the Michigan Securities Commission. During the war he served the Government as a member of the tax advisory board, as chief mine valuer and head of the division of natural resources in the U. S. Treasury.

In recent years Mr. Allen has devoted his attention chiefly to the economics of mining, with special work in taxation and the theory and practice of valuation of mining property. He is a member of the special committees of the National Tax Association and the American Institute of Mining and Metallurgical Engineers on the taxation of mines.

OBITUARY

Jesse Knight, pioneer mining man of the Tintic district and for many years associated with important developments in that section, died on March 15, at the age of seventy-five, as the result of a paralytic stroke which he suffered about a month ago. Born in Navoo, Ill., on Sept. 6, 1845, he went to Salt Lake with his widowed mother, at a very early age. At sixteen he was hauling wood with a team of oxen bought with money earned by himself. Later he freighted into Montana, and also took part in the Black Hawk war. For a number of years he traded in cattle. Then he began prospecting in the Tintic district, where he located a number of claims, but for a considerable time he did note achieve success. The foundation of the fortune which later acquired came through a property popularly known as the Humbug, and which was called the Dream Mine. Mr. Knight and his sons worked intermittently seven years on the Humbug claim in Tintic before striking ore.

In the course of these years Mr. Knight was interested in many minor properties in the district where he made his fortune. His name is associated chiefly with the Iron Blossom and Colorado mines, which he brought to successful operation and put on a dividend-paying basis. Mr. Knight's interests were extensive and not confined to mining. Among his industrial enterprises the Knight Woolen Mills and the Knight Sugar Factory were included in the Knight Investment Co., of which he was president. Mr. Knight, as the name of Uncle Jesse by which he was popularly known will testify, was much beloved, particularly for his kindly generosity. It is said that at times he found himself embarrassed from having given his notes to friends who needed help. In his cattle trading days he paid more for calves bought of widows and poor people than for others.

Fred W. Nash, a mining engineer of San Diego, Cal., was instantly killed on the Mussey grade, near Ramona, Cal., on March 11, when the automobile he was driving plunged off the highway and tumbled 100 feet down the side of a precipice. Mr. Nash, who was a member of A. I. M. E. and other societies, was forty-eight years old, and leaves a wife and two children.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

WEEKLY RÉSUMÉ

Reports from the Carolinas indicate marked activity in non-metallic mining. A British company has bought Texas oil and sulphur lands. John Barton Payne, just before leaving office as Secretary of the Interior, issued a statement in reply to alleged criticisms by the American Mining Congress. The Federated Engineering Societies have established headquarters in Washington. Scientists at the national capital are planning a noteworthy reception to Mme. Curie. Secretary Hoover has appointed a committee to investigate the statistical work of the Bureau of Foreign and Domestic Commerce. Special correspondence from London declares the position of the British owners of gold and tin properties to be still unsatisfactory. Conditions in Mexico continue unsettled, the low price of silver threatening many shutdowns.

Judgment Rendered Against Silver King of Arizona

G. S. Cunningham Wins Action for Damages in State Supreme Court —Receiver To Sell Mine

Judgment for $361,731 against the Silver King of Arizona Mining Co., which has operated the famous old Silver King mine, has been entered in the Superior Court of Pinal County in a suit instituted by G. S. Cunningham. The receiver, John Fowle, has been instructed to sell the property, if possible, for a lump sum. The principal creditor is the Empire Trust Co. of New York, which has been awarded $280,700 for bonds due, $14,884 for interest, $29,558 for attorneys' fees and $1,105 for costs. The receiver has a priority claim for $4,000 a year, salary, and $3,832 for expenses. A claim of $16,000, payable to Edward Kendall for injuries received in the mine, is also included.

The King, once known as the richest silver mine of the Southwest, has had a number of reworkings since its palmy days. Four years ago it was taken over by the company now defendant.

North Butte Suspends Production

On account of the abnormally low price of copper, the North Butte Mining Co. has decided to cease productive operations—stoping—but will continue development work. As soon as the unsettled copper market improves production will be resumed. Only the ore resulting from actual development operations will be mined at present.

Non-Metallic Mining Shows Stimulation in the Carolinas

L. A. Campbell, of Gafney, S. C., reports that he has an order for 3,000 tons of monazite for export to Europe. This may mean a revival of an industry which has been dormant for some time. It is stated that monazite sand in Cherokee, Spartanburg, and Greenville counties will average about 5 per cent thorium oxide, which is sufficiently rich to respond to reasonable requirement. Mr. Campbell is planning to install a magnetic separator for cleaning monazite.

The Talc Products Co., of New York, will develop a 200 acre talc deposit near Glendon, Moore County, N. C. The company is considering the erection of a new grinding plant with an estimated output of 100 tons daily.

Northwest Magnesite Case Settled Out of Court

R. S. Talbot, of Spokane, Wash., who sued President Crocker of Crocker National Bank, San Francisco, for a half interest in the Northwest Magnesite property at Chewelah, Wash., alleging that he had been defrauded out of 2,500 shares of stock, par value of $250,000, and $180,000 worth of bonds of the company, which he had pledged for a $115,000 loan from Mr. Crocker, has ended the litigation by dropping the suit. It has been dismissed from the Spokane court having jurisdiction.

The basis of settlement is known to the litigants only, but it is certain that the Crocker interests are left at least in complete possession of the Northwest Magnesite holdings, which are regarded as the largest and most valuable property of that kind on this continent. They are situated in the vicinity of Chewelah, Wash.

Iron-Ore Tax Bills in Minnesota Legislature

An occupational tax bill relative to the industry of iron-ore mining has been passed by the House of Representatives of the State of Minnesota by a vote of 99 to 25. This bill provides for a 6 per cent tax on the net value of ore mined in Minnesota. At the same time a bill was passed also taxing 6 per cent of the net value of the ore mined, but provision is made in the second bill for a constitutional amendment to place 50 per cent of the tax in a trust fund.

Wages Reduced in Northern Ontario

The two operating companies of the Sudbury nickel district in Ontario have recently announced reductions in the rate of wages over those prevailing since the war peak was reached. The Mond Nickel Co. announced a cut of 5c. an hour about three weeks ago, and the International Nickel Co. has now given notice of a 15 per cent reduction effective April 15. Married men, it is understood are to be exempted, however. Also, salaried men are not included, as their pay was not raised materially.

A board of conciliation has been appointed to investigate the dispute as to wages between the mine operators of Cobalt and their employees arising over the recent reduction of 15 per cent. The men, though not objecting to the reduction, claim that it should have been gradual, extending over a period of three months, instead of being made at once. The board consists of Robert A. Bryce, of Toronto, representing the operators, Arthur W. Roebuck, of Toronto, representing the employees, and J. M. Godfrey, of Toronto, appointed by the government as chairman.

Howe Sound Mill Burned

Fire, which started Saturday night, March 20, completely destroyed the mill of the Howe Sound company at Britannia Beach, B. C. It is believed that short-circuiting was the cause. Fortunately the surrounding buildings were saved, but the loss is estimated at close to a million dollars.

British Company Buys Oil and Sulphur Lands in Rustler Hills

The Anglo-American Sulphur Co. Ltd., of London, England, has purchased 1,280 acres of patented sulphur and oil lands in eastern Culberson County, Texas. The tract, which is underlain by petroleum-charged slates, adjoins the Consolidated Sulphur Co. property in the Rustler Hills district twenty-two miles west of Orla, Texas, on the Santa Fé Ry. The English purchasers have contracted to pay about £60,000 for the property [illegible] a cash payment of £10,000. They are organizing a London company to develop the oil and sulphur resources of the tract, which was favorably reported on about 1920 [illegible] oil geologist, to the late owners, O. W. Dunlap of Bloomington, Ill., and J. D. Smith of [illegible]

Arizona Legislature Provides for Heavy Appropriations

The Fifth Arizona Legislature has adjourned, with little legislation directly affecting the mining industry. The industry, however, was much in evidence at the session, endeavoring to cut taxes down to the lowest figure compatible with proper administration of government. It was explained that the mines pay 56 per cent of the taxes, directly, and much more indirectly. So there was suggestion, strongly pressed, that every possible economy be made for the next two years. It would appear that the representations in behalf of the mining industry were not heeded, for the appropriation bill was larger than known two years ago, aggregating $5,500,000.

For the first time since statehood there was no special labor legislation, though there was enactment of a workman's compensation law, with liberal allowances for injury. Mine operators must report to the state mine inspector the beginning or stoppage of work. A state immigration commissioner is authorized, especially for the benefit of cotton growers, but his services are available as well to mining operators. With much amendment permitting reports on mines by others than licensed engineers, a bill was passed for the licensing of engineers.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Ex-Secretary Payne Replies to His Critics

States That an Appeal to Court of Claims Was a Matter Within Jurisdiction of Congress — Makes Full Report

Just prior to relinquishing his office as Secretary of the Interior, John Barton Payne replied to the criticism of the American Mining Congress that he had not complied with a promise made in connection with war minerals legislation, and that the opinion of the Attorney General had been misinterpreted by the War Minerals Relief Commission.

The understanding of the American Mining Congress was that Secretary Payne had promised on Aug. 10, 1920, to write the chairman of the committees on Mines and Mining of the House and of the Senate to the effect that the department "had not, and would not, undertake to influence Congress either for or against the proposed legislation." In reply, Judge Payne states that what he did say was, "that the allowance of an appeal to the Court of Claims was a matter within the jurisdiction of Congress, which could do as it pleased, and that I was willing to write a letter to that effect at the next Congressional session."

In his letter, Judge Payne says that the Mining Congress "was not warranted in drawing the conclusion that I was personally in favor of pending bills with whose provision I was not then familiar. When requested to make an official report to the House Committee on Mines and Mining, I was bound to express my own convictions."

Judge Payne, in his communication, gives the number of claims that have been decided to the satisfaction of the claimants and the numbers who have acquiesced and those who have filed objections to the recommendations of the commission. He also cites a letter written by W. J. Loring, president of the Mining Congress, in which the work of the commission is commended and in which it is stated that the commission should not be blamed for not having the power to consider matters not within its jurisdiction. In that connection he says it would seem that the Mining Congress "has been misled as to the true situation by the clamor of a few dissatisfied claimants." He adds that "the War Minerals Relief Commission has exhausted every resource to ascertain whether a personal, specific request has been made by any of the five Government agencies named in the law, and has in many instances established such a request or demand, notwithstanding that the claimant originally in his questionnaire stated that none had been made upon him."

New Surface Tension Apparatus Aids Flotation Research

The Bureau of Mines is much interested in the Fahrenwald improvements on the Elder surface tension measuring apparatus. Some difficulty was encountered in obtaining correct absolute values of the surface tension of water with the apparatus as originally planned. It has been improved and simplified by Mr. Fahrenwald into what is believed to be a very useful instrument. It reads direct in dynes per centimeter.

By the use of this instrument in studies of oil-water surfaces and of emulsions of flotation oil in water, it has been found that some of the oil in the emulsion must have been adsorbed on the surface of the mineral particles, so that the surface tension of the remaining emulsion is raised. From a curve of surface tension against quantity of oil in the emulsion, it is possible to tell exactly how much oil is adsorbed on a unit of surface of flotative mineral. Greater quantities of oil are found to be adsorbed on the surfaces of minerals which are regarded as easily flotative, with decreasing quantities on minerals which are reputed to have less flotable properties. With the apparatus it is possible to get definite comparable figures where before it was possible to secure only qualitative results. It is believed that this instrument can be used to great advantage in flotation studies. Further work on the apparatus will be encouraged by the bureau.

Federated Engineering Societies Opens Washington Office

To Consider Engineering Employment and Licensing of Engineers, with Branch Offices in Larger Cities

With the opening this week of its suite of offices in the National Savings and Trust Company Building, in Washington, the Federated American Engineering Societies will direct its work in the future from the national capital. L. W. Wallace, the executive secretary of the organization, has been in Washington completing the arrangements for the opening of the national headquarters.

The principal effort being made at this time at the offices of the Federated Societies is in connection with the extension of the employment service of the organization. In addition to having one central controlling office, the plan is to have branch offices in several of the larger cities. A full report on the employment service is to be made when the executive board meets in Philadelphia on April 16. Secretary Hoover of the Department of Commerce, the president of the organization, expects to attend the executive board meeting. At this meeting, a comprehensive report also is to be made on the activities looking to the establishment of a Department of Public Works.

Copies of a model bill on the matter of licensing engineers now are available at the office of the executive secretary. These bills are being sent out to those interested, not with the idea of offering a recommendation, but in the hope that any state legislation which may be enacted will follow the general lines of the model bill, which is the result of extended study.

More War Minerals Awards

Recommendation of an award of $192,826.69 in the manganese claim of the Oneida Mines Co. brought the total of the recommendations by the War Minerals Relief Commission for the week ended March 12 to $346,559.28. This includes amounts previously recommended on the claims in which additional amounts were allowed.

In the manganese claim of John P. Gose, an award of $1,962.16, or 72 per cent of the amount claimed, was recommended. In the claim of the McQueen Manganese Co., an award of $159.17, or 6 per cent of the amount claimed, was allowed. Previous action in the claim of F. J. and W. D. Fuller resulted in a recommendation for the payment of $831.93. Additional evidence has disclosed that an additional sum of $68 can be allowed. In the claim of A. H. Jarmon, an award of $70,288.45 had been recommended previously. In the light of additional facts $1,317.57 has been added to the recommendation. When the claim of Collins and Winninghoff was first considered it was disallowed. Additional evidence has made it possible for the commission to recommend the payment of $2,124.60. This is 42 per cent of the amount claimed.

Co-operative Work in Black Hills Discussed

A concerted effort is being made by those interested in mining in the Black Hills to arrange for co-operative work with the Bureau of Mines. W. H. Coghill, of the bureau staff, has visited Deadwood, where he attended a meeting of mining and business men called for the purpose of discussing the matter of co-operation. There are three types of ores in the Black Hills which present problems. They are the complex sulphides, argentiferous galena in quartz, and the blue ores containing ore in sulphides. There is said to be a large tonnage of refractory ores throughout the district which cannot be mined until improved processes are devised.

The bureau is giving careful consideration to the matter, but there is some uncertainty as to its being able to obtain the funds with which to conduct the work.

Washington Scientists Plan Big Reception to Mme. Curie

Arrangements are being made to show every honor to Mme. Marie Curie cn the occasion of her visit to Washington. The formal opening of the cryogenic laboratory of the Bureau of Mines will be delayed until her arrival. Plans are being made for a general reception which will make it possible for the scientists resident in Washington to meet the discoverer of radium.

Secretary Hoover, in a letter to Dr. Vernon Kellogg, who is in charge of arrangements for Mme. Curie's entertainment while in Washington, says:

"I am very glad to learn that Mme. Curie is to visit this country in May and that the women in America plan to present her at the time of her visit with a gram of radium for her use in carrying on her investigations.

"Mme. Curie is the foremost living woman of science, and her work has been not only of great scientific importance but of immense immediate value to mankind. Any recognition and support of this wonderful woman and her work that can be given by the women of America meets with my earnest approval."

Broad Pass Railroad Making Good Progress

Barring unusually bad weather or unexpected circumstance the rails of the Alaskan railroad will be laid over Broad Pass before the end of the calendar year. The big Susitna bridge, with a 504-ft. span, has been completed, and trains are going over it. Rail has been laid to mile 275.

The new Secretary of the Interior regards Alaskan matters of such importance that he expects to direct them for a time at least from his own office.

Civil Service Examination Announcements

Examinations for the following civil service positions are announced: Petroleum engineer, $3,000 to $4,500 a year; oil-recovery engineer, $3,000 to $3,600; expert driller, $3,000 to $3,600; chief oil gager, $3,000 to $3,600; assistant petroleum engineer, $1,800 to $2,000; oil gager, $1,800 to $2,100; supervising mining engineer, $4,000 to $5,000; mining and metallurgical engineer, $4,000 to $5,000; illuminating gas engineer, $3,240; assistant refinery engineer, $2,760 to $3,000; mineral technologist, $2,400 to $4,000; assistant oil-shale engineer, $1,800 to $2,400.

Applications must be made before April 26, 1921. Full information may be obtained from the Civil Service Commission, Washington, D. C., or at post offices and custom houses in various parts of the country.

Hoover Appoints Investigating Committee

Owing to the discovery that customs officials have not been reporting all of their figures during the month in which imports and exports were made, Herbert Hoover, the Secretary of Commerce, has appointed a committee to make a broad study of the statistical work conducted by the Bureau of Foreign and Domestic Commerce. The committee is made up as follows: William S. Rossiter, Concord, N. H., former director of the census; Carrol Dolten, Massachusetts Institute of Technology; Walter F. Wilcox, Cornell University; Wesley C. Mitchell, New York City; Allen Young, Harvard University; Edwin Gay, New York *Evening Post*.

Purchases of silver under the Pittman Act totaled 42,345,391 fine ounces at the close of business March 12.

News by Mining Districts

Special London Letter

Tales of Financial Difficulties Among Both Tin and Gold Producers Chief Features of Overseas News

By W. A. Doman

London, March 8 — The tin market has received another nasty blow. For some time the Federated Malay States' government assisted the mining companies within its borders by purchasing production at a fixed price. Having apparently discovered that world conditions were in opposition, and that the policy of "pegging" did not pay, it has ceased to buy at all. Consequently, mines that were subsidized can carry on now only at a loss, and are reducing the scale of operations. The tin market as a whole is affected, and until the metal rises well above its present level there is no possibility of the Cornish mines, at least, reopening. The Geevor, which is interested in the famous Levant Mine, has quite come to grief, some of the larger shareholders—companies presumably—are unable to pay the calls on the last issue of shares at the end of 1919. The Geevor is in debt £15,000, and at least £5,000 is required for pumping. The directors propose an issue of £25,000 8 per cent tax-free debentures, redeemable in two years at par. This scheme may or may not go through, but a suggestion is being made of a drastic reduction of capital. There is plenty of tin ore in the mine, as also at East Pool, Cornwall.

Although small private syndicates in Nigeria can produce and sell tin at a profit, there does not appear to be a single company that can do so. Total costs, generally speaking, are about £160 per long ton, so that a 70 per cent concentrate, with the metal at £153 a long ton, does not yield sufficient to encourage a continuance of operations. There is talk of closing down several mines.

Although work has been resumed at Rio Tinto, prospects are not bright, and a discussion of the dividend position has led to a further fall in the price of the shares to 24. Arizona Copper is reported to be in even worse financial plight, and shareholders are becoming restive at the delay in the proposed sale.

The Daggafontein Mines, a company under the control of the Consolidated Mines Selection Co. and its associates, among whom are the Anglo-American

Corporation, has reached the end of its financial tether. The reconstructed company has expended about £1,100,000. The percentage of payable area so far is not great, but at the end of December about 6,000 ft. had been sampled on reef averaging 23.38 dwt. over 10.8 in. A small footage in January showed 46.1 dwt. over 10 in. The reef is very narrow, and a dike has been encountered in one of the workings. Times are not propitious for raising further funds; hence the reported decision to close down, just at an interesting stage, too.

On the other extremity of the Rand lies the property of the Western Rand Estates. About eighteen years ago an extensive boring program proved the existence of the reef, or, rather, of two reefs, at depths ranging from 1,677 to 3,229 ft. Values of an encouraging nature were disclosed, but two difficulties existed. One was to provide additional capital, and the other was how to deal with the dolomite. The former still exists, but there is a possibility of overcoming the latter. It is said the Union government is urging the company to start operations, and a rumor is current that a scheme for raising money is under consideration.

An agitation is afoot to induce the directors of the National Mining Corporation to write off the uncalled liability of 10/— a share. The corporation will require additional funds, and there are difficulties in the way.

MEXICO

Low Price of Silver and Railroad Strike Seriously Affecting Operations — Many Small Properties Being Acquired for Operation When Normal Conditions Return

Durango

Durango — The smelter at Torreon (Peñoles Co.) opened in February, and despite the continued closing of mines throughout the northern part of Mexico, due to the low prices of metals, has continued to operate. The American Smelting & Refining Co. mines at Velardeña, Durango, closed down the last day of February, although the smelter of the same company at Asarco, Durango, has continued operations. The general strike of railroad workers throughout Mexico which began the last week in February, and which has continued without reaching a definite solution, aided in closing mines and smelters; for, although passenger trains have been handled so as to give nearly normal service, the transportation of freight, including ores destined to the smelters, has been practically nil. Encouragement is held out by the government and by the management of the railroads that the service will be made normal in at least two weeks more, by the substitution of new men for the strikers.

The governor of the State of Durango has recognized the plight of the mining industry in this state. Cognizant of the vital necessity of encouraging miners and owners of mines, he has extended through the "State Official Periodical" an invitation to all interested in mines, who, for lack of immediate capital, cannot continue their operations, to consult with the government direct, and the government will undertake to interest new capital in such enterprises as are promising and assist so far as is possible indirectly, by bringing the properties to the attention of foreign investors.

A state colonization agent has been appointed and a bureau established to distribute, among other things, such information as is possible to obtain for the benefit of prospective investors in mining properties and undeveloped claims.

That those interested in mining are optimistic is shown clearly by the number of new denouncements made, or claims filed for titles to new mining property. The new claims filed average from ten to twenty-five per week, as shown by the publications in the official newspaper of Durango. These claims are not in any one district that is being boomed, but are scattered generally over the various districts of the entire state.

Sinaloa

Culiacan—Large numbers of mining denouncements are being made in the mining agencies all over the state, in the Fuerte district, Mocorito district, Cosala, Mazatlan, and Rosario.

The Antigua gold mine known as the "Guajolote," in the Mocorito district, has been acquired through denouncement by Messrs. Cockaran and Coffee. This property has been worked to a depth of several hundred feet through inclined shafts, the ore formerly all being treated by amalgamation with arrastres, many of which are still in good condition. The present owners expect to have a modern mill and cyanide plant in operation before the coming rainy season, which begins in July.

The old "San Luis Gonzaga" mine, in the Badiraguato district, has been sold to F. E. Avery and associates, of Columbus, Ohio. There is a fifty-ton mill on this property, and it is anticipated that the new owners will soon install a complete flotation plant. This property was a silver producer for a great many years. In former years only the high-grade ore was shipped, carrying from 300 to 1,000 oz. After the mill was installed, the ore of 50- to 100-oz. grade was treated by the lixiviation method with good results, notwithstanding the high cost of salt, which had to be transported from the coast about one hundred and fifty miles distant. E. B. Holt is in charge of operations at the mine.

In the eastern part of the Culiacan district near the Durango line, W. C. Minsch and associates are exploring a number of silver properties with a view to purchase.

The K. & H. Mining Co., which has holdings in the Cosala district, is preparing to blow in its smelter. It will operate on a silver-lead ore. Chas. Kuenzel, Jr., is in charge.

J. H. Hudson and associates from Schrevesport, La., are preparing to work their silver-gold properties, at "La Tuna" camp, in the Badiraguato district. This mine has produced several million ounces of silver, with a good ratio in gold.

Practically all the operating companies are holding up their silver shipments, on account of the extremely low price of that metal at present, and devoting their attention to development work, with the view to having their ore reserves in good condition when the silver price is again above the cost of production.

Coahuila

Torreon—An almost complete temporary paralysis of the mining industry is evident in Mexico. The low price of silver threatens to demoralize every silver camp. The federal government is striving to relieve the situation by enacting more favorable laws and reducing federal and state taxes.

The Torreon smelter is operating and has sufficient ore to keep going for some time, but the general railroad strike is interfering with freight shipments and the company's fuel supply is nearly exhausted.

In the Velardena district several thousand miners have been discharged from the smelter and mines of the American Smelting & Refining Co., which has closed down. The Chihuahua smelter has suspended, and the mines at Santa Eulalia are idle. Four thousand men were discharged last week at the Santa Barbara mines, in the State of Chihuahua. At Guanajuato over five thousand are idle as the result of a complete suspension of the mines of that region. The smelters of both the American Smelting & Refining Co. and the Compania de Minerales y Metales at Monterrey are closed down indefinitely. The mining industry at Pozos, in the northern part of the State of Guanajuato, is at a standstill.

Walter C. Bishop has filed in a group of sixteen gold and silver claims in the municipality of Panuco. The survey embraces the old Panuco and Providencia mines, which were abandoned and went by default for non-payment of taxes during the revolution. Another filing has been made by Mr. Bishop adjoining the old Philena mine, in the same district.

Drs. L. Sandell and W. E. King are in the vicinity of Santiago Papasquiaro, with the intention of locating some mining properties.

It is again rumored that the railroads of Mexico are to be returned to the former owners on the first of next June. In the event that this should prove true the large mining and smelting concerns will not attempt to resume operations in Mexico until the transfer is made and the new management demonstrates its ability to control the labor problem.

According to interviews with a number of individual mine owners and shippers in this district, a majority will employ a reduced force to carry on developing work in blocking out their ore bodies and improving their mine workings.

CANADA

British Columbia

Sheep Creek—Extensive development is in progress at the Motherlode, which now is controlled by the Nugget Gold Mines. The long crosscut driven from the fifth level of the old Motherlode workings tapped the Nugget vein at a distance of 1,165 ft. This gives a vertical depth on the vein of 625 ft. below the Nugget workings, or about 1,000 ft. below the apex of the vein. The large and well-equipped Motherlode mill operated from July to November of last year and continuous operations this season are proposed.

Golden — The Bunyan silver-lead property, Bunyan Mountain, is to be opened. Development, it is said, will be on a considerable scale, as 100 to 125 men will start to work as soon as weather conditions permit. The Brisco Mine, Columbia Valley, is also to be developed.

Stewart—Material contracts amounting to $100,000 have been awarded by the American Smelting & Refining Co., to the Riblet Tramway Co., Spokane, Wash., for building the tramway at the Premier mine, which will probably have a longer single section than any other tramway ever constructed. It will be necessary to clear 11½ miles of right of way at the mine, and the Riblet company will furnish the superintendent for the crew. The work will take about five months.

Hedley—There appears no immediate prospect of resumption of operations at the Nickel Plate mine, except by arrangement between the company and the provincial government with respect to about $70,000 due on retroactive taxes. The company is seeking to have the government cut this amount in two, with the understanding that the company will then spend $70,000 for mine development.

Greenwood — Chicago interests are taking hold of the operation of the Providence mine, and are putting things in order for an active season. Equipment being added consists of a compressor and a motor. It is planned to open up the property to the 600 and 700 levels.

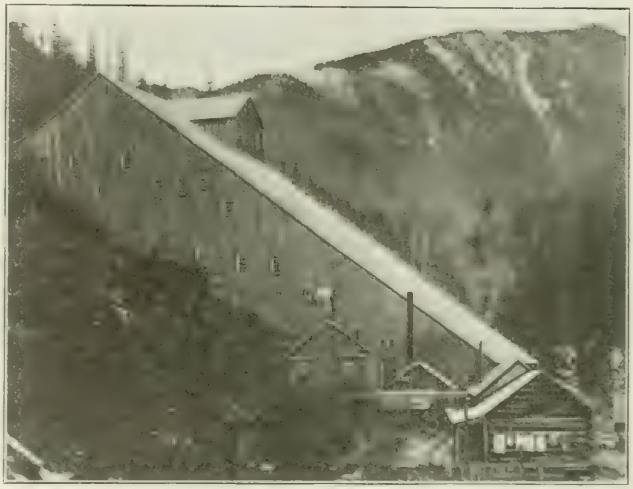
Ontario

Sudbury—The British America Nickel Corporation may resume development work at Murray mine about April 20, though the rumor is denied. A meeting of the bondholders of the corporation will be held in Toronto March 31 to consider a new financing scheme involving the issue of $24,500,000 in bonds of three classes, viz.: $6,000,000 first income; $6,000,000 "A" income; and $12,500,000 "B" income. Of the first issue $4,000,000 would be hypothecated for debts and the balance held in the treasury. The second $6,000,000 would be exchanged for fifteen-year first mortgage bonds, and $10,000,000 of the last issue would be exchanged for debenture stock, the remainder being appropriated to satisfy Norwegian creditors

Cobalt—The Nipissing during February mined ore of an estimated value of $124,391, including cobalt valued at $12,460, and shipped bullions from Nipissing and custom ores of an estimated net value of $234,374.

Shipments for February were 86.69 tons of silver ore from the Coniagas; 179 tons from Dominion Reduction; 76.55 tons from La Rose; 43.99 tons from Mining Corporation and 64.11 tons from O'Brien; a total of 450.34 tons. Of this, 64.11 tons went to the Deloro works; 87.23 tons to the Coniagas plant at Thorold; 25 tons to the refinery at Chrome, N. J.; 87.14 tons to the A. S. & R., Perth Amboy, N. J.; and 186.86 tons to the Pennsylvania Smelting Co. at Carnegie.

Porcupine—Results of milling at the Davidson Consolidated during 1920 were unsatisfactory, the recovery from the treatment of 3,003 tons of ore being only $11,210, or an average of $3.75 per ton, which was considerably less than operating costs.



MOTHERLODE MILL AT SHEEP CREEK, B. C.

Kirkland Lake — The Teck-Hughes mine is now opened up to its mill capacity of between 125 and 130 tons per day. The grade of the ore is satisfactory, and, as costs are low, a satisfactory profit is being realized on this operation.

It is probable that the Wright-Hargraves mill will start about May 1, when power should be sufficient to insure continuous operation. Development work on four levels is stated to be satisfactory.

Franklin Camp—A report to be submitted to the Dominion Department of Mines by experts who have been making examinations will show that platinum, palladium, iridium, osmium, radium, and ruthenium have been found in paying quantities here.

Salmo—Capital stock of Nugget Gold Mines, Ltd., has been increased from $1,000,000 to $3,000,000

COLORADO

Labor Returning to Cripple Creek and Pueblo—Valley View on Full Time

Pueblo—The Colorado Fuel & Iron Co. has announced that, owing to improved conditions in the steel industry, 1,000 additional men will be employed. Four idle mills will reopen, running two eight-hour shifts. The company's orders for finished-steel products have increased during the last month.

Cripple Creek—Hard-rock miners are returning to the Cripple Creek district in large numbers, and more good mine labor is available today than at any time during the last two years. The interest in leasing is increasing, and development work is being resumed at numerous properties, under the leasing system. One of the factors that tends to discourage leasing operations at this time is the high price of powder, which is now selling at about double its pre-war price, which makes small-scale mining operations almost prohibitive.

Matterhorn—The concentrating mill of the Valley View Leasing & Mining Co. is running full time, and producing about twelve cars of concentrate per month.

Silver Plume—The Burleigh mill is being remodeled, and a Ruth flotation machine has been installed. G. L. Cole is manager.

Central City — The Frontenac and Aduddel properties, in Russell Gulch, are being equipped and developed by New York capitalists who have recently purchased the properties for $82,000, under a bond and lease extending over a period of thirty months. A new hoist will be placed at the Aduddel shaft, and connection will be made with workings from the Newhouse tunnel.

Rico—The Rico Wellington properties are being developed and operated under a leasing system, and three groups of lessees are now at work

ARIZONA

Consolidated Arizona Smelting's Finances Being Reorganized

Prescott — The formation of the Southwest Metals Co., a corporation that is to assume the property and liabilities of the Consolidated Arizona Smelting Co., of Humboldt, now in the hands of a receiver, is reported. The reorganization plans are for a stock issue of only 100,000 shares, to be distributed to the old stockholders, with their 1,663,000 shares, each new share to cost $16 and 40 old shares. Thus there would be provision of $655,000 of new capital and 58,425 shares would be left in the treasury.

A Jerome-Verde judgment of $15,000 and costs has been settled out of court, presumably by a protecting group of stockholders who have been keeping the property in condition. Plans are understood to have been made for a bond issue to provide money for further development. An unsuccessful attempt was made last year to secure $260,000 by this means. The company has a large acreage in the heart of the Jerome district.

The Big Reef property of eighteen claims in Big Bug district has been advertised by the sheriff to satisfy a claim of $1,503.

At 400 ft. the Malapai shaft near Kirkland is in 7 ft. of milling ore. A reduction plant is being considered by the management.

A small mill is being erected by Andrew Smith and George Lane upon the Gloriana mine, south of Mayer, a property worked more than forty years ago and well known as the Valencia. Near Mayer is the Gillespie mine, on which a similar mill is to be in operation April 1. The property is owned by the Arizona Copper & Mining Co., with Samuel Hobson, of Mayer, in charge.

A ball mill of 300 tons' daily capacity is being built in Los Angeles for the Arizona Standard Copper Co., to be placed on the company's mine near Parker. A leaching process will be used. Thomas J. Carrigan, once of the Clara at Swansea, is manager.

Bisbee—Sinking has been completed on the Junction shaft, now the deepest in the district. The sump is 2,385 ft. below the collar. Following in order of depth are the Dallas, 2,200 ft.; the Copper Queen, C. & A., 1,870 ft.; the Sacramento, 1,841 ft., and the Denn, 1,810 ft.

Stockton Hill—The new 100-ton mill at the C. O. D. is completed, and is turning out the first concentrates from the old dumps and some mine ore. The successful operation of this mill vitally interests Mohave County, as it will mean, in a great degree, the solving of the complex ore problems of the Cerbat Range.

Wage reductions recently put into effect throughout the county have resulted in no serious difficulties. Practically all crews have accepted the cut in good spirit, and the mines without exception are operating full handed.

Tombstone—A fourth silver mill has been purchased for installation in the Tombstone field. It has been bought near Casa Grande by Joe Best and Thomas Saundercock, for erection at their mine, near the State of Maine property.

Quartzite—A sulphide vein nearly 5 ft. wide, that samples 12½ per cent copper and material values in gold and silver has been cut at a depth of 600 ft. in the Copper Chief mine, twelve miles northwest of Quartzite.

Ajo — Mexican Consul Y. Gonzales, Pat Holland, and Jack O'Brien, all of Ajo, have announced, near the shores of the Gulf of California, the discovery of a large deposit of soda, found in two lake basins. The deposits lie about one hundred miles south of Yuma and thirty-five miles from the new gulf port of Rocky Point, where it is planned to establish the terminus of the new Ajo-Tidewater R.R. An offer of $250,000 is reported to have been made for a third interest in the claims.

Miami—The great chimney of the International smelter is completed, and succeeds a steel stack that is deteriorating from the effect of sulphuric-acid fumes. The new stack is 275 ft. high, with interior diameter of 34 ft. at the base and 22 ft. at the top. The brick, amounting to 2,000 tons, was brought from Almo, N. M. The stack is designed to withstand a wind velocity of more than 100 miles an hour.

CALIFORNIA

Sutter Creek — Central Eureka has taken a three-year option on the South Eureka. The sum involved is $225,000, the first payment of $50,000 to be made Feb. 1, 1922, if the development proves satisfactory. The two mines adjoin, and the lowest workings of the Central are 1,000 ft. lower than those of the South Eureka. The south drift of the Central is within ten or fifteen feet of the property line, and will probably follow pay ore into the South Eureka. The eighty-stamp mill of the South Eureka will be put in operating condition and used with the forty-stamp mill now operated by the Central.

Last Chance (Placer County)—Rich gravel is reported in the Glenn mine, a Tertiary river channel.

Georgetown (El Dorado County) — Two miles from Georgetown, a 2-ft. ledge yielding good assays has been opened up by two prospectors, and as a result a number of prospectors are out scouring the immediate country.

Oroville — The Steifer mine, on Magalia ridge, a drift mine, is to resume operations. A power line has been completed and a force of miners engaged.

Nevada City—The Debernadi quartz mine, at Indian Flat, is being reopened.

The Liberty Hill hydraulic mine near Dutch Flat is operating its full complement of monitors, and the outlook for a long season is excellent.

San Diego—New feldspar deposit is being opened up fifty miles east of San Diego. Franklin A. Kales is in charge, and first shipment is expected to be made this month.

OREGON

Copper Ore Shipments Resumed—Prices and Labor Encouraging

Gold Hill—The gradual drop in prices of mining machinery and supplies, coupled with a steady improvement in the labor situation, has been heartily welcomed by the gold-mine operators in this region, and is the forerunner of a general resumption the coming season. Although but two quartz mines, the Sylvanite group, two miles north, and the Gold Ridge group, two miles south, of Gold Hill, are actively operated, much work is being done in the larger mines in keeping up repairs, with a view to resuming. Among these are the Ashland mine, near Ashland; the Opp, at Jacksonville; the Almeda and the Greenback, near Grants Pass; the Braden, Bill Nye, and Millionaire, at Gold Hill.

The Blue Ledge, south of Gold Hill, and the Queen of Bronze, a copper property west of Gold Hill, are resuming shipments to the Tacoma, Wash., smelters. These copper ores are necessary to flux with several of the Alaskan ores, and run better than 12 per cent copper. Both of these mines are paying over $10 per ton for hauling the ore to a shipping point.

The Blue Ledge owners, the Blue Ledge Mining Co., Copper, Cal., are planning a $50,000 200-hp. electric power plant to operate the machinery and light the camp. Elliott Creek, at Seattle Bar, with a drop of 200 ft. eight miles from the mine, will supply the power.

The quicksilver mining industry in this region is still at low ebb, yet the War Eagle Mining Co. is in steady operation and reducing its ore with a twenty-five-ton Scott furnace and several units of twelve-pipe furnaces. Other operators in this district are also developing cinnabar mines, and over the mountains in Siskiyou County, Cal., in the Gottville district, several new high-grade cinnabar deposits are being developed.

WASHINGTON

Newport—Plans for additional development of Conquest claim, held by Bead Lake Gold-Copper Mining Co., are being considered. A shaft will possibly be put down from the surface to the 200 level.

Valley—The Double Eagle Mining Co. has let a contract for a 300-ft. extension on the 700 level. A number of shipments have been made from this level, the net value being $95 per ton. A portion of the Double Eagle ground is under a ten-year lease to the American Refractories Co., of Pittsburgh.

Chewelah—Chewelah Silver Mining Co. this summer will drive an 800-ft. tunnel to tap the vein at 300 ft. vertical depth.

Spokane—Annual meeting of stockholders of the Hecla Mining Co. will be held in the Empire State Building here on April 12.

Northport—After accumulating bullion in excess of 3,500 tons the Northport smelter has resumed shipment of some of it to Pittsburgh refineries.

Springdale—Western Materials Co., operating here, is reported to be meeting with success in marketing magnesite as a building material. It is ground to 200 mesh after calcining, then making a chemical mixture. The product is being sold chiefly along the Pacific Coast.

Nighthawk—The mill of the Pyragyrite mine, a short distance west of here, began operations the first week in March. There is a large reserve tonnage in the mine, and ample power is now available from the Okanogan Valley Power Co. plant at the Similkameen falls.

UTAH

Character of Ore Shipments to Smelters Changing—Connections Completed on 1,800 Level at Chief

The smelters in Salt Lake Valley are receiving a larger proportion of dry siliceous ores than formerly, owing to the fact that many mines are holding back their lead ores. This greater proportion of dry ores places the smelters in the anomalous position of having to curtail shipments of certain classes of ore while their plants are working at less than capacity.

The dry silver ores come chiefly from Tintic. In the case of the Eagle & Blue Bell mines and Victoria, owned by the Bingham Mines Co., there is a large tonnage of lead ore exposed in the mines, but very little ore of this character is being shipped, owing to the unfavorable price of lead.

Eureka—At the Zuma, machinery is being installed to permit of continuing the winze, which is down to the 800 level, as far as the 1,200. It is proposed to connect with the adjoining Iron King mine on the latter level, the two companies drifting toward each other. At the Chief Consolidated, connections have been completed on the 1,800 level between the new No. 2 shaft and the older workings. Ventilation has been improved, and the temperature perceptibly lowered. Plans have been made to hoist a large part of the waste through the new shaft, to relieve the No. 1, which has been taking care of all ore, waste, and supplies.

Shaft sinking has been resumed at the Lehi Tintic. The shaft is now down to the 340 level, and sinking will be done to 500 ft., when drifting will be started. Drifting in favorable ground has been done on the 200 level, but was given up owing to faulting. The shaft has cut a body of quartz 18 to 20 ft. thick. The Iron King is paying operating expense through the shipment of fluxing iron ore to the smelters. At the Scranton, shipments of zinc ore have been stopped for the present, owing to the state of the metal market, and development is being done with a small force. Work has been resumed at the South Scranton and shaft sinking started. The Grand Central is shipping its best ore only, the output coming from the levels above the 900.

Park City—The stockholders of the Park City King are meeting to consider plans of reorganization and financing, so that work may be resumed. The company owns four claims at the head of Thaynes Canyon adjoining the Iowa Copper and a part of the Silver King Coalition.

NEW MEXICO

Steeple Rock Copper Claims Sold—Burro Mountain Branch Closes April 1

Lordsburg—Ore shipments from this district for February amounted to twenty-seven carloads, 1,773½ tons, of an approximate value of $26,202. The Great Eagle fluorspar mine company is hauling ore for shipment to the steel works in the San Francisco district.

The Blue Bell Mining Co., of Lordsburg, has been incorporated, with a capital of $500,000. Incorporators are M. O'Neill, Tucson, Ariz.; Morgan Wilson, San Simone, Ariz.; G. W. Tremble, W. P. Downey, and L. P. McHalffey, all of Lordsburg, N. M. The property consists of a group of copper claims situated in the Steeple Rock district of Arizona, formerly owned by the Eclipse Mining and Milling Co., which were sold for debt about a year ago.

Tyrone—The Burro Mountain branch of the Phelps Dodge Corporation will shut down mine and mill on April 1. The mill has been handling 2,000 tons of ore daily and employing 1,100 men.

NEVADA

Tonopah District Is Normal—Round Mountain Company Has Started Hydraulicking — United Comstock Haulage Tunnel Progressing

Tonopah—The Tonopah Divide Co. officially reports that an ore shoot has been entered with the southeast hanging wall drift on the 1,000 level at a point 280 ft. from where the crosscut from the shaft cut the vein. The drift has been in ore for the last 20 ft. said to average better than $30 per ton, and values improving. The width of the ore is uncertain, as no foot wall has been developed. This is an important development for the entire district. It is rumored that the shaft is to be deepened to the 1,300 level, where it is expected water level will be reached. The Divide Extension, owning a small acreage northwest of the Tonopah Divide, has opened a narrow width of high-grade ore between the 100 and 200 levels from the Caldwell shaft. Developments are meagre to date.

Mine conditions in the district are good, production is normal, and developments are satisfactory, with nothing new of importance. There are some rumors of apex trouble between the Tonopah Extension and the Cash Boy over ore being developed in the latter company's ground, and said to apex in the Tonopah Extension. It is not likely that a suit will come to trial.

Candelaria—It is reported that the construction of a [illegible] ton plant for the Candelaria Mines Co. will be started about April 1.

Manhattan—The crosscut on the 800 level of the White Caps mine has cut the west orebody at a distance 800 ft. from the shaft.

The Round Mountain Mining Co., owning lode and placer mines at Round Mountain, sixty miles north of Tonopah, has started hydraulic operations. Conditions are favorable for a successful season, there being more water than usual at this time of the year.

Comstock — The United Comstock Mines Co. is making excellent headway on its main haulage tunnel, work being carried on from seven faces. A mechanical shovel is being used with success.

Rawhide—Construction of a custom mill for the Rawhide district is to begin in the immediate future. Plans for the mill are being drawn by a firm of Reno engineers, with sufficient ore pledged by leasing companies to insure its activity for several years.

IDAHO

Bonners Ferry—Cyanide Gold, operating in northeastern part of Boundary County, twenty-five miles from here, has maintained a crew of twenty-five or thirty men on underground and surface development during the winter. The mill has been remodeled, and the two-bucket tram connecting the lower mine workings and the mill site has been partly completed. It is expected the tram will be in working order by the time the snow is gone, and mill operations may then be started.

Sandpoint—An organization has been formed here to further mining interests in Bonner County, embracing the Pend Oreille section.

Hailey—More interest appears to be taken in central and southern Idaho's mineral resources than for some time past, and it is reported that there are preparations for much new work to be undertaken soon, particularly in the case of known silver and gold properties. The Bunker Hill & Sullivan Mining & Concentrating Co., of Kellogg, Idaho, has taken a lease and bond on the Bullion and Mayflower groups, in the Wood River district.

Mullan—New machinery will be installed by the American Commander Mining Co., which operates the First Thought mine. The machinery includes a compressor, motors, transformer, and several machine drills. Two shifts are being worked.

MONTANA

Anaconda Fabricates Most of Its Butte Copper and Sells It West—Churn Drilling at East Butte Properties —Boston & Montana Mill at Elkhorn Progressing

Butte—The bulk of the copper output of the Butte mines of the Anaconda Copper Mining Co. is going to the rod and wire plant of the company at Great Falls, Mont. Production is around 9,000,000 to 10,000,000 lb. monthly, the former being the [illegible] for the last month, and [illegible] being shipped [illegible] works of the [illegible]. The com pany is finding a sale in the West for its products at about 2½c. above the basic price.

Aside from making a drainage connection with the High Ore mine of the Anaconda, which adjoins, the North Butte's chief objective at present is decreasing even its curtailed production, about 450,000 lb. of metal monthly, because of low copper prices. No change is reported from the development work on the 3,600 level.

Working forces at the Colorado mine of the Davis-Daly were somewhat further reduced in the last week. The octagonal air shaft is now connected from the 2,700 level through to the surface.

The Main Range shaft of the Tuolumne is close to the 1,500 level. This mine is confining attention principally to its silver ores, a carload of which daily suffices to carry on all its shaft and development expenses. Sinking probably will continue to 2,000 level unless the copper metal market revives.

With the No. 3 Black Rock shaft practically at the 2,300 level, the Butte & Superior company has under consideration the continuation of sinking to the 2,600.

Development work on the lower levels of the Pittsmont properties of the East Butte Mining Co., appears to promise a material improvement at greater depth. Churn drilling is under way from the surface to determine the depth of the quicksands, which are found in the westerly part of the East Butte's territory, which is situated partly on the so-called "flats" below the Butte hill.

Copper ore development, together with some zinc, is proceeding at the Elm Orlu. The former has proved the chief feature of operations at this property in the last year. The Timber Butte mill of this company is closed on account of the condition of the zinc market.

Elkhorn—Installation of milling equipment is progressing at the Elkhorn property of the Boston & Montana company. Housing of the plant has been completed. Idanha workings on the 300 level continue in ore, the drift now having been extended more than 600 ft., with the ore continuous in both faces.

MINNESOTA

Cuyuna Range

Operators Again Present Claims to War Minerals Relief

Ironton—Cuyuna Range manganiferous ore operators are elated over the announcement of the award of $52,000 compensation to the Gloria Mining Co. by the War Minerals Relief Board. This is the first of the War Minerals Relief claims of Cuyuna operators to be favorably acted upon. The Gloria Mining Co., of which E. J. W. Donahue, of Duluth, is manager, operated the Gloria mine during 1918. Under the wider interpretation of the War Minerals Relief Act several operators are again presenting their claims and feel that the action taken on the Gloria claim presages more favorable consideration of all Cuyuna Range cases. One of the largest claimants is the Oneida Mines Co. for operation of the Clark mine and installation of washing plant at the Sultana mine for a total expenditure of $231,364.

It is reported that plans are under way for unwatering the Ida Mae mine and resumption of mining this summer. The Ida Mae is a manganiferous iron ore property, operated by the Cuyuna-Minneapolis Iron Co. The mine has been idle since last May.

MICHIGAN

Marquette Range

Jones & Laughlin to Increase Scope of Operations

Ishpeming — Mark Elliott, general manager for the Jones & Laughlin Co. in the Lake Superior mining districts, was here from Virginia, Minn., recently, arranging for the future operations of the company on the Marquette Range. Offices at Negaunee have been secured, and plans are under way for a thorough investigation of the mineral lands of the company. The latter now have control of the Breitung hematite mine, and it is probable that work will soon be resumed at this property. The company owns a property at Iron Mountain Lake, Ishpeming, but this has been idle several years awaiting some plan of mining under the lake. The company also has leases for lands on the western end of the Gogebic Range, where the management has been waiting for railway connection to get in the needed equipment.

The Cleveland-Cliffs Iron Co. will soon begin the unwatering of North Lake to permit mining operations to be carried on in that basin.

Gogebic Range

New Crosscut Being Driven on 25th Level at Pabst

Inwood—At "H" shaft of the Pabst mine another 1,000-ft. double-track rock crosscut is being driven. It is on the 25th level, and will be similar to that on the 24th level. The mucking is being done by a Hoar loader, which has just completed the mucking work in the large pump house at the Davis mine. The drilling is being done by three Leyner machines.

Except for work at the power and substations, the high-tension transmission line from the Pabst to the Davis and Puritan mines is completed. It is built with four-post steel towers carrying duplicate lines of steel-cored aluminum cables with spans up to 700 ft. Owing to delays, the power and substations will not be completed for several months. The Davis pump house, which was about ready for installation of the electric pumps, has caved in badly and so that work will also be considerably delayed. The pump house, which was about 65 ft. x 85 ft. x 11 ft., was cut in the foot-wall slate, and was lined with 4-in. reinforced concrete lath supported by 15-in. and 20-in. I-beams on 8-in. H-beam columns. After this was all in place and thoroughly blocked some of the rock over the back began to loosen and broke a few of the roof slabs and bent a roof beam, and additional timber supports for the roof were put in. A day or two later, while this reinforcing was going on, a large amount of rock, probably 1,000 tons or so, loosened and settled down on the roof system, crushing everything flat over an area about 40 ft. x 40 ft., the miners narrowly escaping. The trouble was caused by faults which had cut off the fallen block from the surrounding rock. The method to be used in repairing the place has not yet been decided upon.

NORTH CAROLINA

Crushing Iola Dump for Road Material and Amalgamating Fines

Candor — At the Iola mine a rock breaker and screening plant have been installed and are now crushing the dump near the main shaft. A fleet of trucks operates night and day moving the rock to a siding a mile away, where it is shipped as road surfacing material.

Some of the fine has been going to a ten-stamp mill now in operation, ground to forty mesh and amalgamated. Two discoveries of ore near surface have lately been made at this mine, which ceased operations about four years ago.

TEXAS

New Iron Ore Plant Under Construction at Bowie Hill

Linden—Pratt Bros. Iron Ore Development Co., of Minneapolis, is erecting a 400-ton plant at Bowie Hill, near Linden, for crushing, screening and roasting iron ore. The property at Bowie Hill is estimated to contain 5,000,000 to 6,000,000 tons of 54 per cent iron ore. Mining will be done by steam shovel.

GEORGIA

Mica Industry in State Said To Suffer from Foreign Competition

Atlanta—The Georgia School of Technology, of Atlanta, has announced the establishment of an industrial development department. One of the objects of this department will be to interest capital in the possibilities of iron ore mining in Georgia, and to secure furnaces in the state to handle the raw product of the mines.

J. E. Burleson, who is connected with the mica industry in Georgia and who was in Atlanta recently to obtain support for the proposed mica schedule, said:

"A few years ago when we had the Payne-Aldrich tariff the mica mines of Georgia employed 2,000 people. Not half that number are employed now and unless we get relief the single mine now operating will have to shut down and the industry will become a thing of the past in this state."

Mica is abundant in the western and northwestern part of the state. Mr. Burleson pointed out that while the manufacturers of mica products are protected by tariff, the mining operators are forced to come in direct competition with the coolie labor of British India.

THE MARKET REPORT

Daily Prices of Metals

March	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
17	11.75	27.25	28.25	4.00	4.00	4.75
18	11.75	27.00	28.00	4.00@4.15	4.00	4.70@4.75
19	11.75	27.00	28.00	4.00@4.15	4.00	4.70@4.75
21	11.75@12.00	27.25	28.25	4.00@4.20	4.00	4.70
22	11.75@12.00	27.50	28.25	4.00@4.20	4.00	4.70
23	11.75@12.00	28.50	29.25	4.00@4.20	4.00	4.70

*These prices correspond to the following quotations for copper, "delivered": 12, 12, 12, 12@12.25, 12@12.25, and 12@12.25c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

March	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
17	67	66½	70½	156	159¼	18¼	19	24⅞	25½
18	68	66¾	70½	154¾	157¾	18¾	19	25	25⅞
19	...	...	..	....	..	..	..	...	...
21	67¾	66¾	70½	156	159½	19	19¼	25	26
22	68	66¾	70¾	157	160½	19	19⅜	25⅛	26⅛
23	69	68	71¼	160¼	164	19¾	19¾	25½	26½

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Mar.	Sterling Exchange	Silver New York, Domestic Origin	Silver New York, Foreign Origin	Silver London	Mar.	Sterling Exchange	Silver New York, Domestic Origin	Silver New York, Foreign Origin	Silver London
17	389¾	99½	55½	32¼	21	391	99½	57⅞	33⅝
18	390½	99½	56¼	32⅝	22	390½	99½	58¼	34⅛
19	390¾	99½	57¾	33½	23	390½	99½	56⅞	33⅛

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, March 23, 1921

Though not characterized by more than the usual amount of buying of the last few months, the tone of the market is distinctly encouraging. An increasing number of sellers are becoming disinterested factors at present prices. Many large consumers are making inquiries, but do not seem disposed to place orders and expect to be offered cut prices, as in the past. When they find that metal is not obtainable below the quoted market, they may become more active purchasers. Several factors have influenced the firmer feeling. London has been wavering less, and in the last three days has shown a distinctly firmer tendency all around; business conditions seem to be improving in certain industries; and further curtailments of production are taking place. Mexican production during recent weeks has been particularly small, both on account of the low prices realized and because of the railroad strike in that country. Zinc seems to be the only metal which has so far not responded to the better sentiment.

Copper

Most of those interests which have been selling copper at 12c. delivered, seem to have disposed of their current output, and it is doubtful if any large tonnage could now be obtained at this price. Consumers do not seem disposed to pay more, however, so the market has temporarily reached a deadlock. Most of the few domestic sales for the last three or four days have been confined to copper for forward delivery, and commitments have been made for shipment as late as July. Future business, however, has commanded a premium of about ten points a month. The large producers continue to hold at 13c. delivered, and, if they persist in this policy, the price may reach that figure, as the production of those willing to sell for less does not seem quite sufficient to satisfy the demand.

Export business has been about the same as in the last few weeks, and is confined largely to sales to Germany, both directly, for cash, and to a less extent through the Copper Export Association.

Further curtailments in the copper industry are expected soon. The complete cessation of activities at North Butte is announced, and rumors are current of a similar action soon by some of the Arizona producers. The sooner this happens the better for the market.

Lead

The A. S. & R. official price continues at 4c., New York and St. Louis.

The week has been a quiet one in the lead market. The price of 4c., St. Louis, seems to be temporarily accepted by both buyers and sellers, and we have heard of no business either above or below this figure. The New York market is more variable. Small tonnages for prompt shipment may still be obtained for 4c., but for forward delivery up to 4.25c. is asked, with some of the largest sellers out of the market. Business among consumers is improving somewhat. Inquiries have been fairly numerous from lead-pipe manufacturers in the South and Middle West, where building activity is said to be increasing. White lead in oil is also recognized to be a bargain at current prices, and is, therefore, in more demand than for some time. The battery business is experiencing a seasonal increase. Cable manufacturers have been using a fair amount of lead for some time. Chemical lead, 4.25c., St. Louis.

Zinc

Zinc continues weak. Practically all the demand is from galvanizers, but inquiries were more active yesterday, particularly from some of the larger interests in the Middle West. "Brass-special" zinc commands about ten points premium over Prime Western, and "high grade" continues to be sold at about 7c., delivered at eastern points.

Tin

A slight improvement may be noted in the tin market, coupled with the steadier conditions in London. Yesterday there were more buyers than sellers here in New York, and some of the larger consuming interests seem to be coming into the market. Electrolytic continues to be marketed to the extent of current production, which is now about 800 tons per month. The price received is practically the same as for Straits.

Straits tin for future delivery: March 17th, 28.50@29c.; 18th, 28.50@29c.; 19th, 28.50@29c.; 21st, 29@29.25c.; 22d, 28.50@29c.; 23d, 30.50@31c.

Arrivals of tin, in long tons: March 16th, Buenos Aires, 5; 18th, Straits, 150; China, 5; 19th, Batavia, 200; Liverpool, 25; 21st, Straits, 475; China, 50; 22d, Liverpool, 50.

Silver

The strength of the silver market was due to buying for the Indian bazaars and to bear covering; but apparently the demand has been satisfied, for a sharp reaction occurred today, the London price falling 1d. overnight to 33⅜d. The New York market has closely followed London, and closes quiet on prospect of the Easter holidays.

Mexican Dollars—March 17th, 42⅛; 18th, 42½; 19th, 43¼; 21st, 43¾; 22d, 44½; 23d, 43.

Gold

Gold in London: March 17th, 105s. 4d.; 18th, 105s.; 21st, 104s. 10d.; 22d, 105s.; 23d, 105s.

General stock of money in the United States, March 1: Gold coin (including bullion in Treasury), $2,916,884,770, standard silver dollars, $269,802,326; subsidiary silver, $271,204,125; United States notes, $346,681,016; Federal Reserve notes, $3,345,123,895; Federal Reserve Bank notes, $207,446,400; National Bank notes, $727,793,864; total, $8,084,936,396. The proportion of gold to paper money continues to increase.

Foreign Exchange

European exchanges have been dull. Italian lire showed a marked advance last week, but have been weaker again in the last three days. Chinese rates are strong. On Tuesday, March 22d, francs were 6.95c.; lire, 3.855c.; and marks, 1.61c. New York funds in Montreal, 13$\frac{31}{32}$ per cent premium.

Other Metals

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 23@24c. per lb. Market quiet.

Antimony—Chinese and Japanese brands, 5¼@5½c.; market quiet. W.C.C. brand, 5¾@6c. per lb. Cookson's "C" grade, spot, 9⅝c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony (200 mesh), 6½@6¾c. per lb. Demand light, with heavy supplies available.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 7c.

Bismuth—$1.50@$1.65 per lb., 500-lb. lots.

Cadmium—Nominal, $1.10 per lb., in 1,000-lb. lots. Price reduced as a reflection of London drop. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $4.50 per lb.; black oxide, $3@$3.10 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $250@$300 per oz.

[1]Molybdenum Metal in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 38@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—$72@$75 per oz.

Quicksilver—Nominally, $46@$47 per 75-lb. flask. San Francisco wires $45. Market dull.

[1]Rhodium—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]Selenium—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]Thallium Metal—Ingot, 99 per cent pure, $20 per lb.

[1]Tungsten Metal—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 45@50c. per long ton unit, f.o.b. Atlantic ports.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $7.45; Mesabi bessemer, 55 per cent iron, $7.20; Old Range non-bessemer, 51½ per cent iron, $6.70; Mesabi non-bessemer, 51½ per cent iron, $6.55.

Magnetite Ore, f.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5.80; old bed concentrates, 63 per cent, $6.70; Harmony, cobbed, 63 per cent, $6.70; new bed low phosphorus, 65 per cent, $9.50.

Manganese Ore—35@40c. per unit, seaport; chemical ore (MnO_2) $60 per gross ton, lump; $70@$75 per net ton, powdered. Market dull.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]Titanium Ores—Ilmenite, 52 per cent TiO_2, 1¾@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]Zircon—Washed, iron free, 3c. per lb.

[1]Zirkite—According to conditions, $70 @$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., March 19—Zinc blende, per ton, high, $23.90; basis 60 per cent zinc, premium, $22.50; Prime Western, $21; fines and slimes, $20@$17.50; calamine, basis 40 per cent zinc, $12. Average settling prices: Blende, $22.20; calamine, $16; all zinc ores, $22.19.

Lead, high, $43.25; basis 80 per cent lead, $40; average settling price, all grades of lead, $41.83 per ton.

Shipments for the week: Blende, 6,523; calamine, 20, lead 1,562 tons. Value, all ores the week, $210,560.

Some lead ore was settled for as high as $50 basis, purchased months ago, and considerable lead was settled for on $35 basis, purchases of the last few weeks. The advance to $40 this week brought on the market considerable reserve ore. Zinc ore was purchased again this week on $22.50 basis, but it was a decreased tonnage. Outputting continues around 7,300 tons per week, while the average purchase this year has been but 5,375 tons per week. Estimates of ore stocks in bins are from 70,000 to 80,000 tons.

Platteville, Wis., March 19—Blende, basis 60 per cent zinc, $26 per ton. Shipments for the week: Blende, 833 tons. Shipments for the year: Blende, 8,798; lead, 510 tons. Shipped during the week to separating plants, 337 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $2,000@ $3,000; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@ $75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton f.o.b. Atlantic seaports. Western grades, $24.50.

Chalk—English, extra light, 5@5½c. Domestic light, 4½@5c.; heavy, 4@4½c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@ $10; washed, $10@$12; powdered, $15@ $20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $15@ $20, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $15@$25, f.o.b. American ports; powdered, $35@$45, f.o.b. New York.

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20 per ton, f.o.b. Illinois mines, and $20, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, $60; lump, $17.50, f.o.b. Heathden, N. M. In Canada 85 per cent calcium fluoride sells for $20 per ton, f.o.b. Madoc; output limited. Canadian price generally $18 (Canadian (currency) per ton, f.o.b. mines.

Fuller's Earth—$16 per ton, carload lots, f.o.b. mines.

Graphite—Ceylon lump, first quality, 8@9c. per lb.; chip, 7c.; dust, 5½c. No. 1 flake, 7c.; high-grade amorphous crude, 3c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$2 per net ton; 1½ in., $1.50@$2. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — High - grade caustic calcined, lump form, $30@$35 per ton, carload lots, f.o.b. California points. In Chicago district, $57.70; Atlantic seaboard, $60.

Dead - Burned — $38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); all f.o.b. New York.

Monazite — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Domestic demand weak; movements of stocks into consuming channels reported slow. Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $8.35; 68 per cent, $7.85; 68@66 per cent, $7.60.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 16c., c.i.f. Atlantic seaport; furnace size, 16½c.; Spanish lump, 14@15c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$40, talcum powder grade. Southern talc, powdered, carload lots, $10@$14 per ton; less than carload, $25, f.o.b. cars; freight to New York $5.25 per ton, carload lots; less than carload lots, $9.25. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 8@9c. per lb. in carload lots. Decline due to a further falling off in demand for arsenical products for use in agricultural work. Market quiet and dull.

Sodium Nitrate—$2.75@$2.80 per cwt. ex vessel, Atlantic ports. Market quiet.

Sodium Sulphate—For 95 per cent material, $20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; $30 per ton, New York.

Potassium Sulphate—Domestic, $220@$230 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 15c. per lb. of chromium contained; 4 to 6 per cent carbon, 14½c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $90@$95, f.o.b. furnace; resale, $90, delivered; English, $90@$95, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $30, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $55@$60; 50 per cent, $85@$90; 75 per cent, $145@$150.

Ferrotungsten—Domestic, 70 to 80 per cent W, 50@55c. per lb. of contained tungsten, f.o.b. works. Foreign, 60c.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—Basis 30 to 40 per cent, $5 per lb. of V contained, plus 75c.@$2 differentials and according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York list price, 20⅛@20⅝c. per lb.; wire, 14.50@15c.

Lead Sheets—Full lead sheets, 8c.; cut lead sheets, 8¼c. in quantity, mill lots.

Nickel Silver — 33½c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets 18¾c.; sheathing, 17¼c.; rods, ⅝ to 3 in., 15¼c.

Zinc Sheets—$11 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $80 per net ton, shipping point; arches, keys, wedges, $85; splits, soaps, $100.

Fire Brick—First quality, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $45@$50.

Magnesite Brick—9-in. straights, $90@$100 per net ton; 9-in. arches, wedges and keys, $105; soaps and splits, $120.

Silica Brick—9-in., per 1,000: $45@$55 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, March 22, 1921

Production of steel on the part of the Steel Corporation has been decreasing more sharply, but the decrease has farther to go, being still well above the rate of the independents.

As was the situation in the review a week ago, sheets show the only marked decline among the prominent finished-steel products. Black sheets can now be had in single carloads at 3.85c. and galvanized at 5c., and in one transaction, involving heavy gages, a base price of 4.75c. was done on galvanized. Bars remain at 2c. and shapes and plates at 2.10c., one or two mills taking single carloads.

The demand for steel products has made a slight further gain, chiefly in releases on orders previously suspended.

Pig Iron—The first important inquiry for basic pig iron for some time has just developed, there being three lots in the market, aggregating 5,000 tons. The merchant furnaces are firm at their previous quotation of $25, Valley, and it now seems improbable that steel works will try to take the business, and some may go to middlemen with some speculative iron. Bessemer remains nominal at $27, and foundry is quotable still at $26, with light demand.

Semi-finished Steel — Sheet bars quoted at $38, or $2 decline, without takers. Billets nominal at the same price.

Coke

Connellsville—[illegible] $4.50@$5.00; foundry, $5.50@[illegible]

World's Zinc Industry Depressed

Germany's Production of Cheap Zinc Under Present Light Consumption Prevents Rise—Belgium Unable To Compete in Quiet World Market — United States Production Heavily Curtailed—Zinc Should Recover Quickly

THE KEY TO THE DEPRESSION in the zinc market is the apparent ability of one country, Germany, to outsell the world. All other important zinc-producing countries, in particular Belgium, the United States, and Australia, are not meeting the low prices at which Germany is offering zinc abroad. As a result of this situation, the entire zinc market of the world is in an unhappy position. Almost every zinc-producing country is disposing of its output, in whole or in part, at prices almost universally below the cost of production, and the United States zinc industry especially is feeling acutely the effect of European competition. Production has been curtailed from month to month in an effort to meet the situation, but without any result in stimulating the domestic market. Importations are continually threatening the market, regardless, seemingly, of how low it drops.

Primarily, German competition in zinc at low prices is possible because of the low value of the mark, and trading is being pushed to the limit by the Germans in an undoubted effort not only to regain some measure of the hold exercised upon the world's zinc trade before the war, but also to convert a valuable domestic resource into much-needed cash. Of course, the low value of the mark alone does not allow of cut-throat competition. It is only because of the fact that labor and fuel costs are paid in depreciated paper currency at a rate far lower than the equivalent in any other important competing country that Germany can underbid other zinc producers.

Belgium's Unfavorable Position

The resultant disorganization in the world's zinc markets has left Belgium and Australia in peculiar positions. The Belgian producers are holding their zinc output, which is almost entirely smelted from Australian concentrates, at a price of about £34 per long ton, which is more than 30 per cent higher than the present London quotations for spot zinc, and it is reported that they have succeeded in obtaining a loan on their stocks. Belgian zinc-smelting companies have contracted to take deliveries of Australian concentrate at prices equivalent to about £9½ per ton laid down at Antwerp. These contracts were made at a time when zinc was selling for much higher prices and when Belgium had begun to make determined efforts to regain her position in the zinc industry. The eagerness of the Belgian operators to book shipping from Australia (Port Pirie) incidentally has kept the freight rates between the two points at a high level. Belgium cannot profitably produce zinc under present prices of concentrates and market conditions.

German zinc production is not large, possibly a third as much as the monthly production of the United States, but it is sufficient under the present state of affairs and the demoralized markets to cut a big figure in cheaply supplying a good part of the world's light requirements. Germany is relying entirely on her own resources in producing zinc, as the supply of Australian concentrates normally furnished the country has been entirely cut off. Although the result of the recent Upper Silesian plebiscite has not been definitely announced, it seems to insure German retention of the rich and favorably located zinc deposits in the province and to strengthen Germany's importance as a zinc producer.

That Germany is making a strong bid for her former share of Broken Hill concentrates seems evident from present market tactics and from advices abroad, where the impression is prevalent that inasmuch as Australia is denying the German zinc industry a supply of concentrates, Germany is doing and will do everything in her power to destroy the zinc industry of that continent. The great advantage possessed by Germany in carrying out this policy is the low foreign exchange value of the mark. Desirable as it may be to solve the perplexing problem of exchange and to introduce some measure of stabilization, it matters little to Germany how low present exchanges are so long as they do not fluctuate greatly.

Zinc Prices Respond to Political Situation

The inability of the Allies and Germany to reach an agreement over reparations, and the steps consequently taken by the Allied countries to enforce penalties, have resulted in stiffening the price of zinc, and arresting a decline that has been proceeding for months. However, it is noticeable that the London spot quotation for zinc was influenced more than was that for futures, indicating that the London market discounts the duration of the present situation and that there is little reason for becoming over-optimistic regarding the duration and effect of the present political conditions with respect to zinc.

The pre-war London average price of zinc was about £24. For many years it averaged annually below this price and for a few above it. The price today varies around £25, somewhat above the pre-war average, although it had been quoted lower earlier in March. London zinc quotations generally show a thorough deflation to the pre-war level, and American quotations are below this level. It must not be forgotten that practically the entire world calculates, internationally, on the basis of the pound sterling, despite the strong attempt made by American financial interests to introduce the stable United States dollar in foreign trade settlements, and hence, although zinc in the United States is considered to have dropped much below its pre-war price, the extent of the deflation in other countries, particularly in London, may still be considered as not having progressed the same distance. This is not meant as an inference that zinc will go lower, but to serve as a reminder that world-wide deflation seemingly has no definite level.

The absence of a real consuming demand all over the world serves to keep the zinc market in its present condition. In the United States little zinc is being consumed compared with the normal demand, so that with the great decrease in production any sudden increase in consuming demand would probably be difficult to meet with domestic supplies alone. Zinc is in a good statistical position and should be one of the first metals to recover. Stocks on hand at the beginning of 1921 are estimated by the U. S. Geological Survey at about 71,000 tons, or more than two months' consumption based upon the 1920 record. The present low production should be of material assistance in making inroads in this surplus.

It is out of the question for the domestic market to rise under the influence that European zinc conditions now exert over the world's market. Although the United States produces the greatest proportion of the world's zinc, prices are controlled by minority outputs. Sentiment abroad, particularly in Belgium, seems to center around the possibility of large quantities of zinc being required in the upbuilding of the devastated area in France. The Belgian producer would like to have the price of zinc somewhat nearer cost of production, and loses sight of the fact that present costs of production have little to do with the marketing of any product, agricultural or mineral, the world over.

American producers will undoubtedly seek a higher tariff as a solution to their difficulties, but they should not lose sight of the fact that the tariff alone is not a complete cure, as their own industry is linked closely to the general prosperity in this country, to the steel trade, paint trade, building construction, and other activities no one of which is in a happy or satisfactory position.

COMPANY REPORTS

American Smelting & Refining Co. Reports Improvement

The annual report of the American Smelting & Refining Co. for the year 1920 states that the net income amounted to $6,674,778, after deducting all charges, depreciation, and Federal taxes, compared with $5,595,584 for 1919. Consolidated general income and loss sheet follows:

	Year Ended Dec. 31, 1920	Year Ended Dec. 31, 1919
Total net earnings of operating properties	$14,175,693.44	$13,386,253.49
Other income—net:		
Interest, rents, dividends, commission, etc.	1,572,021.83	1,309,489.44
Gross income	$15,747,715.27	$14,695,742.93
Administrative expenses	1,166,340.87	932,693.24
Research and examination expenses	312,295.87	83,758.95
Corporate taxes (including estimated Federal taxes)	979,458.96	814,275.82
Interest on 5% first mort. bonds outstanding	1,592,834.94	1,605,949.16
Interest on Rosita Coal & Coke Co., 6% collateral trust bond outstanding	71,135.00	11,414.22
Depreciation	3,500,244.69	3,514,097.90
Ore depletion	964,983.64	1,687,881.99
Miscellaneous profit and loss adjustments	485,642.60	450,087.08
Total charges	$9,072,936.57	$9,100,158.36
Net income for the year	$6,674,778.70	$5,595,584.57
Less dividends:		
Total preferred stocks	$4,222,137.25	$4,241,322.25
Total dividends	6,662,057.25	6,681,242.25
Profit and loss surplus at beginning of year	$25,974,571.20	$27,060,288.88
Profit and loss surplus at end of year	$25,987,292.65	$25,974,571.20

A table of production and receipts from sales of metal follows:

Production

	1920	1919
Gold, oz	1,849,048	2,190,041
Silver, oz	77,732,911	78,200,298
Platinum and palladium, oz	936	1,824
Lead, tons	205,249	208,439
Copper, lb	590,850,000	705,676,000
Zinc, lb	44,106,253	33,375,301
Nickel, lb	375,167	662,637
Tin, lb	18,511,160	15,340,000
Sulphuric acid, lb	51,688,000	40,362,000
Arsenic, lb	17,695,266	9,359,541
Copper sulphate, lb	3,618,172	3,675,499
Byproduct metals, lb	1,549,426	884,438
Sulphur dioxide, lb	8,154,734	4,988,000

During 1920 the companies underwent the same general experience as did practically all other industrial companies engaged in business in the United States. The earlier part was quite satisfactory, but the latter part of the year was one of declining business and consequent lessened profits. Nonetheless, the entire year shows a surplus of $12,721 over and above all fixed charges, including the preferred dividends and a 4 per cent dividend upon the common stock of the smelting company. This compares with a deficit in the year 1919 of $1,085,657.

Hecla Mining Co. Makes Large Payments

Lead; Idaho

A report of operations of the Hecla Mining Co. for the calendar year 1920 states that 33,717,168 lb. of lead and 924,179 oz. of silver were produced from 264,093 tons of ore mined or shipped. Net income from ore sales, interest, and rents amounted to $2,573,840.08. Expenditures covering mine development, mining, milling, and miscellaneous expenses totaled $1,285,882.56. Reserves for depreciation were $99,891.41. Net profit was $1,188,066.11, from which dividends amounting to $650,000, and taxes ($303,177.47) and litigation settlements ($150,000) were paid, together with surplus debits of $5,367.54, a total of $1,108,545.01. The sum of $220,138.80 was drawn from surplus account of Dec. 31, 1919, amounting to [illegible], leaving a surplus on Dec. 31, 1920, of $2,014,585.94.

Shattuck Arizona Copper Co. Ceases Productive Operations

A report of the Shattuck Arizona Copper Co. for the year 1920 states that productive operations were stopped on Oct. 29, 1920, owing to the heavy loss on sales of copper. There was produced during the year, 2,374,148 lb. copper, 8,279,678 lb. lead, 401,626 oz. silver, and 4,971 oz. gold. Net operating cost amounted to 23.524c. per lb. of copper and 5.394c. per lb. of lead milled. The average price received for copper was 18.257c. per lb. and for lead 8.182c. per lb. Sales of copper amounted to 4,318,386 lb., which included some unsold copper carried over from 1919. Income account follows:

Gross value of production	$1,529,669.89	
Interest	49,944.55	
Miscellaneous receipts	7,309.27	
Gross income		$1,582,923.71
Mining and development work, refining and marketing	$1,557,565.67	
General administrative expense and taxes	52,306.02	1,609,871.69
Loss		$26,947.98
Reserved for depletion of mine	$99,765.55	
Reserved for depreciation of plants and equipment	112,401.64	212,167.19
Net loss for year, carried to surplus		$239,115.17
Surplus Account		
Balance, Dec. 31, 1919	$557,670.78	
Deduct net loss for year 1920	239,115.17	
Balance, Dec. 31, 1920		$318,555.61

Goldfield Consolidated Mines Co.'s Surplus Decreases

Gold; Nevada

The fourteenth annual report of the Goldfield Consolidated Mines Co. for the year ended Dec. 31, 1920, states that during that year the entire property was held under lease by the Goldfield Development Co., which performed considerable underground work and mill repairs, in preparation for milling low-grade ores on a large scale. It began operating the mill during the latter part of the year, but, owing to high costs and low grade of the ore, the attempt proved unprofitable, and, accordingly, the development company relinquished the lease at the close of the year.

The receipts for the year to the Goldfield Consolidated company on account of royalties and rentals were $20,411, and the expense in this connection was $5,207. Sales of surplus equipment and stores totaled $57,963, and the cost of dismantling and hauling was $10,525. From these sources the total net receipts were $62,641. Profit-and-loss account is as follows:

Earnings		Expenses and Losses	
Rentals	$11,215.00	[illegible]	
Royalties	[illegible]	expenses	[illegible]
Interest	9,155.74	General expenses	[illegible]
[illegible]	1,514.45	[illegible]	
Miscellaneous [illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]
Total earnings	[illegible]	[illegible]	[illegible]
		[illegible]	
		[illegible]	[illegible]
		[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]		[illegible]

Surplus Account

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

MINING STOCKS

Week Ended March 19, 1921

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Adventure	Boston			*65		
Ahmeek	Boston	47½	45	46	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	½	7/16	½		
Allouez	Boston	20	19⅞	19⅞	Mar. '19	1.00
Anaconda	New York	38¾	34¼	37¾	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2¾	2½	2½		
Ariz. Com'l	Boston	8	8	8	Oct. '18,	.50
Big Ledge	N. Y. Curb	5/16	5/16	5/16		
Bingham Mines	Boston	...	..	8¼	Sept. '19, Q	.25
Calumet & Arizona	Boston	47	45	45	Dec. '20, Q	1.00
Calumet & Hecla	Boston	235	225	225	June '20, Q	5.00
Canada Copper	N. Y. Curb	....	....	*13		
Centennial	Boston	...	..	9	Dec. '18, SA	1.00
Cerro de Pasco	New York	26¼	23¾	25⅞	Mar '21, Q	.50
Chile Copper	New York	10½	9¼	10		
Chino	New York	21	19⅞	20⅝	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*30	*23	*23½		
Con. Arizona	N. Y. Curb	....	....	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	...		1⅞		
Copper Range	Boston	33	30¼	32¼	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*36	*31	*34		
Davis-Daly	Boston	6	5½	5¾	Mar. '20, Q	.25
East Butte	Boston	8½	8	8½	Dec. '19, A	.50
First National	Boston Curb	*76	*73	*75	Feb. '19, SA	.15
Franklin	Boston	2¼	2	2		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol.	New York	20	19¼	19½	May '19, Q	1.25
Greene-Cananea	New York	20	20½	20½	Nov. '20, Q	.50
Hancock	Boston	...	..	3		
Howe Sound	N. Y. Curb	2¼	2⅛	2¼	Jan. '21, Q	.05
Inspiration Consol.	New York	33⅝	30¼	33⅝	Oct. '20, Q	1.00
Iron Cap	Boston Curb	7¼	6⅛	6½	Sept. '20, K	.25
Isle Royale	Boston	19	18	18½	Sept. '19, SA	.50
Kennecott	New York	18⅜	16⅛	18⅞	Dec. '20, Q	.50
Keweenaw	Boston	1¼	1¼	1¼		
Lake Copper	Boston	2½	2½	2½		
La Salle	Boston	...	...	2¼		
Magma Chief	N. Y. Curb	...	..	*21		
Magma Copper	N. Y. Curb	19¼	18	18	Jan. '19, Q	.50
Majestic	Boston Curb	....	....	*10		
Mason Valley	Boston	..	..	1¼		
Mass Consolidated	Boston	1.75	0.80	1.00	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	3⅞	3¾	3¾		
Miami Copper	New York	18	17	17¾	Feb. '21, Q	.50
Michigan	Boston	3	3	3		
Mohawk	Boston	47	45⅛	47	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5	4⅞	4⅞		
Nevada Consol.	New York	10	9¼	9⅞	Sept. '20, Q	.25
New Baltic	Boston Curb	...	...	3		
New Cornelia	Boston	14	13½	14	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....	....	*5		
North Butte	Boston	10¾	9⅞	10¾	Oct. '18, Q	.25
North Lake	Boston	*25	*25	*25		
Ohio Copper	N. Y. Curb	...	...	5/16		
Old Dominion	Boston	18½	17¼	17½	Dec. '18, Q	1.00
Osceola	Boston	26½	25	26½	June '20, Q	.50
Phelps Dodge	Open Mar.	†180	....	....	Jan. '21, Q	2.50
Quincy	Boston	39½	37¾	39½	Mar. '20, Q	1.00
Ray Consolidated	New York	12¾	11⅞	12	Dec. '20, Q	.25
Ray Hercules	Boston Curb	*40	*38	*38		
St. Mary's Min. Ld.	Boston	31	31	31	June '20, K	2.00
Seneca Copper	Boston	14¼	14¼	14¼		
Shannon	Boston	1	1	1	Nov. '17, Q	25
Shattuck Arizona	New York	6	5½	5¾	June '20, Q	.25
South Lake	Boston	....	....	1½		
Superior Copper	Boston	3	3	3	Apr. '17,	1.00
Superior & Boston	Boston	1⅞	1¾	1⅞		
Tenn. C. & C. cfs.	New York	8	7⅛	7⅛	May '18, I	1.00
Toulumne	Boston	*55	*50	*55	May '13,	.10
United Verde Ex.	Boston Curb	27	24¾	25¼	Feb. '21, Q	.50
Utah Consol.	Boston	4½	4	4¼	Sept. '18,	.25
Utah Copper	New York	50	47⅛	48⅜	Dec. '20, Q	1.50
Utah M. & T.	Boston	1⅝	1 5/16	1½	Dec. '17,	.30
Victoria	Boston	1 7/16	1¼	1 7/16		
Winona	Boston	*50	*50	*50		
Wolverine	Boston	11½	11½	11½		
NICKEL-COPPER						
Internat. Nickel	New York	15⅛	13¾	15⅛	Mar. '19,	.50
Internat. Nickel, pf.	New York	..	..	80	Feb. '21, Q	1.50
LEAD						
National Lead	New York	72	70¼	72	Dec. '20, Q	1.50
National Lead, pfd.	New York	101¾	101¼	101¾	Dec. '20, Q	1.75
St. Joseph Lead	New York	11¾	11½	11⅝	Dec. '20, QX	.50
Stewart Mining	Boston Curb		..	*6	Dec. '15,	.05
ZINC						
Am. Z. L. & S.	New York	9	8½	9	May '20,	1.00
Am. Z. L. & S., pfd.	New York	27½	27	27	Nov. '20, Q	1.50
Butte C. & Z.	New York	5	4½	5	June '18,	.50
Butte & Superior	New York	12½	11½	12½	Sept. '20,	1.25
Callahan Zn-Ld.	New York	5½	5	5½	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb			139	Feb. '21, Q	2.00
Success	N. Y. Curb	*3½	*2	*2	July '16,	.03
Yellow Pine	Los Angeles			*50	Sept. '20, Q	.03

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

Stock	Exch.	High	Low	Last	Last Div.	
GOLD						
Alaska Gold	New York	1¼	1	1⅛		
Alaska Juneau	New York	1¾	1½	1½		
Carson Hill	N. Y. Curb.	....	....	22¾		
Cresson Consol. G.	N. Y. Curb	1 1/16	1	1 1/16	June '20, Q	$0.10
Dome Extension	Toronto	*56	*56	*56		
Dome Mines	New York	15¼	15½	15½	Jan. '21, Q	.25
Golden Cycle	Colo. Sprgs.	*65	*53	*65	Dec. '20, Q	.02
Goldfield Consol.	N. Y. Curb	*9	*7	*8	Dec. '19,	.05
Hollinger Consol.	Toronto	6.75	6.60	6.73	Feb. '21, M	.05
Homestake Mining	New York	54¼	51	54¾	Sept. '19,	.50
Kirkland Lake	Toronto	*49	*48	*49		
Lake Shore	Toronto	1.17	1.16	1.16	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	1.98	1.94	1.94	Jan. '21, K	.05
Porcupine Crown	Toronto	*20	*20	*20	July '17,	.03
Portland	Colo. Sprgs.	*45	*45	*45	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*5½	*4	*5	May '19,	.05
Silver Pick	N. Y. Curb	*7	*5	*6		
Teck Hughes	Toronto	*10	*9¼	*9¾		
Tom Reed	Los Angeles	1.27	1.22	1.26	Dec. '19,	.02
United Eastern	N. Y. Curb	2 9/16	2 7/16	2 9/16	Jan. '21, Q	.15
Vindicator Consol.	Colo. Sprgs	†*19	†*17½	*19	Jan. '20 Q	.01
West Dome Consol.	Toronto	*6½	*6⅜	*6½		
White Caps Mining	N. Y. Curb	*9	*7½	*8½		
Yukon Gold	Boston Curb	1	1	1	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*17	*13	*15	Apr. '20, M	.03
Batopilas Mining	New York	¾	¾	¾	Dec. '07, I	.12½
Beaver Consol.	Toronto	*38	*37½	*37¾	May '20, K	.03
Coniagas	Toronto	....	....	2.00	Nov. '20, Q	.12½
Crown Reserve	Toronto	....	....	*16	Jan. '17,	.05
Kerr Lake	Boston	2⅜	2⅜	2⅜	Jan. '21, Q	.12½
La Rose	Toronto	*21	*21	*21	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	....	....	*30	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.00	*90	*90	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	7⅞	7½	7⅞	Jan. '21, QX	.50
Ontario Silver	New York	....	....	4⅞	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	1⅝	1½	1½	Jan. '12,	.10
Peterson Lake	Toronto	*7½	*7	*7	Jan. '17,	.01½
Temiskaming	Toronto	*24½	*24½	*24½	Jan. '20, K	.04
Trethewey	Toronto	*17	*16	*17	Jan. '19,	.05
GOLD AND SILVER						
Atlanta	N. Y. Curb	*2	*1	*2		
Barnes-King	Butte	‡	....	1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*70	*65	*67		
Cashboy	N. Y. Curb	*8	*7	*8		
El Salvador	N. Y. Curb	5/16	5/16	5/16		
Jim Butler	N. Y. Curb	*16	*14	*15	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*9	*7	*8	June '16,	.05
Louisiana Con.	N. Y. Curb	..	....	¼		
MacNamara M. & M.	N. Y. Curb	...	...	*14	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1⅝	1 7/16	1 9/16	Jan. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1 5/16	1	1¼		
Tonopah-Extension	N. Y. Curb	1½	1⅜	1½	Jan. '21, Q	.05
Tonopah Mining	N. Y. Curb	1 11/16	1⅜	1½	Oct. '20, SA	.05
West End Consol.	N. Y. Curb	1 1/16	15/16	1	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N.Y. Curb	*13	*11	*12	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	...	...	1.10	Dec. '20,	.15
Chief Consolidated	Boston Curb	2⅝	2½	2 9/16	Feb. '21, Q	.05
Consol. M. & S.	Montreal	19	18½	18⅞	Oct. '20, Q	.62½
Daly Mining	Salt Lake	....	...	2.50	July '20, Q	.10
Daly-West	Boston	2	3	3	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	....	....	2⅛	Dec. '20, K	.25
Electric Point	Spokane	*7	*7	*7	May '20, SA	.03
Federal M. & S.	New York	5⅞	5⅞	5⅞	Jan. '09,	1.50
Federal M. & S., pfd.	New York	25	25	25	Dec. '20, Q	1.75
Florence Silver	Spokane	*17	*16	*16	Apr. '19,	.01½
Grand Central	Salt Lake	..		*37½	June '20, K	.03
Hecla Mining	N. Y. Curb	4¼	3⅞	4	Dec. '20, QX	.15
Iron Blossom	N. Y. Curb	*18¾	*16	*17	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake			3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*8	*6½	*7		
Prince Consol.	N. Y. Curb	5/16	¼	¼	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*6½	*6	*6	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*8½	*7	*8		
South Hecla	Salt Lake	*63	*52	*63	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*18¾	*18¼	*18¾	Oct. '17,	.05
Tamarack-Custer	Spokane	1.60	1.50	1.50	Jan. '21, K	.04
Tintic Standard	Salt Lake	3.20	2.70	2.80	June '20, Q	.10
Utah Apex	Boston	2¼	2⅛	2⅛	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*4	*3	*3½	Nov. '17,	.01
QUICKSILVER						
New Idria	Boston	...	....	*95	Jan. '19,	.25
VANADIUM						
Vanadium Corp.	New York	31½	26	30	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	78	74	78	Jan. '21, QX	3.50
Asbestos Corp., pfd.	Montreal	90	89½	90	Jan. '21, QX	3.75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	41	37½	40	Dec. '20, Q	1.00
Amer. Sm. & Ref. pf.	New York	77½	75½	77	Mar. '21, Q	1.75
Am. Sm. pf. A.	New York	63½	63¼	63½	Jan. '21, Q	1.50
U. S. Sm. R. & M.	New York	31½	30	30½	Jan. '21, Q	.50
U.S.Sm.R.& M. pf.	Boston	42¼	41½	42	Jan. '21, Q	.87½

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Taxation and the Mining Industry

TAXATION AND WAR go together: but taxation is with us the longer. Whether we lose or win, we lose; and when the ardor of fighting is long past, we must settle down to the payment for shot and shell, for scrapped airplanes and condemned uniforms; to the payment of what was grabbed by the owners of "war babies" who grew rich, and by the war claimant who bursts with indignation at a government which lets him lose money.

Under what claim shall we get a remission of our heavy war taxes, and thus be protected by our beneficent Government against the grief of war? There is, alas, no relief—taxes and death, as we believe Franklin once observed, are two things which we cannot go to Congress to have remitted. Nature exacts the one and the Government the other.

There is, however, science and efficiency in war making, and also in tax collecting. We did not get down to efficiency and economy in the carrying on of the war. We had no time, and our Government had forbidden preparation, or even the thought of preparation, lest we should offend the Germans. But there is nothing to prevent our applying our brains promptly to the taxation problem. It is in large part a cold-blooded, unsentimental problem, and we shall have it with us a long time—long after we have almost forgotten that we paid so much of the bills of the war, and that then our European and Asiatic friends divided up the spoils among themselves and threw us the advice that if we had no more money for them we had better go on home and mind our own business.

The debts and the running expenses of the Government must be paid; and we must provide money for the process. We shall attack the problem firmly, and every individual and corporation will cheerfully pay its fair share. The mining industry will gladly support the burden in proportion to its importance. We shall cut down our mining profits to build battleships; but we shall build none by shutting the mines down. That is the great danger from the Government side—the killing of the goose that lays the golden egg of taxes—and this is not an academic danger, for it is one of the great factors which are responsible for many closed mines today, and for the lack of enthusiasm about reopening them.

The Government will derive the maximum revenue from a policy and from methods of taxation which will enable a maximum prosperity in the mining business. In other words, the interests of the taxing Government and the taxed industry are identical, and, therefore, there should be mutual eagerness to work together toward the common end.

We are new also at this taxation game—but we can learn. Individually and as individual corporations, we find taxation annoying. The income and excess-profits taxes are annoying, and sometimes we question their equity. Certainly, they create classes, on whom the burdens of government are loaded. In olden days, you will remember—and not so very long ago—the theory was to tax the poor so that the rich might enjoy life. Indeed, that was the way the rich became rich in those days. Now the process is reversed, and the theory is to tax the rich so that the poor may benefit. Either way erects a special class and militates against the ideal democracy: but there is something about the last-named that appeals to the sporting instincts even of the wealthy, who may well have had some Robin Hood in their ancestry.

So be thankful when you dig up for your income or your excess-profits tax; and get your compensation out of swelling up a little, as you reflect that you are paying the bills. Nevertheless, apart from sentiment, the whole system, and especially that part which applies to excess-profits tax, is on trial, and for sober business reasons: is not such a system destructive of the prosperity of the tax-collecting business? It is all very well to tax wealth, but to tax initiative is another thing.

Mining engineers are taking a deep interest in this most important factor in their industry. The mining industry must be encouraged, and tax laws and their application must keep this in view as the prime consideration. Afterward, the problem must be to tax equitably, and evenly—and simply.

The principles of mining are not difficult to those who know; and methods of taxation which keep every one guessing, and leave the problem where it is only dimly grasped by accountants and lawyers, and quite unintelligible to every one else, constitute an all-round loss and a wet blanket on all concerned.

Secondary Enrichment: Its Use And Abuse

THE MOST HARMLESS and conservative geological conception, when it becomes fashionable and the fad, is forced into positions of which its sober sponsors never dreamed. Such a phantasm was the "true fissure vein," which was held in the reports of engineers, and in the prospectuses of promoters, to represent the last word in stability and persistency. "This has been pronounced by geologists," the report would run, "a true fissure vein, which means that it can be mined as deeply as the art of man can devise methods for extraction." No fear, then, of the ore petering out.

Well, the "true fissure vein" has become rather unfashionable: too many ore shoots, in veins, fissure veins, and otherwise, have been bottomed: even the popular conception of the geology of a vein demands something a shade more complex, a thought more refined.

Such a conception was supplied by the coterie of geologists who, some years ago, came out with a more or less simultaneous boost for "secondary enrichment," showing how the downward action of surface waters may transform a lean copper ore, in a limited superficial zone, to a rich one. Since then the fertile idea has sprouted and run wild; and in the minds of the amateur geologist (and the operating engineer is often such) it explains satisfactorily all of the variations of ore deposition, which militate against the uniformity implied of yore by the "true fissure vein."

Not only copper but all the other metals indiscriminately are brought under this law. Does an orebody peter out in depth? The explanation is "secondary enrichment." On the other hand, does it go down? The reason is "secondary enrichment." If it peters out and gives way to barren vein below, go still deeper, and look for the "secondary enrichment." In the California gold mines, it has been found in some cases that after the orebodies in the first thousand feet or two have been worked out, still deeper work may develop new orebodies. The explanation? Why, "secondary enrichment." Ah, secondary enrichment! How many crimes have been committed in thy name! Thou and the "true fissure vein" and the "good hanging wall" and the "favorable f'mation" and the "porfry dike," and the "contack"!

A case of true secondary enrichment is like a case of typhoid; if you diagnose it correctly and promptly you know how to treat it, and the knowledge is worth while: on the other hand, if what ails you is dyspepsia, or its geological equivalent, the sooner you find that out the better for your bank account. And the way to find out is to consult a real doctor, and not listen to the wise dictum of the quack.

Advertising Propaganda And Scientific Discussion

OUR scientific and engineering societies owe it to their members to exert some degree of censorship on the papers which are presented at their meetings. The opportunity is a most attractive one for interested people to push their own machinery or processes, and unless considerable care is exercised things may be said and statements be published which might better be confined to a catalog. The American Institute of Mining and Metallurgical Engineers had experience of this kind several years ago when the ball-mill controversy received much more attention than should have been accorded to it. Some other technical groups have yet to profit by the Institute's experience.

We are led to comment on this subject by a paper which was read at the Montreal meeting of the Canadian Institute of Mining and Metallurgy. This paper dealt with a certain kind of alloy steel castings; it was presented by a representative of the company which specializes in such castings; and its general tone was that of advertising propaganda rather than a technical discussion of the subject. One would think that castings of the kind described should displace all other kinds in all of the highly diversified applications which were mentioned and illustrated by lantern slides. No discussion whatever followed the paper, but we venture to say it was not because counter arguments could not have been made by many of those present. We think the members showed their good sense by refusing to comment.

It is not to be denied that papers of this kind have a certain value and can be made interesting and informative, as was the paper in question. We do think, though, that they should be presented frankly for what they are, and should not be subsequently incorporated into the proceedings, thereby making the society responsible in a way for the opinions expressed. Advertising is certainly not colorless these days, and often we read the back pages of a magazine before turning to the "reading matter." But it belongs on the back pages, and we do not relish it so much when it is promiscuously mixed with the text.

Technical societies should require that papers be submitted for examination before presentation to their members, for thereby much outright propaganda can be toned down or excluded, as seems advisable. Some nice points will undoubtedly arise, but the matter is one of too much importance to be allowed to go unnoticed.

Proposed Changes in California Industrial Compensation Laws

AN ATTEMPT IS BEING MADE at the present session of the Legislature of California to recodify and amend the Workmen's Compensation Act of California, which has been in operation since 1917 and which has reached a condition of equilibrium such that it may be said to be operating with a fair degree of satisfaction. Most of the dubious points have been cleared up by interpretation of the courts, and the administration of the existing law appear to be going along smoothly. We understand that the proposed legislation embodied in Senate bill No. 259, otherwise known as the Jones bill, was initiated by the California State Industrial Accident Commission, which is charged with the administration of the existing law. It is a fact, we are informed, that the existing law is one of the most liberal in operation in the United States.

We are thoroughly in accord with the objectives of compensation laws generally, and believe that they have been productive of much good. They are in spirit equitable, and have been generally well administered.

We have examined the proposed Jones law, and find it voluminous and complex. It attempts to be specific, and then allows unreasonable discretionary powers to the Industrial Accident Commission. It increases compensation allowances, despite the fact that existing allowances are exceedingly liberal as compared with those of other states. It provides for guarantees by employers and insurance carriers, and then proposes that they shall pay death-benefit payments to the commission, to constitute a "death-benefit fund," to be administered by itself. It allows an almost indefinite time to elapse before a given case can be closed. It throws the burden of proof upon the employer in cases of alleged injury. It places a 2 per cent assessment upon the workmen's compensation insurance premium, payable by the employer, of which 60 per cent is to go to the accident-prevention fund and 40 per cent to the industrial rehabilitation fund.

Apart from many other considerations, the increased expense to industry generally in California is estimated to be 30 per cent of the existing cost for compensation. The mining industry of California is passing through a lean period. It will probably be hit harder by the increase in compensation than other industries. At a time when it is gradually getting on its feet, we feel that additional burdens by legislative enactment might well be spared. We also feel that the commission, in initiating this new legislation, has not given the industrial side of the case due consideration, and does not appreciate what "working in the red" means to industry. We commend its humanitarian viewpoint, but we question its practicability.

Hearty co-operation of employers and companies cannot be expected unless the commission fairly considers both sides, and is as solicitous of the welfare of industry as it is of the welfare of its workers.

Trade With Russia

WE REJOICE that Hoover, in a newspaper interview, has declared himself against opening diplomatic trade relations with Soviet Russia. We approve all the more this frank expression of opinion, as it comes so quickly on the bid for trade by Lloyd George, and the reopening of trade relations between England and Russia. Yet the views of Hoover are more eminently practical than sentimental, and directed to the pragmatists. "What is there to trade for?" he asks pertinently. "Soviet Russia has neither raw materials nor manufactures. There is nothing but a 'parcel' of gold and platinum, which the present holders have obtained by cutting the throats of the original holders. We would derive no economic benefit from holding this dirty gold; nor would the condition of Russia be alleviated by our shipping her sundry supplies. Therefore, Russia's only recovery, her only regeneration, must come from within."

A wise, simple, and true word. Why, then, has England "reopened trade"? For various and political reasons, which do not apply to us. England has a lower labor stratum which looks on revolution and anarchy kindly, and will be appeased by England stretching a pseudo-friendly hand to the bloodiest of dictators, who sits in the ruins of what the Czars had built. We have no such important stratum, which is a natural antithesis to a persistent aristocracy. Then England would make friendly gestures, to relieve the pressure of Russian conquest on some of her far-flung outposts of empire—a pressure that she does not well know how to support by force of arms. She would also like from Russia a little oil; in fact, a little breathing space, and to "stand in" as first and next friend, on any division of property. In all of these things we either are not interested or prefer to express our problem straight out and as it stands, as our State Department has done to England and France regarding the "partition of petroleum" in Mesopotamia.

We moderns, who assume all too swiftly that we live in new days, and that the precepts of our earlier statesmen, well enough in their day, do not apply in our generation, are perceiving with astonishment that Washington, who counseled keeping clear from entanglement in European affairs, is perhaps not so much out of date. There have been a lot of things in our day, like government operation of railroads and especially the League of Nations, which appealed to our reason at once as thoroughly desirable. But we reckoned in part without making due allowances for the weaknesses of human nature; and when partial government railroad operation took place during the war, we were grieved at the inefficiency and the rapacity which made things worse than before.

Similarly, as we view the European and the Asiatic nations at close quarters, in the light of being associated with them in a closely controlled World-Government, we perceive that they are wedded to ideals and methods which are repugnant to us and injurious to what we believe to be our best growth; and we see more and more clearly the dangers we have escaped at the hands of the most maladroit American statesman in our history.

It Speaks for Itself

WE HAVE RECEIVED from the Tri-Hemisphere Brokerage & Trading Co., of Seligman, Ariz., an article entitled "Big Power Project May Electrify Santa Fé" and describing a proposed hydro-electric development in Mojave County, Ariz., for which publication was asked. Excerpts from this article follow:

> Application for a mammoth water-power development on the Colorado River in Mojave County, Ariz., which producing 480,000 hp., will make possible electrification of 500 miles of the Atchison, Topeka & Santa Fé R.R., and irrigation of approximately 500,000 acres of land, has been filed with the Federal Power Commission by E. L. Beyard, of Seligman, Ariz.
>
> Backed by Kansas City and Philadelphia financiers in a corporation capitalized for $6,000,000 to start with, and ultimate capitalization of $60,000,000, Mr. Beyard proposes in his application to construct eight dams, the first of which will be located about twenty-five miles due north of Needles, Cal., and the last of which will be built outside Grand Canyon National Park.
>
> The large group of producing gold and copper mines located at Chloride and Oatman, in the mountains, a short distance from Kingman, Ariz., will be supplied with hydro-electric energy from the first of the eight power plants, each of which, it is estimated, will produce 60,000 hp.
>
> The application filed with the commission states in detail:
>
> "It will be the aim of our company to duplicate approximately 60,000 hp. from sites one or five for the Oatman and Chloride mining district, and, as development progresses, the Atchison, Topeka & Santa Fé R.R. will without doubt start negotiations for the electrifying of two divisions from Seligman, Ariz., to Barstow, Cal.
>
> "Located in the desert a considerable distance from California, the source of crude oil used in locomotives, and a still greater distance from the nearest coal fields, the two divisions mentioned, while almost entirely non-revenue producing, cost it is understood three times as much to operate as any other stretch of track belonging to the Santa Fé. Repeatedly the railroad as well as private interests has endeavored to develop irrigating water in the Hualapai Valley by drilling for artesian wells in a hope of turning its wondrously fertile soil into producing territory, but without success."

Interested in this as somthing that would benefit the mining industry, we wrote to the main office of the Santa Fé railway at Chicago, and received the following reply:

> Your letter of March 8 addressed to Atchison, Topeka & Santa Fé R.R. in regard to possible electrification of some 500 miles of that railway in Arizona—we do not have at the present time any plans looking toward the possible electrification of our lines in that territory or at any other point. So far as a water-power development plant is concerned, we are in no position to advise, as, if one is contemplated from a private source, we have not had negotiations of any sort covering the subject.
>
> A. G. WELLS,
> Vice-president.

We are now wondering what makes the Tri-Hemisphere Brokerage & Trading Co. so solicitous about the welfare of the Santa Fé, when the latter does not seem at all concerned.

WHAT OTHERS THINK

The Naica Controversy

I notice on page 320 of the Feb. 12, 1921, issue of *Engineering and Mining Journal*, under the title "The Naica Controversy," an article written by John E. Kelly that I, as a Mexican lawyer and interested in the future of my country, feel bound to rectify.

There is no possible description of the havoc this article, if uncontested, could produce in Mexico. If foreign investors think that companies even so conservative and so well informed in Mexican laws as the American Metal Co. can be made the victims of legal chicanery; if, after more than twenty years of quiet possession, the shareholders of a Mexican company are still subject to a claim based on merely formal defects of an old contract which may destroy their company and divest them of their rights; if the statute of limitations can never bar an action based solely on technical errors; if the voluntary performance of a contract by the parties to it, together with their silence for more than twenty years, does not stop them from bringing an action for the nullification of that contract, brought by the very parties who made it—if such is the law of Mexico, then it would be the death blow to the development of Mexican industries and wealth, either by investors at home or abroad.

Fortunately, that is *not* the law of Mexico, which is based upon all those principles of equity and good judgment of the civil law traditions. On the contrary, it considers the statute of limitations a base of social order and a principle of public policy. For mining enterprises all actions, without any exceptions, are barred after ten years, unless the law provides for a shorter period. For corporate matters that period is five years, and in commercial transactions the statute of limitations runs against minors as against persons of age.

In this unfortunate case of Naica, the Mexican courts, miscontruing our law, have based their decision on the opinion of French authors; but the French law, at variance with ours, provided, at the time those opinions were given, that actions of nullity of a corporation were never barred by limitation when based upon defects of the original charter. This French law was since changed and now limits such action to ten years. Lyon Caen, the most famous commentator of that law, explaining the amendment, states: "It would be ruinous to have the action of nullity subsisting in perpetuity." The Mexican courts ignored this comment, which explains our own law.

Mr. Kelly apparently intended to be neutral, but undoubtedly he was misinformed in many substantial points. He thus says: "The heirs of Santiago Stoppelli are suing the Compañia Minera de Naica, S. A., for the return of the Maravillas mines." Such is not the fact. Saturnino González and the heirs of Stoppelli sued jointly the Naica company for the nullity of a contract of association which González and Stoppelli themselves made in 1896. That contract, in the Mexican law, constitutes the charter of the Naica company. The foundation of the complaint is that the plaintiffs themselves overlooked in the contract to comply with certain legal formalities; and, *as a result of their own fault* and the ensuing nullity of the Naica charter, they now demand that the Maravillas mines be returned to both González and the heirs of Stoppelli. The latter did not claim *the whole* property, as they based their claim on the 25 per cent interest of Mr. S. Stoppelli. And the fact that the courts gave the heirs of Stoppelli *all* the mine (more than they demanded) is a juridical heresy unheard of by Mexican lawyers. The complaint also shows that the plaintiffs did *not* claim that Stoppelli "did not sell or transfer his ownership" in the mines, as Mr. Kelly asserts. Not even the courts support that statement.

Mr. Kelly further states: "They (the plaintiffs) quote the *Commercial* code to show that a protest against an action in bad faith may be brought by the interested person or his estate at any time, no matter how long after the action of which the complaint is made." The uninformed reader may think that bad faith on the part of the company was alleged. No charge whatever of bad faith is there in the complaint. It is based solely upon those formal defects in which González and Stoppelli themselves concurred, and the article quoted is from the *Civil* Code, which does not mention actions in bad faith.

In 1904 the executor of the will of Santiago Stoppelli, duly represented by an attorney, brought an action against the Naica company for the payment of dividends on certains shares which had been declared forfeited under the bylaws of the company, thus recognizing the existence and validity of the company. A compromise was made; the estate, acknowledging the legitimacy of the declaration of forfeiture of those shares, waived all rights to raise further questions on the matter, and received in consideration thereof 30,000 pesos. The law of Mexico prohibits attacking the validity of a compromise until the return of the money received in consideration of it is secured. The plaintiffs never gave such guarantee nor brought any action to invalidate the compromise.

Mr. Kelly states: "To this charge the claimants reply that the former suit was brought by María Stoppelli, not by the heirs, as the majority of them were minors in 1905." That is not true. The claimants raised the objection that the executor could not delegate his power to the attorney who acted for the estate in the compromise, and that such attorney exceeded his authority. Whatever the merits of this objection, the fact is that after more than ten years the statute of limitations barred the heirs of Stoppelli, minors included, from attacking such agreement. Its validity was not one of the issues in the suit, and the courts had no jurisdiction to declare the compromise void and overrule the defense based upon it.

It has been necessary to enter into these details to show that the laws of Mexico have been disregarded in many respects; that the courts, for reasons that I do not wish to discuss, have overridden principles heretofore considered as being the base of our social order, have even exceeded the claims of the plaintiffs, and have given one party more than demanded, thus violating the express provision of our codes; have ignored defences based on authentic documents bearing the authority of *res judicata;* have made the fault and negligence of the plaintiffs in their incorporation of the Naica company the only support of the decision in their favor; and, finally, the courts have decreed an impossibility under the Mexican law, inasmuch as a company which has been declared a nonentity cannot do anything; but they have clothed their decision in impersonal sentences directed against no one, instead of making a direct personal command to the defendant, thus making such decision unenforcible.

It was necessary to enter into these details, because, in the alternative between presenting the courts of Mexico with their full responsibility in this case of Naica, and defending the fairness and equity of our traditional institutions, neither I nor any Mexican could hesitate. The courts reflect the chaos and anarchy which have swept our country. Fortunately they do not make the law, nor even its authentic interpretation, as our institutions are the inheritance of centuries, under which foreigners as well as Mexicans used to find adequate protection. When courts more conscious of their responsibility are established, which I hope will be in the near future, the world may know that Mexico deserves both economic credit and moral respect.

I am not associated in any way with the American Metal Co. nor with the Compañia Minera de Naica, but being familiar with the facts in this case deem it my duty and privilege as a Mexican lawyer to call your attention to the errors in Mr. Kelly's article, as I feel confident that my country can best be served by pointing out the errors of its administrators, so that they can be corrected, thereby justifying our confidence in her inherent justice to all men.

New York. RAFAEL MARTINEZ CARRILLO.

Loose Construction in Textbooks

Your editorials on the "Correspondence School Mining Engineer" have brought to my mind an idea that I believe would be of considerable help in the proper education of engineers. It is in regard to the proper construction of textbooks. Why is it necessary to have such a great duplication of work along this line? Would it not be possible to publish something besides a compilation of so-called facts, from many sources, with no direct authority back of the publication? Certain state reports on geology are used to a considerable extent as reference works in engineering courses, and in a series of reports, from many states, on one subject about 50 per cent of the material has simply been lifted bodily from the original publication. I wonder if any thought has been given to the great loss of time and money in the use of textbooks that are loosely put together as to facts and grammatical construction, or where a mass of material is presented that has absolutely no value to the future engineer.

The valuable information given below is taken from Government reports and from textbooks:

"In river sands, the grains are angular in beach sands rounded."

"Mica is obtained in large sheets from Farther India, and is used in the manufacture of lamp chimneys."

"Residual clays may show almost any color, but red and brown are perhaps the commonest. When free from iron oxide or nearly so the material is white, and this variety is termed kaolin."

"Calcite and Iceland Spar are pure crystallized calcium carbonate . . . the former occurs in flat rhombohedrons."

"When sands are cemented by calcite and limonite, they form sandstones and when by silica they form quartzites."

"Kaolin or *clay* like mica is an orthosilicate."

"Sandstone is composed of sand grains cemented together by clay or by calcium carbonate."

"In assaying, the material carrying the gold is heated with borax and lead in a small crucible (cupel) of bone-ash."

"Cement is made by heating limestone $CaCO_3$, clay and sand or a natural rock containing all of them in right proportions."

"The motion (rotary motion of the cement kiln) continually turns over the thin layer and exposes every particle to the heat of the air-blast charged with pulverized coal, burning in the interior."

"Gold mills are always wet stamping."

"When a limestone containing something like 8 to 18 per cent of clay is burned in the ordinary way the product will slake and form a mortar which will set and harden under water and hence is called hydraulic cement. A much better product is made by burning a limestone which contains 20 per cent or more of clay until the carbon-dioxide is driven off. The substance so produced will not slake; but if finely ground and mixed with water will set and harden out of contact with the air. This is known as natural cement. Portland cement is the best hydraulic cement."

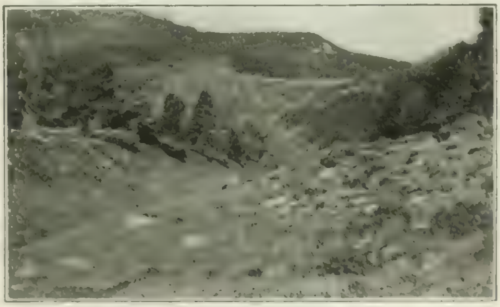
It happens that the preceding quotations are from branches of work in which I am directly interested, and I have thought that if I was able to take such statements out of publications that are supposed to be authoritative, perhaps other lines of work might be as badly represented. ROBERT W. JONES.

West New Brighton, N. Y.

Botany Applied to Mining

The accompanying photograph illustrates a condition in which the lack of vegetation was used as a guide in prospecting and an interesting geological feature.

The marked depression, due to normal faulting, acts as a gutter for the water of the mountain side, and the scrub spruce will not grow in the damp ground of the trough. Prospectors thought the natural clearing was due to rock minerals that would not support vegetation, and hoped to find ore beneath.



The fault is in the mountains northwest of Lillooet, B. C., near the canyon of Bridge River. From the point at which the picture was taken to the top of the farthest ridge cut by the fault is at least one and a half miles. The trough near the camera station is twelve feet deep. On the far ridge the displacement is fifty feet.

From the camera to beyond the first ridge the fault cuts a granitic rock (Rexmount porphyry). In the far ridge the foot wall is porphyry, and the hanging wall slate. The porphyry is part of the eastern fringe of the coast range; the slate the western border of the interior plateau. FRED E. NELSON.

Anyox, B. C.

Chloridizing Practice in Sweden

There are a number of interesting points in Mr. Östman's article in *Engineering and Mining Journal* of March 5 under the heading "Chloridizing and Leaching as Practiced in Sweden." It would be quite worth while if Mr. Ramén could be induced to write an article for the *Journal* giving in full the results of his investigations on the theory of chloridizing roasting. The extracts in the article state "The process, in my opinion, depends principally upon gas reactions. . . . It has been proved with a certainty that the mass acts as a contact substance. . . ." It is interesting to note that this is borne out by the fact that the best temperature for the process is close to the temperature found best in practice for making sulphuric acid by the contact method. This fact is also true for sulphatizing roasting, so that it seems probable that the direct conversion (equation 5) as given, $RS + O_4 = RSO_4$ does not take place to any considerable extent.

Some of the mechanical details spoken of in Mr. Östman's article are different from practice in this country, and would appear to have advantages, particularly the method of precipitation. In addition to those mentioned by the author, it would seem that a properly designed drum precipitator would be much less expensive to install and operate than a tank system, due not only to reduction in labor but also to increased speed of precipitation and consequent larger capacity.

It would have been interesting to have a comparison in some detail as to cost and other factors of the method of briqueting and burning as against sintering.

No mention is made of how the cement copper produced is treated. In this country cement copper from chloridizing plants is not looked on with enthusiasm by the refiners, and is not so readily salable nor at so good a price as other forms of copper. A suitable method for treating cement copper in considerable amounts is an important practical problem at present unsolved in this country, and it would be interesting to know if the methods used for this purpose in the installations described differ materially from those in use here.

Los Angeles, Cal. G. D. VAN ARSDALE.

Answering Mr. Van Arsdale's letter:

1. We beg to refer to the article written by Prof. P. Klason which appeared in the *Mining Magazine*, December, 1918, and which goes at length into the theory of chloridizing roasting.

2. Sintering of the purple ores has been done, and this process has worked out very well. I am, however, unaware of the difference in cost between such sintering, and briqueting and burning.

3. *Treatment of cement copper.* As practiced in Sweden, the cement coper is smelted and refined in a common refining furnace and the final refining is carried out by the Sundberg process. This consists in blowing soda ash, plus pulverized charcoal, into the molten bath at the moment it begins to "throw the worm." The alkali combines with the impurities present and rises to the surface as slag, which is rabbled off. This refining process, however, would not apply for any cement copper containing precious metals.

Electrolysis of the copper solutions has been tried, but with no marked success. There is no doubt that if a suitable electrolytic process can be developed, it will be readily taken up by the European works, as they have trouble in getting a fair return on all such cement copper which contains gold and silver.

Some of the cement copper produced these analyses:

Cu	65 per cent	Cl	0.8 per cent
Fe, Zn, etc	5 to 8 per cent	O	5 to 7 per cent
Ag	120 oz.	H_2O	10 per cent
$Na_2SO_4.10H_2O$	15 per cent		

It is obvious that this cement copper can be handled by electrolytic plants only and will be heavily penalized. It may be possible, however, to convert it abroad into blister copper and sell it as such. If the cost of such converting would be less than or equal to the penalty applying to the crude cement copper, it would be an advantage, as the saving in freight on the blister copper would be considerable.

H. A. DE FRIES,
Consulting Engineer to Hamilton & Hansell, Inc.
New York, N. Y.

Costs at Las Dos Estrellas Mill

"Side Lights on the Cyanide Process," by Alfred James, in the *Engineering and Mining Journal* of Jan. 15, 1921, contains a paragraph dealing with present-day milling costs at Dos Estrellas, Mexico. The paragraph states that the total cost during 1919 averaged 3.20 pesos per dry metric ton, but the items composing said paragraph add up to but 2.646 pesos. Obviously some additional information must be forthcoming to give the statement its due importance, and I take pleasure in furnishing a complete cost sheet showing itemized costs in the Dos Estrellas mill during 1919 and 1920.

Year 1919.

Amount of ore treated, 361,878 dry metric tons.

Total milling and treatment costs, 3.203 pesos per ton.

Year 1920.

Amount of ore treated, 366,821 dry metric tons.

Total milling and treatment costs, 3.0506 pesos per ton.

During October, 1920, operations in the mill were suspended for twenty-five days owing to labor troubles.

A perusal of the accompanying statement and comparison with the incomplete figures given in Mr. James' article will be interesting. The economy effected by zinc dust plus Crowe vacuum over zinc thread will be seen to amount to 29 centavos per ton during 1919 and somewhat in excess of this during 1920, but lower first cost of zinc is of course responsible for a small proportion of the reduced costs.

T. SKEWES SAUNDERS.
Minera de Dos Estrellas, Michiacan, Mexico.

COMPANIA MINERA "LAS DOS ESTRELLAS," S. A.

Comparison of Milling and Cyaniding Costs for the Years 1919 and 1920

	Costs per Ton	
	1919	1920
Milling department:		
Superintendence	$0.0313	$0 0340
Handling ore in bins	.0159	0377
Gyratory crushers	.0670	.0520
Conveyor belts	.0613	.0558
Automatic sampling and weighing	.0057	.0129
Batteries	.2814	.2781
Tube mills	.5987	.2829
Classifiers	.0839	.1043
Handling of tube-mill rock	.0208	.0170
Conservation and innovations to plant and buildings	.0229	.0043
Sampling and assaying	0129	0303
Cyaniding department:		
Superintendence	.0311	.0348
Thickeners (Dorr)	.0170	.0144
Agitation	1301	.0903
Handling of slimes	.0587	0557
Handling of solutions	.0684	.0721
Handling of water (purchased from an adjacent company)	.1496	.1462
Clarifiers	.0215	.0213
Filters (Butters)	.1570	.1870
Precipitation:		
January to July, 1919, with zinc thread: 220,150 tons at 0.46 centavos per ton August to December, 1919, with zinc dust and Crowe vacuum: 146,671 tons at 0.17 centavos per ton } Average	.3441	.1417
Smelting	0879	0982
Maintenance of solutions	.7956	.7619
Experimental work	.0122	.0244
Conservation of buildings, tanks, and innovations	0795	0495
Sampling and assaying	0233	.0256
Recuperation plant		.0141
Concentration	0253	.1041
Total	$3.2031	$3.0506

The Construction and Operation of a Cyanide Plant in Ecuador

Mill of About 280 Tons' Daily Capacity, Treating Ore and Tailings From The Zaruma Mines, Includes Stamps and Tube Mills, Dorr Classifiers and Tanks, Butters Filters, Merrill Apparatus, and Crowe Vacuum Equipment

By Paul C. Schraps*

Written for *Engineering and Mining Journal*

THE ZARUMA MINES of the South American Development Co. are situated in the district of Zaruma, Province of El Oro, Ecuador, about forty-six miles by mule trail from the river port of Santa Rosa, which, in turn, is fifteen miles by launch or river steamer from the Pacific port of Puerto Bolivar.

The veins carry gold and silver in the proportion, at present, of about 1 to 3.75 by weight. The higher recovery obtained on the gold, however, leaves the silver relatively unimportant, and operations are conducted on a gold basis. The largest and most important orebodies are situated in a main north-and-south fissure system. Smaller veins connecting at sharp angles with this fissure system also carry ore. The orebodies in the main fissuring have a gangue of quartz and calcite, with some country rock and only a small percentage of sulphides.

The ore from the branch veins has a quartz and country-rock gangue with little or no calcite, and carries a high proportion of pyrite, chalcopyrite, sphalerite, and galena. Both classes of ore carry tetrahedrite, with which the gold and more especially the silver are closely associated. The ore from the main fissuring is much more amenable to treatment, but the presence of the calcite renders it more difficult to settle after fine grinding. Previously the mine produced a higher percentage of the baser ore than it does at present.

Remote Location Involves Transportation Difficulties

One of the principal problems met in operating the mine is the inadequate and expensive means of transportation available. Most of the supplies, with the exception of timber, are purchased outside of Ecuador and delivered by ocean steamer to the ports of Guayaquil and Puerto Bolivar. Thence they are transported in small craft to the river port of Santa Rosa, whence they are packed into the property on mules or by men. As previously stated, the mule trail is forty-six miles long and crosses a divide at 6,500 ft. The elevation of the mine is about 2,000 ft. Previously this trail in the rainy season became almost impassable. In the last few years extensive cobblestone paving has transformed it into a reasonably good all-year-round trail.

The net effect of the difficult transportation is to increase the cost of all construction and the cost of supplies for operation. Furthermore, the necessity of sectionalizing all machinery to the lowest possible weight limit increases its cost and reduces its strength.

Previous to the spring of 1919 the ore was treated by a combination of amalgamating and cyanide leaching. The mine product was crushed through 30 mesh and passed over amalgamating plates on which about half of the gold was retained. During 1917 and 1918, when the ore was of unusually good grade, the recovery on the plates was a little under 55 per cent. The tailings from the plates were sluiced to masonry tanks, where, by means of a gooseneck, a rough classification into sand and slimes was made. The sands, which constituted about 75 per cent of the stamp-mill tailings, were leached with cyanide solution, and a further recovery was obtained of nearly 25 per cent of the original contents of the entire tonnage.

GENERAL VIEW OF PLANT BEFORE COMPLETION

Including the extraction by cyanide, the total recorded gold recovery during 1917 and 1918 was just under 80 per cent. These recoveries, however, are based on assays of tailings and product shipped and take no account of loss and theft. The absolute recovery probably was not much more than 75 per cent, even during these periods of extraction of high-grade ore.

During recent years the leached sands have been stored. The gold and silver are not evenly distributed through the storage dump, a considerable concentration having taken place near the discharge of the pump which was used to elevate them. Their value at this point is about $5 gold, whereas at the extreme margin of the dump it is only about $1.25. The slime, so-called, from the gooseneck overflows was sluiced and stored below the sand dump. It consisted chiefly of true slime, but contained, also, a fair proportion of very fine sand. The storage of this material was begun before the storage of the sand. The average value of the slime treated to date in the new plant is $[illegible] gold and $[illegible] silver. Concentration also took place to some extent in the storage of this material, but less markedly than in the storage of the sand.

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*Mr. Schraps' original manuscript contained much additional matter which we were compelled to omit owing to limitations of space. This included details of excavation and concreting, and [illegible] tailing, transportation, and construction cost.

The problem of erecting a more modern and efficient plant was studied for a number of years, and various experiments were conducted to obtain data on settling, concentration, extraction, and complementary operations. The operators desired to treat a larger tonnage and to obtain a higher recovery, and at the same time, by eliminating amalgamation, to reduce the loss by theft. A thorough study indicated that the new installation should be based on the Dorr counter-current decantation system, and the Dorr Company, in 1915, was appointed consulting engineers.

OUTLINE OF DESIGN OF NEW PLANT

The plant as designed included the use of the old stamp-mill crushing equipment, i.e., crushers, bins, grizzlies, batteries, and the like; the alternative of using or discarding the amalgamating plates; regrinding in three tube mills after classification in closed circuit with three Dorr classifiers; thickening in one 12 x 39-ft. Dorr thickener; agitating in four 12 x 28½-ft. Dorr agitators; decanting in five more Dorr thickeners; clarifying, and precipitation by the Merrill zinc-dust method and Crowe vacuum apparatus. In addition, sand- and slime-handling plants were designed and built locally. A further addition was a rectangular masonry sump constructed below the last tank, at the edge of the river. The original design called for a steel-frame building covering the entire new plant. Because of freight congestion on the trail this is still stored at the coast. It will facilitate operations when finally erected. The use of amalgamating plates has been discontinued entirely.

The unsuitability of local lumber led to the decision to use steel superstructures on all the tanks and to build the tanks themselves out of reinforced concrete. Concrete floors have also been laid throughout the plant, so that all solution which may leak or splash is drained either into wells or into a catch-all sump at the bottom of the plant.

About the only available location for the new treatment plant was between the old stamp mill and the Amarillo River, a small but rapid stream flowing by the property. The mortars of the batteries are about 50 ft. above the level of this river, giving a drop ample for all gravity flow required. A power canal, however, was situated near the mill, between it and the river. This canal had to be maintained, as its water furnished the motive power for the mine compressors. It also had to be reconstructed in a more substantial form before even the excavation for the tanks could be begun. This caused a delay of several months in beginning construction operations on the plant proper. The reconstructed power canal was so placed that the tube mills and classifiers could be set between it and the batteries. The rest of the plant was set below the canal.

Shipments of machinery began to arrive in Ecuador in the winter of 1915-16. The plant was put into operation in April, 1919. The long period of construction was due chiefly to the inadequate system of transportation from the coast, complicated by two very bad rainy seasons, in part to the naturally dilatory spirit of the country, and, finally, to the delay involved in awaiting construction of the concrete power-canal.

TABLE I. REINFORCEMENT REQUIRED FOR ONE THICKENER TANK

	Lin.Ft.	Pounds
Wall, vertical bars, $\frac{3}{8}$-in. twisted	2,640	1,262
Wall, horizontal bars, $\frac{3}{8}$-in. twisted	3,450	1,649
Floor, bars, $\frac{3}{8}$-in. twisted	9,445	4,515
Wall, horizontal bars, $\frac{1}{4}$-in. twisted	1,830	388
No. 5 triangular mesh fabric (sq.ft. 1,313)		442
No. 7 triangular mesh fabric (sq.ft. 1,800)	....	378
Total	....	8,634
Tons		4.317
Contract price for placing reinforcement for one tank was	110.00 sucres	
The bars were delivered rolled up, for mule-back transportation. For straightening them contract was as follows:		
Each 10-ft. x $\frac{3}{8}$-in. twisted bar	0.022 sucres	

DETAILS OF CONCRETE TANK CONSTRUCTION

The method of making the concrete tanks will be of interest to many. Inasmuch as there were to be six thickener tanks, all of one size, and four agitators, also all of one size, wooden forms were made in sections for each size of tank, so that they might be used over again. The outside forms were continuous for the full height of the tank; the inside forms consisted of sections extending for a little over half the height of the tank. The cycle of tank construction consisted in standing, centering, and placing the wall forms, placing the wall and floor reinforcement, pouring the bulk of the floor and the lower half of the walls, raising the inside wall forms after twenty-four hours, pouring the upper half of the walls, and completing the pouring of the floor.

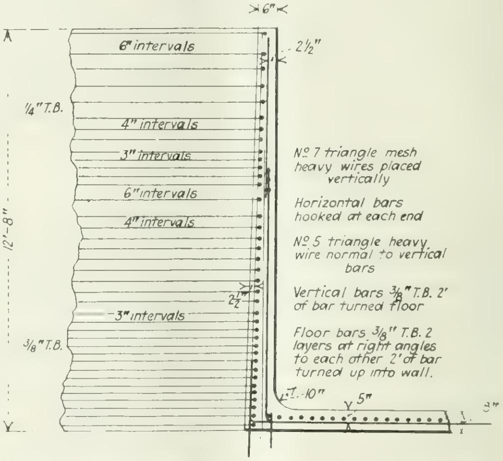
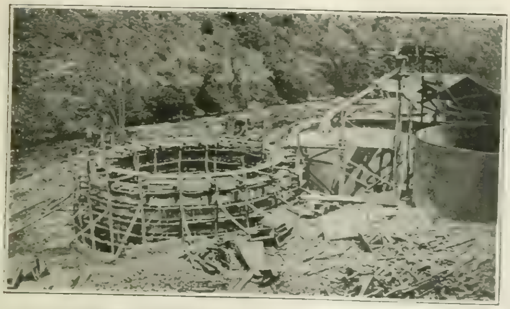

6"
6" intervals
2½"
¼" T.B.
4" intervals
3" intervals
No. 7 triangle mesh heavy wires placed vertically
6" intervals
Horizontal bars hooked at each end
4" intervals
No. 5 triangle heavy wire normal to vertical bars
12'-8"
2½"
Vertical bars ⅜" T.B. 2' of bar turned floor
3" intervals
Floor bars ⅜" T.B. 2 layers at right angles to each other 2' of bar turned up into wall.
⅜" T.B.
1'-10"
5"
3"

FIG. 1. REINFORCEMENT DETAILS. 39-FT. CONCRETE DECANTER TANK

Vertical Bars: 8 in. c.c. 2 bars tied 5 ft. plus 10 ft. — 15 ft.
Floor Bars: 4 in. c.c., two layers.
Horizontal Bars: $\frac{3}{8}$-in. and $\frac{1}{4}$-in. bars placed in wall spirally.
No. 5 Triangle Mesh Reinforcement: Tie to vertical bars. Heavy wires placed horizontally. Each width of wire placed as a continuous piece. Place three rows. Overlap, 4 in.
No. 7 Triangle Mesh Reinforcement: Long wires placed vertically and tied to horizontal bars.

The arrangement of the reinforcement for a thickener is shown in Fig. 1. For the walls it consisted of $\frac{3}{8}$-in. twisted bars 10 ft. long, set vertically on 8-in. centers, 2½ in. from the inside forms, with 2 ft. of each bar turned into the floor of the tank 5 in. below the floor line. To each of these bars was tied a 5-ft. length of $\frac{3}{8}$-in. bar, with a lap of 12 in. reaching to within 8 in. of the top of the tank. No. 5 triangular mesh fabric was then tied to the vertical bars, so that the heavy wire lay circumferentially around the tank. A lap of 4 in. was used in connecting this mesh material, which had a total height of 9 ft. Twisted bars of $\frac{3}{8}$-in and $\frac{1}{4}$-in. section were then placed horizontally, as shown. Each of these had a hook in the end, and these and all bars were joined by connecting all these hooks so as to make the horizontal reinforcement as continuous as possible. To the outside of the horizontal bars was tied



FORMS READY FOR POURING CONCRETE

No. 7 triangular mesh with the heavy wire standing vertically.

The $\frac{3}{8}$-in. twisted bars for the floors were placed on 4-in. centers in two layers at right angles to each other and 5 in. below the finished floor line. Two feet of each bar was turned up into the walls outside of all other reinforcement. No. 18 annealed wire was used for tying the reinforcement.

The only difference between the agitators and the thickeners consisted in a smaller quantity of reinforcement used in the former.

JOINTS AND FINISHING REQUIRED CAREFUL WORK

Considerable care was necessary to make a tight joint between the lower and upper halves of the walls. This was done by removing from the top of the lower half of the first-poured section all the surface concrete that contained laitance and then cutting a groove in the center of the wall 3 in. wide and 3 in. deep. Curved forms were used to make a bevel joint between the bottoms of the walls and the floor. The walls were 10 in. thick at the top of this curve, and were battered on the outside to give a thickness of 6 in. at the top.

In the pouring of the 8-in. floors only the lower 6 in. was poured at first and the last 2 in. was applied after the walls were completed. This arrangement permitted finishing the floors with a skin surface at the same time that the last 2 in. was poured, which was cheaper than pouring the floors originally to their proper thickness and finishing off with cement mortar.

The large quantity of reinforcement in the walls rendered tamping exceedingly difficult, and in consequence the lower halves of the walls on the outside, which were the most difficult to reach with the tamping bars, showed voids when the forms were removed. These had a depth of about $2\frac{1}{2}$ in. extending to the reinforcement from the outside wall. They were patched, and have caused no trouble.

To have the tank walls as impervious as possible, very fine sand screened from the mine material was used to make a rich cement mortar, which was applied with a brush to the walls as rapidly as possible after the forms were removed. If the forms are removed within twenty-four hours, and this paint, made up in small amounts, is applied promptly, it will set with the rest of the concrete and constitute a relatively impervious skin surface. The application of a mortar paint after the concrete has thoroughly dried showed absolutely no beneficial results.

Bolt holes were left in the walls for the overflow launder and the tray supports. Although the tray bolts were specified for 4-in. centers, they were put in on 12-in. centers, and have proved satisfactory.

The units in the new plant as operating, apart from the sand and slime transportation systems, are as follows:

1. Four 10 x 7-in. Fraser & Chalmers sectionalized Blake type crushers.
2. Eight batteries of five 900-lb. stamps each; each battery separately driven; normal drop of stamps, 92 to 100 per minute; height of drop, $6\frac{1}{2}$ in.; screen, 4 mesh.
3. Three 6 x 14-ft. Allis-Chalmers tube mills with Tonopah liners, driven at 28 to 30 r.p.m. through herringbone pinions on a line shaft on which are set two 48-in. double-nozzle pelton wheels; each mill separately clutched.
4. Three 20-ft. duplex Dorr classifiers driven from tube-mill line shaft through countershafting.
5. One 39 x 12-ft. Dorr thickener with one open-type tray driven by a 2-hp. motor.
6. Four $28\frac{1}{2}$ x 12-ft. Dorr agitators; three driven by 2-hp. motors; one by a 3-hp. motor, which also operates a Gould duplex diaphragm pump drawing from the thickener.
7. One 9 x 6-in. belt-driven Ingersoll-Rand class ER-1 compressor driven by a 15-hp. motor furnishing 120 cu.ft. of free air per minute to the agitators at 25 lb. pressure.
8. Five decanting tanks identical with the thickener, each driven by a 2-hp. motor and equipped with a Gould duplex diaphragm pump, except that for the last two tanks a quadruplex pump is used and the motor on the next to the last, No. 5, is 3 hp.
9. Clarifying equipment consisting of thirty-eight 5 x 8-ft. Butters filter leaves set in a cylindrical concrete tank 14 ft. in diameter by 9 ft. 6 in. deep, connected through a header to two 8 x 6-in. Gould Challenge double-acting piston pumps; each pump actuated by a 3-hp. motor through double reduction gearing.
10. Precipitation equipment consisting of a cylindrical concrete gold tank 14 ft. in diameter by 5 ft. 5 in. deep; three 36-in. frame Merrill presses holding 72 frames; one 6 x 7-in. Aldrich triplex pump with capacity of 150 gal. per minute against a 175-ft. head, belt-driven by a 10-hp. motor; Crowe vacuum equipment, including vacuum receiver and a 6 x $3\frac{1}{2}$-in. Gardner-Rix pump; Merrill zinc-dust feeder; 3-hp. motor-driven vacuum pump and zinc-dust feeder.
11. Refinery consisting of drying furnace, briquet machine, No. 1 Monarch-Rockwell melting furnace, dust flue, slag well, masonry vault, and other necessary equipment.
12. Return-solution pumps, handling solution from the first decanter following the agitators to a concrete tank above the stamp mill, from which it is drawn to

MOVING CONCRETE FORMS

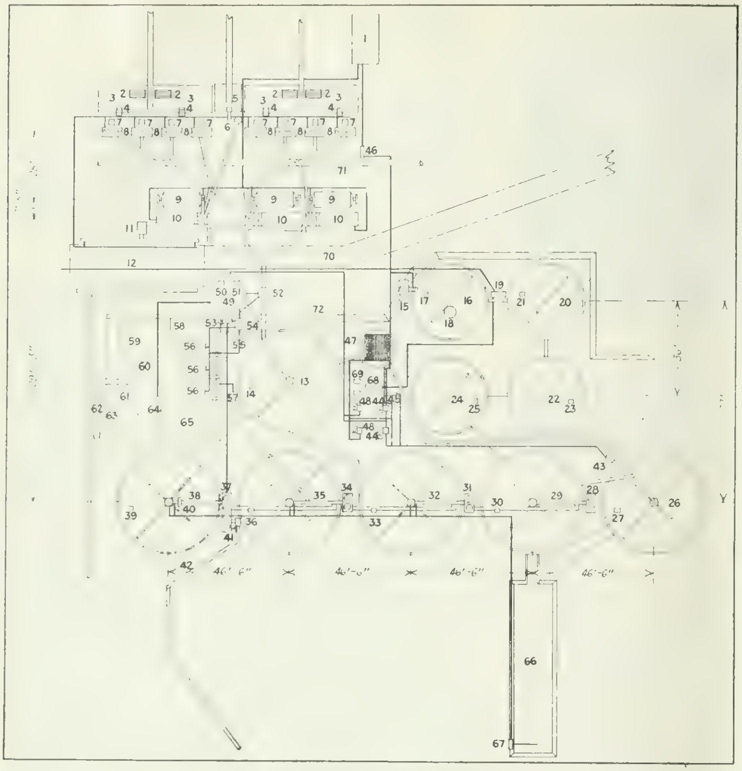


FIG. 2. SCALE PLAN OF THE MILL

1. Mill solution tank.
2. Four grizzlies.
3. Mill bins.
4. Four Blake crushers.
5. Accumulated slime bin.
6. Slime mixer.
7. Eight Challenge feeders.
8. Forty stamps.
9. Three tube mills.
10. Three Dorr classifiers.
11. One bucket elevator.
12. Accumulated sand bins.
13. Thickener No. 1.
14. Thickener No. 1 motor.
15. Thickener No. 1 pumps.
16. Agitator No. 1.
17. Agitator No. 1 motor.
18. Cyanide dissolving tank.
19. Air receiver.
20. Agitator No. 2.
21. Agitator No. 2 motor.
22. Agitator No. 3.
23. Agitator No. 3 motor.
24. Agitator No. 4.
25. Agitator No. 4 motor.
26. Thickener No. 2.
27. Thickener No. 2 motor.
28. Thickener No. 2 pumps.
29. Thickener No. 3.
30. Thickener No. 3 motor.
31. Thickener No. 3 pumps.
32. Thickener No. 4.
33. Thickener No. 4 motor.
34. Thickener No. 4 pumps.
35. Thickener No. 5.
36. Thickener No. 5 motor.
37. Thickener No. 5 pumps.
38. Thickener No. 6.
39. Thickener No. 6 motor.
40. Water meter.
41. Tailing sampler.
42. Tailing launder.
43. Stand pipe.
44. Challenge solution pumps and motors.
45. Centrifugal solution pump.
46. Centrifugal solution pump booster.
47. Clarifying tank.
48. Challenge vacuum pumps and motors.
49. Gold solution tank.
50. Gardner-Rix vacuum pump.
51. Motor.
52. Vacuum receiver.
53. Zinc feeder.
54. Emulsifying cone.
55. Triplex pump.
56. Three precipitating presses.
57. Solution meter.
58. Vault.
59. Drying furnace.
60. Briquet press.
61. Monarch-Rockwell furnace.
62. Dust flue.
63. Slag well.
64. Sump, refinery.
65. Office and laboratory.
66. Mill sump.
67. Air pump.
68. Air compressor.
69. Air compressor motor.
70. Portovelo power-canal.
71. 30-in. high-pressure water pipe.
72. 19-ft. retaining wall.

batteries, sand bins, slime bins, and elsewhere as required.

The original design provided two Gould Challenge pumps identical with the two used in clarifying, but after a few months of operation it was found that solution demand for sluicing sand and slime was so high as to require additional pumping capacity. Two 5-in. centrifugal pumps, which were on hand, were erected, one for driving by a 25-hp. motor drawing from the first decanter, and the other driven from the battery line shaft, taking the discharge from the first pump and lifting it to the tank above the mill.

13. One rectangular masonry sump catching all drainage from floors and tunnels, from which solution is pumped by a duplex Snow steam pump to thickeners 4, 5 or 6. Crushers, stamps, tube mills, classifiers, elevators and one of the return-solution centrifugal pumps were driven by the pelton wheels, which operate under an average static head of about 155 ft. Compressed air is used for the sump pump. On account of power troubles, and for additional capacity, it has also been found necessary for agitating. The rest of the plant is operated by motors on power from the hydro-electric plant. Interruptions to this power required the setting of a 55-kw. generator for driving from the compressor turbine shaft. The total cost of construction was 427,173 sucres ($1 = 2.05 sucres normally, but during the war averaged 2.40 to 2.50). Of this amount 70 per cent went for supplies and 30 per cent for labor. As the plant was built for a daily capacity of 280 tons, the construction cost per ton was 1,526 sucres.

OPERATION OF THE NEW PLANT

After the plant had been thoroughly tried out and was running smoothly it was calculated that it would be possible and advisable to treat about 300 tons of material per twenty-four hours. This was to be made up of 150 tons of mine ore, 60 tons of accumulated sand, and 90 tons of accumulated slime, including a little fine sand. This tonnage it has not been possible to attain to date for more than twenty-four hours' continuous run. The maximum tonnage put through the mill over a period of thirty days was 8,010. It was found that the sand was exceedingly hard to grind and the grinding capacity set a definite limit to the tonnage that could be treated, and inadequate transportation system cut down this tonnage somewhat further. The slime needs practically no grinding, and is limited only by the settling capacity of the plant, but at the end of the period covered by this report it became evident that seventy-five tons of this material was all that could be handled.

Fig. 2 gives a scale plan of the plant, which answers as a flow sheet.

With all crushers and stamps running, almost 200 tons of mine rock per twenty-four hours can be delivered to the classifiers. At times, however, due to various causes, it has been possible to drop only twenty-five stamps, and in such circumstances the crusher jaws have been closed down so as to relieve the work on the batteries. The crusher jaws are set normally at 1½ in. The grizzlies are spaced 2¼ in., and possibly these, when required, will be set closer together, thus throwing more work on the crushers and less on the stamps.

Stamping is carried on in a solution carrying approximately 0.7 lb. of NaCN per ton. At present a 4-mesh screen with 0.178-in. opening and 0.072-in. wire is used on the mortars. It is planned to try some 3-mesh screening in the near future. With the 4-mesh screen the stamp duty averages about 4.9 tons per day, but varies with the number of drops per minute, the weight in the stamp shoes and stems, and the care with which the height of drop and the discharge are regulated.

TABLE II. STEEL CONSUMPTION IN STAMPING

Tons Stamped	Total Consumed — Shoes, Lb.	Total Consumed — Dies, Lb.	Consumption per Ton of Ore — Shoes, Lb.	Consumption per Ton of Ore — Dies, Lb.
33,847	9,664	4,130	0.2855	0.1220

Adamantine chrome-steel dies and shoes are used. Table II gives consumption of steel in shoes and dies over a period of ten months. Worn shoes and dies are recast in the local foundry into tube-mill liners. Locally cast shoes and dies have been used in times of emergency, but their short life does not justify their adoption for routine operations.

CLASSIFIERS AND TUBE MILLS

From the batteries the pulp flows to the classifiers, as do the sand and slime sluiced from their respective bins. The specific gravity of the classifier overflow is maintained at approximately 1.1, or a solution ratio of 5.5 to 1. Of the classifier overflow, 80 per cent is minus 200 mesh. The classifiers work in closed circuit with the tube mills. The classifier oversize flows to the tube-mill scoop-box, and is picked up by a 30-in. scoop.

The feed to the tube mills is diluted with mill solution to a specific gravity of 1.58, equal to about 40 per cent moisture. In practice this moisture content of the mill feed varies as much as 5 per cent either way. About 135 lb. of cyanide is added to the tube-mill feed daily. The launders to the classifiers from batteries, slime mixer, and sand elevator are so arranged that any mill can be run on almost any combination of batteries. It has been found most satisfactory to divide the three products—i.e., battery crush, sand, and slime—equally among the three mills, although this division is only approximate, as no distributer is installed.

Various kinds of rocks have been used for tube-mill pebbles. At the beginning, large chunks of hard quartz were tried, but they did not grind satisfactorily, nor did broken pieces of an extremely hard siliceous rhyolite, nor scrap iron. Finally, river pebbles were adopted as the most satisfactory medium available at the time. These vary greatly in hardness, but it has been found impracticable to select only the best, and about the only specification insisted upon is that they be chiefly of a size which can be fed through the scoop. Consumption of these pebbles is exceedingly high, about 110 lb. per ton of ore ground. Their cost is about 5.07 sucres per ton, which, at the current rate of exchange of 2.16, corresponds to $0.129 per ton of ore ground. The price of these pebbles is rising, as they are being packed from greater distances. Lumps of run-of-mine ore, after rough sizing and cobbing, were tried for grinding, but it was found that the soft calcite wore so rapidly as to render their use impracticable.

Tests are under way for using the hard vein quartz, more carefully sized and cobbed, and also the hard rhyolite prepared similarly. In all probability one of these materials will be eventually adopted for grinding. Heavy freight charges make the use of Danish pebbles or iron balls impracticable.

Tube-mill shell liners, which are of hard white iron, have shown a life of approximately eight months. The river pebbles will not wedge in the liners, and consequently the iron has to take all the wear of the charge. By selecting the least-worn sections in a mill for relining, it is probable that the average life of a set of liners can be prolonged to one year. The end liners have shown a life of only about four months. It is planned to make these about twice as thick, so that their life will correspond more closely to that of the shells.

Performance in the grinding is shown in Table III. The percentage of moisture in the classifier drag was 22.12. Samples were taken from mill No. 2 when mine ore, sand, and slime were being fed to all three mills evenly divided, and the time for taking samples was four hours. When the last sample was taken a higher proportion of sand had been turned into mill No. 2, and the rakes of the corresponding classifier were heavily loaded.

TABLE III. SCREEN ANALYSIS

Mesh (Tyler Standard)		Sand Feed %	Sand Feed (Cum. %)	Slime Feed %	Slime Feed (Cum. %)	Battery Discharge %	Battery Discharge (Cum. %)	Classifier Drag %	Classifier Drag (Cum. %)	Tube-Mill Discharge %	Tube-Mill Discharge (Cum. %)
On	4							0.2	0.2		
On	6					2.9	2.9	1.5	1.7		
On	8					7.1	10.0	3.8	5.5		
On	10					6.9	16.9	4.3	9.8		
On	14					5.0	21.9	3.6	13.4		
On	20					7.4	29.3	5.5	18.9		
On	28					6.4	35.7	5.0	23.9		
On	35	3.8	3.8			6.0	41.7	6.6	30.5	0.4	0.4
On	48	23.6	27.4			6.6	48.3	12.7	43.2	0.6	1.0
On	65	24.2	51.6			6.8	55.1	11.5	54.7	2.0	3.0
On	100	23.8	75.4			8.2	63.3	18.9	73.6	10.2	13.2
	150	13.4	88.8			6.4	69.7	14.4	88.0	20.0	33.2
	200	3.6	92.4	2.2	2.2	2.3	72.0	3.6	91.0	6.4	39.6
Through	200	7.2	99.6	97.8	100.0	28.0	100.0	8.4	100.0	60.4	100.0

The drive of the tube mills has not proved altogether satisfactory. Flexible couplings were provided to relieve the herringbone gears from the effects of the float of the mill. Either the eccentricity of these or improper setting of the collars on the line shaft, or some other unknown cause, broke three of the concrete piers carrying the line-shaft bearing. The flexible couplings were discarded, and to date no bad effects on the herringbone gears have been observed. The clutches are also a source of trouble. When a mill is thrown out, the wooden clutch blocks are not entirely disengaged, and char rapidly unless a stream of water is played on them.

AGITATING

From the classifiers the overflow goes to the thickener, called No. 1. This thickener underflow is elevated to agitator No. 1 by Gould diaphragm pumps, where it is diluted with mill solution to a ratio of 1 to 1. In this agitator about 270 lb. of NaCN and [illegible] lb. of local lime are added daily. The local lime is quarried and burned near the property and [illegible] grade, about 35 per cent CaO. [illegible] through the four agitators, and the average time of agitation is approximately fifty [illegible]. As noted, for the present tonnage, which is higher than the design called for, it has been necessary to draw on the mine compressors for agitating air. This was secured by running a 1-in. air line from the high-pressure compressed-tir main leading to the mine.

AGITATOR TROUBLES DUE TO INTERMITTENT SUPPLY OF POWER

At the beginning of operations some mechanical difficulties were experienced with the agitators. The mechanism was designed originally for a 10-ft. tank, and later the depth of the tank was increased to 12 ft., requiring the addition of a 2-ft. section to the elevating column. The rakes are attached to this section, which is screwed to the bottom of the original 10-ft. section of the column. At the time of starting operations failures of power were rather common occurrences, and overloads resulted in the agitators. The rakes, bedded in the settled material, would stick, and the lower section of the column turned on the upper and wrapped around the top of the column the ropes by which the rakes are suspended. It was difficult to find a breaking pin of just the right strength to take care of these overloads. One of the bevel crown gears was broken in this way. After a continuous power supply was provided and the operators became more familiar with the machinery these difficulties disappeared, and the four agitators have been in continuous operation for ten months without repair. Since the time of this installation the Dorr Company advises that rakes are designed to be pinned to the column, which obviates trouble such as that noted.

DECANTING

The overflow from agitator No. 4 joins the overflow from the second decanter, called thickener No. 3, and flows to the first of the series of decanter tanks, called thickener No. 2. The overflow from No. 2 is pumped to the mill storage tank, as previously noted. Through the series of thickeners Nos. 2, 3, 4, 5, and 6 the work is straight counter-current decantation. The underflow from No. 6 is discarded to the river. The barren solution from the presses is added to No. 4. Adding it to No. 5 has the effect of lowering the dissolved gold loss but of increasing the mechanical loss of cyanide, and it has been found that by adding it to No. 4 the commercial efficiency at present prices is higher.

Serious mechanical troubles occurred with the thickener mechanism at the beginning of operations. Power interruptions caused overloads, but even while the power supply was steady, overloads kept developing suddenly in the whole series of thickeners. This is believed to have been caused by the fact that the trays were not set up to a perfect cone, but contained swells and depressions, and these caused accumulations of loose material, which would slip suddenly and bury the rakes. Several worm gears were broken in this way, and on one occasion the 2-hp. motor even wrenched the superstructure anchor bolts loose from the edge of the tank. A further cause of overloads was the fact that the spacer pipes between the spiders of the upper and lower rakes were not shipped with the mechanism, and their absence was not noted by the erectors. This allowed the upper-rake spider to slip on the stirring shaft, so that the rakes caught on the tray. These difficulties, which were not due to inherent faults in the design of the equipment, were finally overcome, and the mechanism has been running without accident for a number of months.

Table IV gives theoretical calculations for the mill flow sheet, assuming certain fixed conditions.

TABLE IV. THEORETICAL CALCULATIONS OF MILL FLOW SHEET

Tonnage:	
140 tons of mine rock at $7.86 per ton	$1,100.40
60 tons of accumulated sand at $4.91 per ton	294.60
100 tons of accumulated slime at $4.65	465.00
Total	$1,860.00
50 per cent dissolved in crushing	930.00
50 per cent dissolved in agitation	930.00

Barren solution precipitated to $0.02 enters thickener No. 4; 37.5 per cent moisture in all thickener discharge pulp.

50 tons of water enters the mill at the classifiers.

130 tons of water enters the mill at thickener No. 6.

Value of solution leaving decanters with a variable tonnage of solution precipitated:

Solution Precipitated	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
200	$8.6911	$7.18974	$3.55263	$1 56864	$1.2040	$0.69910
400	4.6034	3.28300	1.07984	.33163	.25454	.15000
600	3.103	2.0414	.5058	.1271	.097	.05634
800	2.338	1.4638	.295	.06841	.0525	.03048

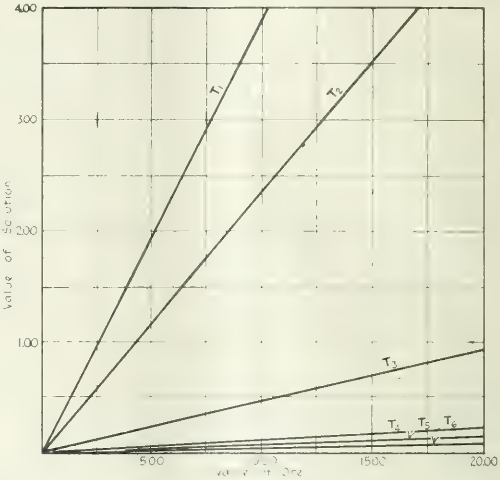


FIG. 3. VARIATIONS IN VALUE OF SOLUTION LEAVING THICKENERS

When the solution in the crushing department is kept at 0.7 lb. of cyanide, and that in the agitators at 1 lb., the cyanide strength of the solution overflow in the thickeners is as follows:

1. 0.7 lb.
2. 0.78358 lb.
3. 0.69464 lb.
4. 0.6727 lb.
5. 0.51632 lb.
6. 0.29980 lb.

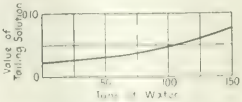


FIG. 4. EFFECT OF WATER ENTERING MILL AT CLASSIFIERS

Fig. 3 shows the variations in the value of the solution leaving the thickeners as the value of the ore and other materials varies. Fig. 4 shows the value of the tailing solution as the amount of water entering the mill at the classifier varies.

Table V shows actual performance of the decanting system over a number of months. Dissolved gold-silver loss is higher in practice than the theoretical, although the percentage of moisture in the thickener discharge is lower than that used in the calculation. This discrepancy is due to the dissolving action that takes place in the decanting. Mechanical loss of cyanide is also slightly higher than the theoretical figure. A value of $1 per oz. has been used in the silver calculations.

CLARIFYING

Overflow from the thickener, No. 1, flows to the clarifying tank. Here the two Challenge pumps take out about 750 tons of solution per day and deliver it to the gold tank. The rest of the solution overflowing the thickener is short-circuited back to the mill storage tank.

TABLE V. VALUES OF TAILINGS

Month	Moisture Content of Tailings	Soluble Loss per Ton Dry Tailings	Total Loss per Ton Dry Tailings Gold	Silver	Total	Consumption NaCN per Ton Ore Lb.
May	49.0	$0.26	$0 68	$1.10	$1.78	1.338
June	41.40	.13	.53	.88	1.41	1.81
July	42.33	.20	.66	.97	1.63	1.13
August	(a)	(a)	(a)	(a)	(a)	(a)
September	48.0	.20	.70	1.05	1.75	1.70
October	42.0	.33	1.27	.80	2.07	1.44
November	36.75	.12	.72	1.15	1.87	1.29
December	35.50	.07	.46	1.13	1.59	2.36
January	34.07	.07	.43	.98	1.41	2.80
February	33.59	.05	.52	1.01	1.53	1.26
March	34.55	.12	.57	.99	1.56	1.726
Maximum	49.0	.33	1.27	1.15	2.07	2.80
Minimum	33.59	.05	.43	.80	1.41	1.13

(a) Not operating.

The clarifying leaves, after a year's use, remain in good condition and should be available for another six months or more. No acid was used in cleaning them for a period of nine months, but two leaves were removed from the tank daily and were washed and scrubbed with a stiff brush. Solution from the gold tank after subjection to vacuum in the Crowe apparatus flows to the suction of the press pump. The zinc feeder discharges into the de-aërated solution in the press-pump suction line about 3 ft. from the pump. From this point to the presses the distance is between 40 and 45 ft.

The screw type of zinc feeder has not proved entirely satisfactory, because the zinc, although put into the hopper practically bone dry, absorbs moisture in the rainy season, forms a chimney, and thus gives an irregular feed, requiring constant attention as the humidity varies.

The Crowe equipment caused no trouble after it was once adjusted. The excellent results from this equipment in the saving of zinc are shown in Table VI. The consumption of zinc shavings in the old sand-leaching plant was 0.8 lb. per ton of sand leached. It is calculated that the vacuum equipment reduces the cost for merrillite by about $3,800 per year.

On the Merrill presses the filtering medium used is No. 10 duck covered with one layer of sheeting. The presses are cleaned up once a month, when the sheeting is removed and clean sheeting put on the frames. The sheeting is washed thoroughly and used four or five times before being burned. The duck lasts about six months. Operation of the presses has been entirely satisfactory, although preliminary test with one press on solution from the old sand leaching plant had proved unsatisfactory, because precipitate, probably carbonate, formed on the sheeting, and it was impossible to run a press for more than three or four days, even when no zinc dust was added. In the new plant this carbonate precipitation has been eliminated. It has been found that the gold solution must carry a minimum of 0.4-0.5 lb. of free cyanide per ton to secure satisfactory precipitation.

Table VII shows the extraction of the gold in the several stages of beneficiation, the total extraction of the silver, and the actual gold recovery based on product shipped and assay of the tailings. The silver extraction is extremely low. The ore is known to contain tetrahedrite, which is not easily amenable to cyanidation, and the silver is contained largely in this mineral. Furthermore, the accumulated sand had already been treated and the accumulated slime [illegible] had [illegible] easily recoverable gold and silver [illegible].

During the last of December, 1919, and all of January, 1920, a test was run on silver extraction with the cyan-

TABLE VI. PERFORMANCE OF VACUUM APPARATUS

Month		Vacuum	Merrillite per Ton Ore, Lb.	Consumption per Ton Solution Precipitated, Lb.	Per Ounce Doré, Lb	Gold Solution	Barren Solution
June,	1919	No	0.4405	0.1539	0.3412	$3.98	$0 24
Feb.,	1920	Yes	0.2150	0.0640	0.2640	1.87	.03
March,	1920(a)	Yes	0.263	0.0920	0.305	2.41	14
April,	1920(b)	Yes	0.206	0.0770	0 239	2.12	.01
May,	1920(a)	Yes	0.235	0.0890	0.248	2.12	01

(a) During March precipitating trouble developed due to low cyanide content of gold solution.

(b) Precipitate for May contained 21.71 per cent copper; 351.46 lb. precipitated during the month.

TABLE VII. EXTRACTION

Month	Gold Extraction In Crushing, per Cent	In Agitation, per Cent	In Decanting. per Cent	Total, per Cent	Consumption Cyanide per Ton of Ore. Lb.
November	46.47	46.59	..	93 06	1.29
December	55.04	37.15	3.40	95.59	2.36
January	56.69	32.51	5 88	95.07	2 80
February	27.84	56.29	8.83	92.96	1.26
March	23.86	65.48	4.26	93.60	1.73

	Silver Extraction	Gold Recovery
November	32.29	91.97
December	41 07	94 80
January	43.32	94 09
February	33 83	92 22
March	35.63	91 91
Maximum gold recovery, June, 1919		97.52

TABLE VIII. OPERATING COSTS

Costs are all given in sucres and are averages over a period of five months, December, 1919, to April, 1920, during which time the following tonnages were treated:

	Tons
Mine ore stamped	21,211
Accumulated sand and slag	8,027
Accumulated slime	8,521
Total	37,759
Total tons tube milled (ore, sand, slag and oversize slime)	29,459

Department	Supplies	Labor	Total	Cost per Ton of Tailings
Crushing and stamping	8,855.59	6,837.06	15,692 65	0 41560
Grinding and classifying	11,565.17	7,917 25	19,482 42	0.51597
Decanting and thickening	1,661 24	3,687 42	5,348 66	0 14165
Agitation	630 25	1,816 23	2,446 48	0 06479
Clarifying	479.07	1,969 09	2,448 16	0 06483
Precipitation	5,178.68	1,210 80	6,389 48	0 16922
[illegible] pumps	2,130.59	1,391.52	3,522 11	0 09328
Preparing precipitates for shipment		281 38	281 38	0 00745
[illegible] hardware, pipe and fittings, lumber, office and laboratory, [illegible] repairs, [illegible] machinery repairs, cement, paint, carbide and [illegible]	3,996 58	807 15	4,803 7[illegible]	0 1272[illegible]
Total departments	34,497 17	25,917 90	60,41[illegible]	[illegible]
Chemicals:				
Cyanide	63,799 74		63,799 74	1 [illegible]
Zinc	14,860 17		14,860 17	0 39355
Lead	854 54		854 54	0 02263
Total [illegible] sand and slime handling	114,011 62	25,917 90	139,929 52	3 705[illegible]
				Per ton of [illegible]
[illegible] accumulated sand	829 10	4,153 [illegible]	4,9[illegible]	[illegible]
				[illegible]
[illegible] accumulated slime	80 [illegible]	[illegible]	[illegible]	[illegible]
[illegible] total	114,9[illegible]	[illegible]	[illegible]	[illegible]

ide solution about 2½ times as strong as that used previously. This practice, however, at current prices of silver and cyanide, was found to be uneconomical.

Table VIII shows the operating cost over a period of five months, December, 1919, to April, 1920, inclusive, and Table IX shows the cost of handling the three products treated.

On account of the experiments performed with strong cyanide during December and January, the average consumption for the two months is high. The cyanide consumption should not have been more than 1.3 lb. per ton of tailings, which would give a total consumption of 52,387.4 lb. at a cost of 43,813.15 sucres. This reduces the cost for the chemical to 1.087 sucres per ton of tailings. This cost, also, is not correct, because the cyanide was bought in England, and the saving on exchange between the ruling ratio of pound to dollar of less than 4.00 and the normal of approximately 4.86 was not credited to the cyanide price but was taken into an exchange account. The same is true of the saving on sucre exchange for payments made inside of Ecuador.

TABLE IX. UNIT COSTS BY PRODUCTS

	Sucres
Treatment of Mine Ore:	
Crushing and stamping	0.73983
Grinding and classifying	0.66134
Decanting and thickening	0.14165
Agitation	0.06479
Clarifying	0.06484
Precipitation	0.16923
Return solution pumps	0.09327
Preparing precipitates for shipment	0.00746
Incidentals	0.12722
Chemicals (a)	1.50310
Total per ton	3.57273
Treatment of Accumulated Sand:	
Grinding and classifying	0.66134
Decanting and thickening	0.14165
Agitation	0.06479
Clarifying	0.06484
Precipitation	0.16923
Return solution pumps	0.09327
Preparing precipitates for shipment	0.00746
Incidentals	0.12722
Chemicals (a)	1.50310
Total	2.83290
Transportation	0.61825
Total	3.45115
Treatment of Accumulated Slime:	
Decanting and thickening	0.14165
Agitation	0.06479
Clarifying	0.06484
Precipitation	0.16923
Return solution pumps	0.09327
Preparing precipitates for shipment	0.00746
Incidentals	0.12722
Chemicals (a)	1.50310
Total	2.17156
Transportation	1.12053
Total	3.29209

(a) 1.3 lb. of cyanide per ton of ore

Experiments in the Use of Dolomite Refractories*

LARGE quantities of magnesite are used for furnace linings in the metallurgical industries. Until the war began, substantially all the magnesite used for the manufacture of refractories came from Austria and Greece. When Austria entered the war, the exportation of magnesite from that country was shut off, and soon afterward the exportation of the Grecian product stopped. The American refractory manufacturers were, therefore, compelled to draw upon the American magnesite deposits, which are said to be inferior to the foreign magnesite for refractory purposes. These deposits are situated in the states of Washington and California, whereas most of the metallurgical industries utilizing magnesite refractories, notably steel, are centered chiefly in states east of the Mississippi River. Owing to cheap labor in Austria and Greece, and water transportation, the foreign magnesite in normal times can be delivered to points east of the Mississippi River cheaper than the magnesite from the Pacific Coast. During the war, the selling price of magnesite brick quadrupled.

Dolomite, the double carbonate of lime and magnesia, is widely distributed throughout the United States and occurs in large masses. The State of Ohio contains thousands of acres of dolomite with very little or no overburden. Its principal use is for crushed rock in surfacing roads and in concrete work. It also finds a limited use in the manufacture of "dolomitic lime." Before dolomite can be successfully used as a refractory for furnace linings, it must be calcined at a high temperature to remove its shrinkage and to place it in a "stable" or "dead-burned" condition. The lime content is the troublesome ingredient; it may cause the calcined dolomite to "slake" or "disintegrate" when stored in the open air.

To prevent slaking of the calcined product, there must be added to the dolomite a suitable material which will combine with the lime and place it in a condition in which it will not disintegrate. The substance added to the dolomite to bring about a dead-burned condition is called a "dead-burning agent." It must be of such a nature that it will not lower the melting point of the dolomite to such an extent as to render the latter useless as a refractory, and the dead-burning agent must also be inexpensive. Several patents have been granted on methods of dead-burning dolomite for refractory purposes, and three or four firms have placed the product on the market under different trade names. It is sold in lump or granular form, and is mixed with slag and tar and tamped in the bottoms of furnaces. It is also used for temporary patches for furnace walls.

Magnesite brick will stand storage indefinitely without disintegration, but up to the present a firebrick made from dolomite which can be stored indefinitely without crumbling to powder has not been produced. The different patented processes of preparing dolomite for refractory purposes were investigated by the ceramic experiment station, and it was found that all such products would show signs of disintegration within one week to six months.

Other methods of dead-burning dolomite were devised and tried by the ceramic station. The briquets made from the different calcined dolomites are stored in the open air and observed every week. Two of the samples prepared from calcined dolomite have been under observation for more than a year. They still appear to be sound and show no signs of disintegration. Further tests on these promising dead-burned dolomites are to be made, and if it can be demonstrated that firebrick can be made from dolomite which will compare to magnesite firebrick and will stand storage indefinitely without crumbling, it will be the means of developing a new industry of far-reaching importance.

About 80 per cent of the firebrick is used in the iron and steel industries. Ohio ranks second to Pennsylvania in the production of iron and steel. The work of the ceramic station on the preparation of dolomite for refractory purposes has been done on Ohio dolomites. Ohio, with its thousands of acres of dolomite to furnish the raw material for firebrick, and its vast iron and steel industry to utilize them, would profit more than any other state by the work on refractories.

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*Bureau of Mines, *Reports of Investigations*

ENTRANCE TO SPIRO TUNNEL OF SILVER KING CONSOLIDATED MINING CO. NEAR PARK CITY, UTAH

Tunnel Driving in War and Peace

Comparative Costs of Labor and Supplies on Spiro Tunnel Project, Near Park City, Utah, During Five-Year Period 1916-1920 Show Effect of Changes in Economic Conditions Caused by the War

By Harry A. Lee
Written for *Engineering and Mining Journal*

THE WORLD WAR brought many evils in its train to metalliferous mining. Prior to the war, operating costs of mining and results attainable could be determined with a fair degree of accuracy. Following the year 1916 the constant increase in the costs for material and labor, shortage of skilled labor, and consequent necessity of employing inefficient help proved a combination that almost drove to distraction operators who were accustomed to gaining results in proportion to cash outlay.

To determine the effect of the changed economic conditions produced by the war, and to demonstrate the increased cost of material, the increased cost of labor and the inefficiency of labor, an enterprise operating prior to and after the beginning of the war must be selected. Of equal importance is the selection of an enterprise wherein the material and labor demands are constant factors throughout the operating period. The driving of a drainage and transportation tunnel is almost monotonous in its demands, and comes as near meeting the requirements as it is possible to find in mine development.

Progress of Work on the Spiro Tunnel

The Spiro tunnel of the Silver King Consolidated Mining Co., of Utah, is selected as a type of mine development meeting the necessary requirements for comparison. The tunnel is situated near Park City, Utah, and was named after Solon Spiro, the president of the company. Work was started during the summer of 1916, and has been continuously prosecuted since that time. The breast is now 14,400 ft. from the portal. The period of time comprised in this review is four years, extending from July 1, 1916, to July 1, 1920, and the length of bore considered is 12,944 ft.

TABLE I. LABOR COST

Year	[illegible]	[illegible]	[illegible]	[illegible]	—Increased Cost Due to—		
					[illegible]	[illegible]	[illegible]
1916	1,461	$3.857	$8.157	Base			
1917	3,539	4.294	16.031 (a)	96	11.30	[illegible]	[illegible]
1918	4,001	5.006	17.978 (a)	120	29.79	14.[illegible]	75.96
1919	2,622	5.403	21.947 (a)	169	40.[illegible]	[illegible]	[illegible]
1920	1,321	5.757	22.978	182	49.27	33.20	[illegible]
	12,944		$17.65				

(a) Average wage per shift paid [illegible]

The Spiro tunnel starts at the base of the mountain and is driven on a tangent, with a grade of 0.3 per cent. Starting in the limestones of the Thaynes formation, it passes into the Woodside shale, Park City limestones, and the Weber quartzite, in the order named. These formations have an average dip of [illegible] deg., and the bore cuts the beddings at an acute angle.

The hardness of the rock is of little moment in driving a tunnel. A shift's work in the heading consists of drilling and firing a round. In the 12,944 ft. no rock was encountered in which a round could not be completed in an eight-hour shift by competent machine-drill men. The material and labor demand for each round and each foot of progress was constant, the only exceptions being when in soft or swelling ground that required timbering close up to the breast following each blast before it was practicable or safe to start the next round and when the haul was longer.

The machine drills were operated under 100-lb. pressure. Each machine man had his own drill, and following each shift the drill was trucked out, cleaned, oiled, tested, and, if necessary, repaired. This method insured a machine that worked perfectly when placed on the bar and obviated the claim so commonly made that the man on the previous shift had left a "bum" drill. It also proved a big saving in drill repairs.

The average sizes of timber used were: Sills, 6 x 10; legs, 8 x 8; caps, 8 x 10; and lagging, 2-in. rough. These sizes were varied somewhat to suit heavy or swelling ground. The sets were placed 5 ft. from center to center on the average, and where timber sets were not required the sills were placed on grade at 5 ft. centers and hitched into the walls for the entire distance.

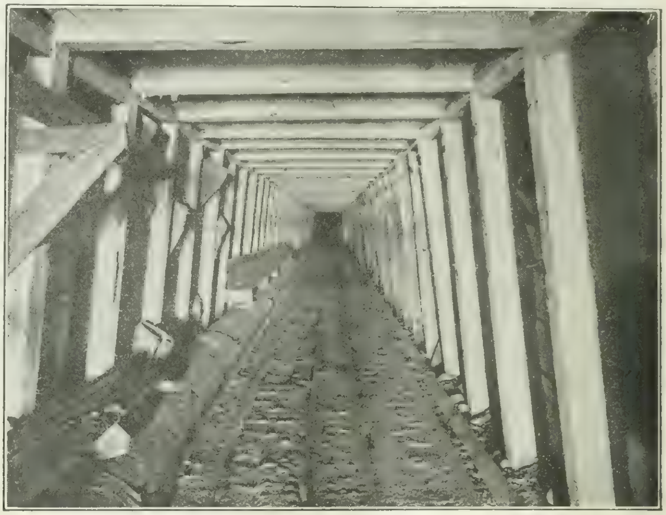
The surface plant is modern, with a well-equipped blacksmith shop, a machine shop, a carpenter shop, a change room, magazines, and adequate storage rooms.

DETAILS OF SPIRO TUNNEL FOR 12,944 FT.

Location, Park City, Utah.
Purpose, Development, drainage, transportation.
Character of rock penetrated, Limestone, shale, quartzite.
Size broken, 8 x 9 ft.; ditch on side, 3 x 4 ft.
Cross-section, 84 sq.ft.
Grade, 3 ft. rise in 1,000 ft.
Power, Purchased electric current.
Air pressure, 100 lb., generated by electrically driven compressor.
Air line, 4-in. O. D. casing.
Ventilator pipe, 18-in. steel, dipped.
Water line to drills, 1½-in. black pipe.
Drills, Pneumatic hammer.
Drill mounting, Horizontal bar.
Explosives, 50 per cent gelatine dynamite in cuts; 35 per cent in sides.
Number of holes per round, 16 to 24.
Average depth drilled, 5 to 8 ft.
Cars, 20 cu.ft., roller-bearing.
Type of haulage, Horse.
Track of switches, 30-lb. rail, 18-in. gage.

Costs of labor and material for the five-year period 1916 to 1920 are given by years in accompanying tables.

The tables presented do not take into consideration the initial cost and equipment of plant, depreciation, taxes, legal expense, fire insurance, office expense, or administration. The daily wage is the average of all employees, both underground and upon surface, including bonuses, averaged for the year from monthly and semimonthly payrolls. The figures illustrate plainly the effect of increased cost for material and labor and the inefficiency of labor; also that an increase in wages produced no improvement in results.



INTERIOR VIEW OF SPIRO TUNNEL, SHOWING CONSTRUCTION

By reason of the fact that a shift's work per man was practically fixed at the Spiro tunnel, and that the same wage could be had at other properties in the district, wherein a shift's work could not well be measured, it is possible that the inefficiency of labor at other properties may not have been so marked. Conditions have been improving, but normal routine is still to be achieved.

TABLE III. COMBINED LABOR AND MATERIAL COSTS

	Cost per Foot					Per Cent Increase Over 1916			
	1916	1917	1918	1919	1920	1917	1918	1919	1920
Labor...	$8.157	$16.032	$17.978	$21.947	$22.975	96.0	120.0	169.0	182.0
Material	7.912	10.384	12.09	15.089	17.08	31.2	52.8	90.7	128.5
Totals	$16.07	$26.42	$30.07	$37.03	$40.06	....	....	....	....
Averages						64.4	87.1	130.4	149.3

TABLE II. MATERIAL COSTS

[illegible]	Cost per Foot					Per Cent Increase Over 1916			
	1916	1917	1918	1919	1920	1917	1918	1919	1920
[illegible]	$2.547	$3.54	$4.504	$5.27	$5.537	38.83	75.50	106.70	116.90
[illegible]	.41	.517	.749	.73	.743	27.0	83.0	79.0	78.1
[illegible]	.332	.46	.63	.80	.806	38.6	89.8	141.6	142.8
[illegible]	.95	1.25	1.67	1.60	1.75	31.6	75.8	68.5	84.3
[illegible]	.58	.75	.79	1.19	1.50	29.4	36.3	105.2	158.7
[illegible]	1.71	1.74	2.14	2.589	2.20	1.8	25.2	51.2	28.7
Electric power	1.56	1.099	1.26	1.964	2.16	(a) 30.2	(a) 19.3	25.7	38.5
[illegible]	.245	.489	.308	.47	.75	104.2	29.2	96.0	212.5
[illegible]	.09	.244	.179	.26	.288	166.0	100.0	188.0	210.0
[illegible]	.158	.094	.133	.38	.363	(a) 43.7	(a) 18.7	137.0	125.0
Lubricants	.35	.038	.064	.135	.187	33.0	100.0	333.0	500.0
[illegible]	.117	.254	.46	.886	1.305	108.0	283.0	633.0	990.0
General repairs and plant maintenance	.07	.14	.236	.30	.379	92.0	223.0	311.0	419.0
Coal and coke	.025	.13	.131	.274	.38	550.0	550.0	1,350.0	1,900.0
[illegible]	$7.912	$10.384	$12.09	$15.089	$17.08	31.2	52.8	90.7	128.5

(a) [illegible]

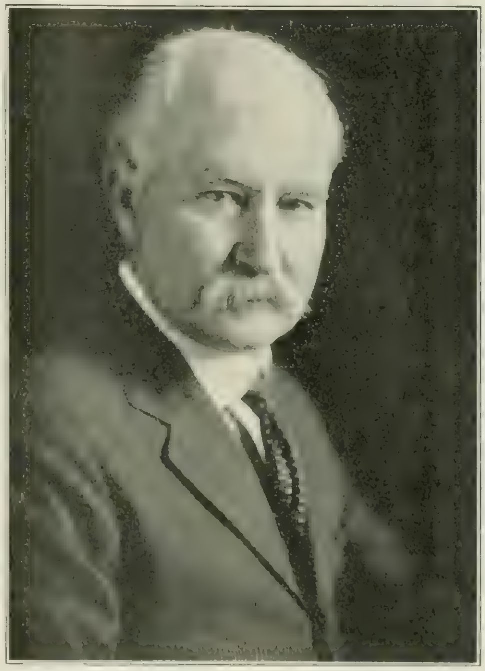
Hon. A. B. Fall

Secretary of the Interior

By Paul Wooton

Written for Engineering and Mining Journal

CABINET REPRESENTATION for the prospectors has been attained in the selection of Albert Bacon Fall as Secretary of the Interior. This department has jurisdiction over practically all work done by the Government in the interest of mining. The new Secretary has worked in and has operated metal mines, is an experienced prospector, and is closely abreast with the needs of the industry. He promises to leave undone nothing within his power to relieve the depression now gripping mining. Secretary Fall's first mining experience was in Mexico. From boyhood the rôle of prospector had appealed to him, so at the age of twenty-one, with such knowledge of mining as he could acquire from books, he ventured into Mexico. That was in 1882. He began at a mine near Nieves, Zacatecas, where for three years he worked as a mucker, as a timberman, and as foreman. He served his apprenticeship on the hoist and in the operation of pumps. He sorted ore, built roads, and sharpened drills. When the Mexican Central, in 1884, ran its first through train from Mexico City to El Paso, young Fall returned to the United States with enough practical experience, he believed, to undertake operation on his own account. During 1885, 1886, and 1887 he prospected through the back range of the Sierra, in Grant County, N. M. He located a number of properties and undertook the development of several. While in Mexico, he had acquired some prospects in that country, and these he developed with the aid of associates, together with his New Mexico activities. Finally, in 1907, he sold his holdings in Mexico. In discussing his mining experience Secretary Fall said that there are numerous monuments to bad fortune in the wake of his mining experience, but he admitted that there are a few monuments to good fortune as well.



HON. A. B. FALL

One of the prospect holes which Mr. Fall dug came near being his grave. He was doing a little double-hand hammer work in the bottom of a 25 ft. shaft while his partner was hoisting the used drills. One of these slipped through a hole in the rawhide bucket and landed on Mr. Fall's head. The resulting injury was a severe one, and even yet he carries a conspicuous scar as a reminder of this episode.

Twice during his experience in Mexico Mr. Fall barely escaped death. While exploring an old Spanish working bad air was encountered by two of his Mexican workmen. One managed to reach the surface, more dead than alive, but he was unable to bring out his companion. Thereupon Mr. Fall went into the hole himself, found his workman at the bottom of a winze, and managed to carry him up the chicken ladder and the crude roadway to the surface. His heroism was in vain, as it developed that he had brought a corpse out of the mine. The other narrow escape he had in Mexico resulted from the proclivity of chicken ladders to turn over. Incidentally, Secretary Fall does not think much of chicken ladders. Mr. Fall was born in Frankfort, Ky., Nov. 26, 1861. His father was William Fall, who was a member of the staff of Gen. Nathan B. Forrest, of the Confederate Army, during the Civil War. His mother was Miss Edmonia Taylor, of Kentucky. The then future Secretary of the Interior earned his first money as an operative in a cotton factory in Nashville, Tenn. Later he returned to Frankfort, where he taught school and read law under Judge William Lindsey. In 1879 he went to Indian Territory and later moved to Clarksville, Tex. On returning to New Mexico from Mexico Mr. Fall made his home in Las Cruces. He took an active interest in territorial politics and served as a member of the Constitutional Convention. He was sent to the state Legislature for several terms.

Prior to 1902 Mr. Fall was affiliated with the Democratic party. In 1892 he was appointed an associate justice of the Supreme Court of New Mexico by President Cleveland. In 1896 he was appointed by the Democratic Governor as Attorney General. In [illegible] he was elected to the state Senate as a [illegible] candidate. He was elected to the United States Senate as a Republican by the New Mexico Legislature March 27, 1912. He was re-elected for the term ending March 3, 1919, and again was re-elected for the term which will end on March 3, 1925.

Fan Equipment for Metal-Mine Fires

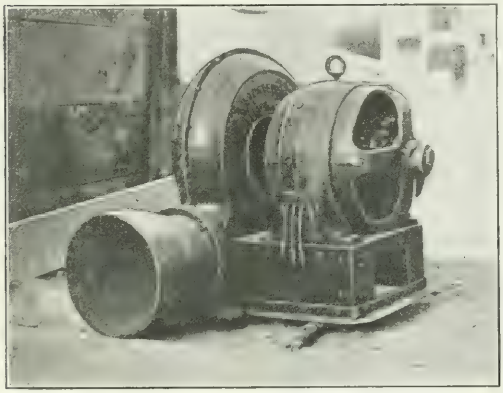
Uses of Portable Direct-Connected Blower and Disk-Fan Units Described Ventilation Fans Render Valuable Aid Where Already Installed—Function of Air in Fire Fighting Sometimes Misunderstood

BY T. H. ARNOLD

Written for *Engineering and Mining Journal*

FIRES UNDERGROUND must be handled in a different manner than that applicable to those on the surface. In fighting some underground fires water can be used, but in the larger mines this method is almost always impracticable for various reasons. The method most generally used is to isolate the fire and smother it in its own gases.

The first thing to be done is to get the men safely out of the working places, and their names checked to see that all are out, before changing any air currents. The chief danger, except in fighting a shaft fire, is that carbon monoxide gas will spread through the mine. A very small percentage of this gas will render the air deadly.



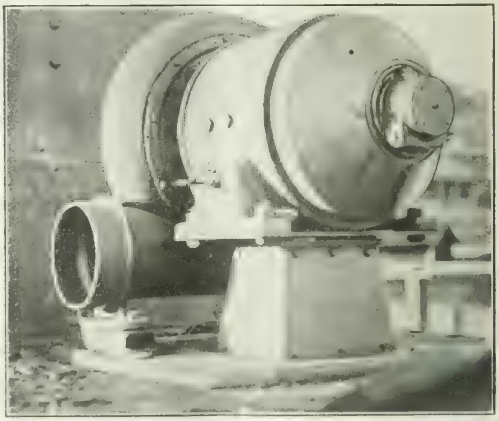
NO. 4 BLOWER UNIT PURCHASED COMPLETE

After the men are removed, the gases should be confined to the smallest possible area and the necessary bulkheads built to keep them there. This work must be done with the greatest dispatch. Prompt and efficient handling in the early stages of a fire will frequently limit the damage and save weeks or months of time in opening the parts of the mine affected. To accomplish these results the mechanical and electrical forces must co-operate with the mining forces by maintaining an adequate equipment of fans, blowers, and motors for handling the gases. Men should be trained to install these quickly.

IMPORTANCE OF BLOWERS AND FANS NOT ALWAYS FULLY REALIZED

The importance of helmets and a properly trained helmet crew is recognized by many of the larger mining companies, which have gone to considerable expense to maintain such crews. The necessity of providing fans and blowers does not appear to be so well realized. Fans for this use may be divided roughly into three classes, each of which fills a different requirement. The direct-connected unit is the best for rapid handling and installing. No time is consumed in lining up. A belt may run off or break at a time when the consequences may be counted in men's lives. Less room is required, and room may be at a premium. These factors become important during the disruption of normal operations due to a fire. It is entirely possible to have a fan of this class running within ten minutes after it has been brought into position.

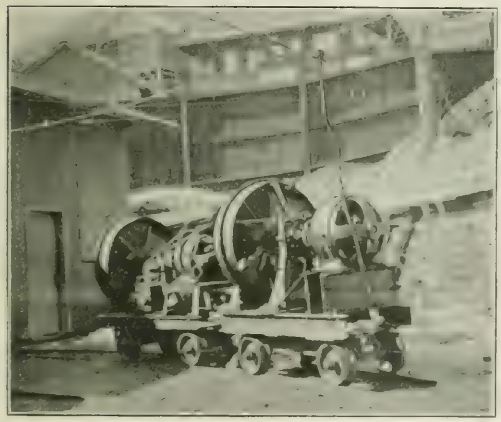
The No. 4 blower, direct-connected to a 2- or 3-hp. motor, forms a very compact and useful unit. These fans are commonly used for ventilating individual stopes, and may be standardized with the regular mine equipment. They should be reserved for special service and kept ready for use at all times. These units are small enough to be loaded intact on the average cage, and can be readily handled on push cars or slipped along the track. They can be operated without being bolted down, and either with or without a discharge pipe, as conditions warrant. Their chief use is in forcing back the gases to permit the building of bulkheads where the source of good air is not too far distant. The employment of timbermen for this purpose instead of the helmet crew will release the latter for other duties, and will result in much quicker work. These units may also be used for holding back the gases in a drift until the material and labor can be collected to build the bulkhead. They are used to blow between two bulkheads to prevent gases leaking around through broken ground. They are also used to clear small areas behind the bulkheads for exploration.



DIRECT-CONNECTED NO. 4 BLOWER UNIT MADE BY REMODELING BELTED BLOWER

The second type is the disk fan in sizes from 36-in. to 60-in. Smaller sizes are not of much use, and larger ones cannot be handled in the average mine. These should be provided with a 5- to 10-hp. motor of variable speed and should be capable of running at rather higher speeds than those usually recommended.

During a fire, if a little more air is needed, the tendency is to speed the fan up until the required amount is obtained. Disk fans of this type are used where a larger quantity of air is required. They may conveniently be mounted on a truck, but should be so designed that they may be readily taken apart if it is necessary to handle them through a shaft or raise. Where electric haulage is in use, they may be wired in such a manner that merely by placing a hook on the trolley wire they will be ready to start when in position. A canvas brattice should be provided around the fan, which can be extended to close off the drift completely; otherwise much of the air will be reflected back and cause eddies. This fan is used in forcing back the gases in long drifts or for changing air currents in larger sections of the mine. For this reason it is usually installed in one of the main haulageways.



TWO 36-IN. DISK-FAN UNITS AND TRUCKS CONSTRUCTED IN MINE SHOPS. NOTE HOOK ON TROLLEY WIRE FOR POWER CONNECTION

The third type is the mine-ventilation fan which is designed to furnish air for all or for a large part of the mine. These are not fire fans primarily, and, as their installation requires a considerable amount of time, they cannot in general be used unless they have been installed prior to the occurrence of the fire. Where they have been available their aid has been invaluable. The absolute control of the air to be obtained with a fan of this type will frequently allow work which would be impossible under any other conditions.

In one mine fire a fan of this type saved months of work and more than the entire cost of the installation. The fire occurred in a raise driven from a timbered drift in heavy ground. The fan was operated with restricted opening till the gases were held a short distance from the raise. The red-hot material falling down the raise was quenched as it fell by playing a stream of water on it from a hose. The material continued to fall till it had filled the drift and a considerable distance up the raise. When the caved material had been removed it was found that the timbers, although somewhat charred, were still strong enough to support the ground. In this instance the entire work of sealing off the fire was done without the use of helmets, although the place was about 900 ft. from the shaft supplying fresh air.

The exact function of the air as used in attacking a mine fire does not appear to be clearly understood, and the objection is raised that the fans only tend to feed the fire. This may occur unless the air is properly handled, especially in the early stages while the bulkheads are being constructed. However, an effort should be made to use only such air as is necessary to produce the desired results. A fan in a drift or raise may be regulated to neutralize or even to slightly reverse the draft without forcing an appreciable amount of air through the drift.

Where a fire occurs in a confined space, large quantities of gases are given off. These gases must find an outlet and will build up pressure if necessary till they overcome the natural draft and air currents. In this manner they may work back through the mine or they may work their way through crevices and broken ground and appear on the surface or in some other section of the mine. The general purpose of the fans is to build up local pressure and hold back the gases at certain points.

Though the current of air may eddy and mix with the gases near the fan, where the velocity is high, a short distance away the action is more in the nature of a piston, and a sharp line of demarkation exists, with little intermixing. This is quite visible where smoke or dust is present. It is thus entirely possible to force the gases back several hundred feet and maintain them within the working distance of a fire without appreciably feeding the fire with fresh oxygen.

To do this, adequate equipment is necessary to control the air pressure accurately. The factors which account for the air delivered by the fan are the counter pressure of the gases, the air friction in the drift, and the air dissipated by leakage. As a matter of fact, the fan is adjusted to furnish only the number of cubic feet of air which will leak back at the pressure necessary to maintain the gases at a certain point. This is a matter of proper equipment and careful manipulation, and should not be attempted unless both are available. When work of this character is going on, at least two helmet men should be in attendance to give warning in case of any change in air currents or other occurrence which might endanger the men at work. They should not be called upon to do anything which might distract their attention from these duties. They would also act as a rescue crew if unforeseen contingencies arise.

Work of this character must usually be rushed, and has its element of danger. For this reason the men of the electrical and mechanical forces selected should be as carefully picked as those of the helmet crews. In fact, training along much the same lines should be given, to make them realize the importance of giving the correct amount of air when required.

Sand-Sucker Mining

Operating under license from the Ontario Department of Mines, sand-suckers working on the bars and shoals in the beds of the Great Lakes and rivers in 1920 recovered 1,456,417 cu.yd. of sand and gravel, valued at $830,634, according to Bulletin 41 of the department. Output of sand and gravel in Ontario increased nearly 100 per cent in 1920 over that of 1919. Revenue to the province from the source noted approximated $100,000 for 1920.

The use of the sand-sucker in mining operations suggests interesting possibilities of recovery from submerged beaches or ledges that are thought or known to be mineralized.

American Clay in Graphite Crucibles*

Bureau of Mines Finds the Domestic Bond Material Suitable for Crucible Use and Equal to Imported Product

PRIOR to 1914 practically all graphite crucibles manufactured in the United States were made from Ceylon graphite bonded with German Klingenberg clay. It was the general belief among graphite crucible manufacturers and users that good crucibles could not be made from American bond clays and graphites. Graphite crucibles were essential for melting certain alloys and special steels urgently needed for the manufacture of war materials. The demand for such metals was so great that it created an unprecedented demand for graphite crucibles.

After the Great War began no Klingenberg clay could be shipped out of Germany. However, it was fortunate for the crucible makers that they had large stocks of Klingenberg clay on hand. When the stock of Klingenberg clay became exhausted it was necessary for the crucible makers to turn their attention to American clays. There were no data or other information available to guide the crucible makers in the selection of good bond clays for their crucibles. It was necessary for them to select their clays by "guess," which resulted in the period of service or life of graphite crucibles being shortened 15 to as much as 60 per cent.

The ceramic station at Columbus, Ohio, undertook the investigation of American bond clays and graphites to determine their crucible-making properties as compared with foreign raw materials, and to furnish both crucible makers and users with much-needed information. Careful laboratory tests were made on a large number of clays. As a result of these tests the clays were "sifted down" to twenty which appeared to be promising. Eighteen of these clays were domestic, one was an English clay, and one the German Klingenberg clay.

After the laboratory tests were completed, the next step was to apply the results obtained in the laboratory to actual factory practice. Fifteen large-size crucibles were made of each of the twenty clays, using a standard graphite. That the tests might be comparable to actual practice, the crucibles were made in the regular manner at the plant of the Vesuvius Crucible Co., Swissvale, Pa. Ten of the crucibles of each clay were tested under the regular foundry practice for melting brass at the plant of the Detroit Lubricator Co., Detroit, Mich., and five were tested under steel-melting practice at the foundry of the Simonds Manufacturing Co., Lockport, N. Y. Three representatives of the ceramic experiment station were present during the tests and kept accurate records of the performances of the crucibles. The results of the tests on the brass-melting crucibles showed that two American clays tested higher than the German Klingenberg clay and eight tested higher than the English clay. Tests on the steel-melting crucibles showed thirteen domestic clays giving crucibles of higher service than the Klingenberg clay and five testing higher than the English clay.

At present 120 crucibles are being made to test the crucible-making properties of the foreign and domestic graphites. Graphite samples are to be tested from the following localities: Ceylon, Madagascar, Canada, New York, Alabama, Texas, and Montana. The work on the bond clays is finished and the tests on the graphites will be completed soon. The crucible makers of the United States have been quick to profit by these experiments. In so far as has been determined, no German Klingenberg clay is used in America at present, and it is gratifying to note that some crucible makers advertise that the superior qualities of their crucibles are due to the use of the best American bond clays.

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*Bureau of Mines *Reports of Investigations.*

Potash Production 57 Per Cent Greater In 1920

Returns thus far received by the U. S. Geological Survey from the producers of potash in the United States during 1920 indicate that the output amounted to 167,346 short tons of crude potash salts, containing 48,625 short tons of actual potash (K_2O). The stocks on hand amounted to about 30,000 short tons of crude salts. The sales were valued at more than $7,000,000. This material was produced at 65 plants. In 1919 there were in operation 77 plants, which reported an output of 110,243 short tons of crude salts, containing 30,845 tons of actual potash. In 1918, 128 plants were in operation and made the largest domestic production—207,686 tons of crude salts, containing 54,803 tons of potash.

The table reproduced herewith shows that the bulk of the output in 1920 was obtained from salines, and, as in former years, the Nebraska lakes afforded the largest percentage. The company that made the largest output, however, did not operate on the Nebraska lakes.

POTASH PRODUCED IN THE UNITED STATES IN 1920

Source	Number of Plants	Crude Material (Short Tons)	Actual Potash (K_2O) (Short Tons)	Percentage of Total
Salines:				
Nebraska	11	85,245	20,934	43 0
Elsewhere	.6	46,865	17,207	35.4
Totals	17	132,110	38,141	78.4
Cement dusts	7	10,056	1,141	2.4
Blast-furnace dusts	9	1,503	152	.3
Waste from molasses distilleries	4	9.420	3,253	6.7
Waste water from sugar refineries that use the Steffens process	7	9,201	3,394	7 0
Wood ashes	16	294	200	.4
Alunite, silicate rock, kelp, and miscellaneous	5	4,762	2,344	4.8
Totals	65	167,346	48,625	100.0

About 200,000 short tons of potash was imported in 1920, and this quantity, with the 48,625 short tons produced in this country, made the available supply about equal to the quantity normally used in each of the five years immediately preceding the war.

Because of the low price received for their produce many of the farmers of the country were unable to take up promissory notes given by them for fertilizer in the spring of 1920 and were also unable to buy the fertilizer they required in the fall. This condition, coupled with the abundance of potash on the market, resulted in a cancellation by the fertilizer-manufacturing companies of orders for domestic potash and greatly reduced the prices of all potash fertilizer materials. As a consequence, all the Nebraska plants were closed by the end of December. Most of the other fifty-four plants reported almost continuous operation during the year.

Another hardship suffered by the Nebraska producers was the unprecedented rainfall early in the summer, which diluted the brines in the lakes so much as to make their concentration more difficult and more expensive. There is still considerable apprehension as to whether the domestic potash industry will be able to maintain its existence in the face of the renewed importation of potash salts.

THE PETROLEUM INDUSTRY

RICHMOND PETROLEUM REFINERY OF STANDARD OIL CO. OF CALIFORNIA

Petroleum in California

Unfavorable Position in August, 1920, Improved by Increased Production at End of 1920 and Beginning of 1921—Activity in Oil Prospecting in Northern Part of the State

Written for *Engineering and Mining Journal*

PRODUCTION of crude petroleum in California comes principally from eleven fields and from an acreage somewhat less than 100,000. The estimated acreage, number of wells, and wells per acre are given in Table I. For comparison, the number of wells being drilled, number of producing wells, and daily production from the various oil fields for December, 1920, are indicated. Production is principally in the hands of large companies, such as the Standard Oil of California, Southern Pacific Land Co. and associated and allied companies, Union Oil Co., Shell Co. of California, General Petroleum Co., American Oilfields and allied companies, Santa Fe R.R. and allied companies, Pan-American Petroleum, Commonwealth and allied companies, Honolulu Consolidated Oil Co., and Ventura Consolidated Oilfields. There are also many minor producers.

In a report by a special committee of the San Francisco Chamber of Commerce[1] attention was called to the fact that increased yield came from four of the eleven principal fields, the others showing declining production in 1919 as compared with 1916. Increases in the four fields (Coalinga, Santa Maria-Lompoc, Newhall-Ventura and Whittier-Fullerton) amounted to 18,261,064 bbl., and decreases in the remaining fields were 8,861,642 bbl. The difference, 9,399,422 bbl., represents the 1919 gain in production over 1916. The principal gain was in the Whittier-Fullerton field, 13,987,011 bbl.,

TABLE I. ACREAGE, NUMBER OF WELLS, DECEMBER, 1920, AND 1920 PRODUCTION, CALIFORNIA OIL FIELDS

Field	June 30, 1920 (a)			December, 1920 (c)			1920
	Acres	Wells	Acres per Well	Drilling	Wells Producing	Production per Day, Bbl.	[illegible]
Coalinga	13,924	1,253	11.1	30	1,293	[illegible]	[illegible]
Kern River	7,034	2,042	3.4	46	2,152	[illegible]	[illegible]
McKittrick	1,580	317	4.98	6	357	[illegible]	[illegible]
Midway-Sunset	[illegible]	[illegible]	[illegible]	93	[illegible]	[illegible]	[illegible]
Belridge-Lost Hills	4,344	579	7.6	16	[illegible]	[illegible]	[illegible]
Salt Lake-Los Angeles	1,014	266	3.8	9	[illegible]	[illegible]	[illegible]
Whittier-Fullerton	5,594	913	6.1	204	990	81,254	28,694,163
Ventura-Newhall	2,174	[illegible]	4.8	46	[illegible]	[illegible]	[illegible]
Santa Maria-Lompoc	[illegible]	[illegible]	[illegible]	17	[illegible]	[illegible]	[illegible]
Sargent	80	9	8.9				
Miscellaneous				40	[illegible]	[illegible]	[illegible]
Totals	[illegible]	[illegible]	[illegible]	507	[illegible]	[illegible]	[illegible]

(a) Summary of operations, California oil fields, October, 1920, California State Mining Bureau.
(b) [illegible] January, 1921.
(c) According to the [illegible] January, 1921, there were [illegible] producing wells [illegible] production [illegible] 1920 [illegible]
The Independent Oil Producers' Agency [illegible] 1920 [illegible] 8,642 given in the table is the number for [illegible]

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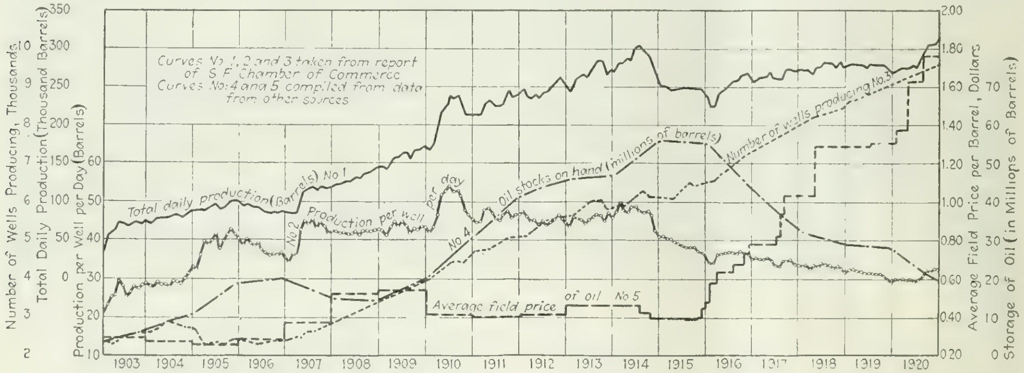
[1] A part of the information in this article was taken from that report [illegible]

and the most notable decline was in the Midway field, 5,742,751 bbl. The Whittier-Fullerton field, with a production of 28,657,683 bbl. in 1919, took the leading position, supplanting the Midway field, which held the first rank from 1911 to 1918, inclusive. In 1920, however, the Whittier-Fullerton field produced 28,694,163 bbl.

The average daily rate of California production was substantially uniform during 1918, 1919, and the first eight months of 1920. The daily production for August, September, October, November and December, 1920, was respectively 290,000, 304,000, 305,102, 312,082, and 324,933 bbl. These figures show a substantial gain in production. A graphic representation, showing total daily production, production per well per day, average field price, number of producing wells, and oil stocks on hand for the period 1903 to 1920, inclusive, is given in the figure.



CURVES SHOWING CALIFORNIA OIL PRODUCTION

The increase in the number of wells shows that a constant augmentation is required to maintain production. The capital investment per unit of production is thus increasing. As compared with prewar conditions, the cost of an oil well has more than doubled. The aggregate increase of capital outlay incident to the last two factors is relatively large as compared with 1913 conditions.

Although the production figures for the latter part of 1920 and the beginning of 1921 are encouraging, it by no means follows that the ascending curve of daily production will persist for more than a relatively short time. No one can predict with accuracy either the expansion or the contraction in California crude-oil production. At present, development activity is on the increase. According to the March 5, 1921, report of R. E. Collom, State Oil and Gas Supervisor, twenty-six new wells were started during the week terminating with the foregoing date, and the total of new wells for 1921 to that date was 247, compared with 169 to the corresponding date in 1920.

There is marked activity in wildcatting, both in new localities and on the fringes of established districts. The state is being literally combed for oil. The activity has spread to the northern part of the state, and ordering of equipment for actual drilling has taken place in Tehama, Colusa, Yolo, Lake, Humboldt, and Solano counties. The net result of these activities may be expected to maintain production somewhere near the current figures, if not to increase it, but in the final analysis such activity is hastening the day when there will be no more new territory to drill.

Field stocks of crude oil in California, according to the report noted before, declined from 57,000,000 bbl., Jan. 1, 1916, to 23,400,000 bbl. on Aug. 31, 1920, a decline of 59 per cent in somewhat less than five years. Since Jan. 1, 1919, field stocks declined 9,608,000 bbl., or nearly 30 per cent. For the twelve months ended Aug. 31, 1920, field stocks declined from 33,700,000 bbl. to 23,400,000 bbl. According to the *Standard Oil Bulletin* crude-oil stocks were 22,240,271 bbl. on Dec. 31, 1920, showing a further decline. Since then, however, the rate of decline has decreased, and recently, for the first time in a long period, it is probable that that has been a gain in field stocks.

Compared with Jan. 1, 1919, refinery stocks for Jan. 1, 1920, show an increase (7,079,000 bbl. to 7,558,000 bbl.). These increases are not of especial significance as compared with the decline of field stocks.

According to the report already quoted, the excess consumption over production during January-August, 1920, was at the rate of 26,500 bbl. per day, or 9,700,000 bbl. per year. Recent increased production has improved this condition, and the spread between consumption and production has diminished.

CALIFORNIA FUEL OIL

For the first six months of 1920 the approximate daily consumption of California fuel oil[2] for the principal consuming agencies was as follows:

TABLE II. CALIFORNIA DAILY CONSUMPTION OF FUEL OIL
JANUARY-JUNE, 1920

	Barrels	Per Cent of Total
Railroads	87,400	37.4
Shipping Board	12,300	5.2
Other merchant shipping	23,000	9.8
U. S. Navy	7,500	3.1
Public utilities	30,000	11.8
Cement, lime, etc	5,600	2.4
Sugar refineries and plantations	4,800	2.1
Shipbuilding, foundries, etc	4,600	2.0
Miscellaneous Government uses	4,000	1.7
Total	179,200	75.5

During the first six months of 1920, consumption of fuel oil was at the rate of 234,000 bbl. per day. The yield of fuel oil from crude for the same period was at the rate of 212,000 bbl. per day, or a draft upon crude-oil stocks of 28,500 bbl. per day, or 10,400,000 bbl. per year. This draft on crude-oil stocks was maintained in fairly regular month-to-month depletions throughout the period of Sept. 1, 1919, to Sept. 1, 1920, and cannot therefore be considered spasmodic or seasonal. The total consumption of crude oil in the six months from January to June, inclusive, was at the rate of 303,000 bbl. per day, of which 234,000 bbl. was for fuel purposes, 45,000 bbl. for refinery products, and 24,000 bbl. was consumed in the industry.

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[2] San Francisco Chamber of Commerce Report.

There is a well-marked tendency in the oil-refining industry generally toward a greater production of refined products. Whereas formerly the proportion of these products obtainable in refining was almost entirely dependent on the gravity of the oil run, the development of the "cracking process" has changed this situation. In the refining of California crudes, the heavy character of the oils and the nature of the base are such as to increase the proportion of fuel oil. Fuel oil is also extensively used in California, and for a long time was the important market outlet for crude oil. Since 1918, however, the production of kerosene in California has doubled, and approximately 6,000 bbl. per day which formerly remained in the residuum or was sold as engine distillate is now distilled as kerosene.

The "cracking process" will cause an additional drain upon the fuel-oil supplies. Just how much this will be is not accurately known, but it is roughly estimated that it will reach 22,000 bbl. per day by the end of 1921. Assuming that the rates of production and consumption continue as they were during the year ended Aug. 31, 1920, the sum of the actual and potential drafts is at the rate of 50,000 bbl. per day. Adding the potential draft for "cracking purposes" to the total consumption of 303,000 bbl. per day estimated for the period of January-June, 1920, gives 323,000 bbl. per day as a rough approximation of the consumption by the end of 1921. This assumes no increase in consumption other than that provided for "cracking."

The production for December, 1920, as given in Table I, was 324,933 bbl. per day. These figures show how close to the wind the industry is going. Even if the immediate favorable condition persists, it is evident that, with the general growth of the state, consumption of crude oil will increase, and it is evident that unless active development of new areas and the extension of old ones continue at a proportionate rate, existing field stocks of crude will be further depleted.

Investment, Expense, and Profit in Commercial Shale-Oil Production

A general outline of the principal items of investment, expense and profit in shale-oil production has been prepared by L. H. Sharp and A. T. Strunk, and is published by the U. S. Bureau of Mines in *Reports of Investigations*. This outline is intended to cover the main items of equipment for large-scale operations.

The only sources of revenue considered are those products that are in general demand and that are not likely to be lowered excessively in price even by extensive production. They are products which experience in the established shale-oil industry of Scotland has shown may yield a profit.

The known general sources of income are crude oil; gasoline; kerosene; gas oils; lubricants;[1] wax; ammonium sulphate, possibly; and shale gas[2]—and producer gas from spent shale, when ammonium sulphate is made. The total income from these sources must be sufficient to cover the cost of production, marketing, and general expenses, and yield a profit on the capital invested.

It is assumed that the company owns its shale land, does its own mining, and operates its own retorts, refinery, and wax and ammonium sulphate plants. All manufacturing operations are carried on at the same place as the shale is mined, the products being sold to distributors and shipped in the company's own tank cars or other containers.

The three principal items under capital invested or first costs are: land, buildings, machinery, and equipment.

Land: This includes cost of land, legal expense, surveying, sampling and preliminary assays, water-supply system, and roads and sewers.

Buildings: The principal mine buildings required are a fanhouse, hoisting engine house, locomotive shed, machine shop, tool house, and storage bins. Retorting buildings will include housing for crusher, housing for retort and condensers, and housing for ammonium sulphate plant. In addition to mining and retorting buildings, there will be required several miscellaneous refinery buildings, a warehouse, laboratory, garage, office, and camp for labor.

Machinery and Equipment: Mining machinery needed will include hoists, hoisting engines, fans, locomotives and cars, pumps and pipe lines, drills, conveyors, and rails. Retorting machinery covers such items as conveyors, crushers, retorts and condensers, scrubbers, pumps and pipe lines, gas producer (if desired), storage tanks, ammonia fixation plant, and producer-gas plant. The principal items required under refining machinery are stills (primary and re-run), condensers, heat exchangers, agitators, filters, compounding machinery, wax plant, candle factory (if desired), chemical recovery plant, cooling towers or spraying pond, pumps and pipe lines, oil storage tanks, and fire-protection system. For the power plant there will be needed boilers, engines, dynamos, measuring and recording instruments, motors, pumps, and compressors. In addition to the foregoing, there will be required laboratory equipment, garage equipment, warehouse equipment, loading and delivery equipment, office equipment, and camp equipment.

Operating Costs: The cost of producing shale-oil products would be the sum of the costs of each process, as mining, crushing, retorting, fixing ammonium sulphate, and refining. The cost of each process would consist of the following main items: Labor; supplies; supervisional salaries of foremen, superintendents, and other executives; clerical salaries connected with the works; fixed plant charges, as taxes, insurance, interest and depreciation; variable plant charges, as power, water, camp, and other incidentals. In addition there would be added to mining costs, (1) depletion or exhaustion of the property per ton of shale mined, and (2) development or opening up new territory, the total cost of which would probably be a deferred expense, to be amortized against the mined shale.

Selling and General Expenses: The main items of selling expense would be: Salaries and commissions, advertising, traveling expense, office supplies and expense, shipping department expense, repairs and maintenance of delivery equipment, and depreciation of delivery equipment. The main items of general or administrative expense would be: Salaries of general officers, general office expenses, and deferred charges, usually consisting of organization expense.

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[1] [illegible] experience and investigation [illegible] Bureau of Mines [illegible] that it may not be possible [illegible] only from shale.

[2] [illegible]

Book Reviews

Field Methods in Petroleum Geology. By G. H. Cox, C. L. Dake, and G. A. Muilenburg. Flexible cloth; 5¼ x 7½; pp. 305; illus. McGraw-Hill Book Co. Inc., New York. Price, $4.

This book has been prepared for the purpose of providing a handbook for petroleum geologists similar to those prepared for field work in other branches of engineering. Chapter I describes the instruments commonly used in field work; Chapter II outlines the instrument methods in general use; Chapter III discusses the various geologic standards that are used in correlating beds and identifying structures, and Chapter IV is devoted to the personnel of the field party, to the actual field procedure in reconnaissance and detailing, and to the preparation of the map and final report. A glossary and useful tables are also included.

Copper Refining. By Lawrence Addicks. Cloth; 6 x 9; pp. 211. McGraw-Hill Book Co., New York. Price, $3.

When copper first was electrolytically refined on a commercial scale, about forty years ago, metallurgical processes were not given the publicity which they today receive. Most plant managers considered themselves the custodians of a great secret, about which nothing should be said for fear a competitior would learn something to his advantage. In those days, we suspect, editors of technical publications must have been particularly *persona non grata*, for, of course, they would describe everything they saw, tell everything they knew, and suspect things which they shouldn't. Gradually, however, this custom has become obsolete, in this country at least (we understand the old idea dies hard in England). It began to be embarrassing to certain officials to find out how far ahead their competitors had progressed, and that their secrets had not only been fathomed, but considerably improved upon. Then came the realization that if any one wanted to find out just what was going on in Mr. Clam's plant, all that was necessary to do was to carry on a little elementary detective work. Also, the individual benefit resulting from a promotion of the general welfare of an industry came to be understood. Now, technically interested visitors to metallurgical works are usually welcome, and they generally leave more than they take.

Unfortunately, as copper refining was developed in the Age of Metallurgical Mysticism, no authoritative work on the subject was written, and nowadays the process seems too old to warrant extended description; technical writers find that such subjects as the electrolytic deposition of zinc are of more contemporaneous interest. Several articles have appeared on this new phase of zinc metallurgy, and a book has also been published on the subject, which we hope to review next week. Copper refining, however, deserves some attention, and we welcome a volume written by an engineer of Mr. Addicks' discernment and experience. The text does not pretend to cover the subject completely; rather is it a discussion of certain phases of copper refining which came within the personal experience of the author. This is shown by the chapter headings: Metal Losses; Metal in Process; Tank Resistance; Current Density; Current Efficiency; Impurities; Byproducts; Furnace Refining; The Requirements of Refined Copper; Copper From Secondary Material; The Power Problem; Elements of Design; and Application to Other Fields.

The separate chapters were published during 1916 and 1917 by *Chemical & Metallurgical Engineering*. Their assembly in the present volume makes them more convenient and available for reference. The book will be valuable to any one interested in electrometallurgy. E. H. R.

Powdered Coal as a Fuel. Second edition, revised and enlarged. By C. F. Herington. Cloth; 6 x 9; pp. 338, 124 illustrations. D. Van Nostrand Co., New York. Price, $4.50.

The first edition of Mr. Herington's book, written in 1917, was so successful, and the progress of pulverized-coal firing practice since then has been so rapid, that three years later it was found advisable to prepare this second edition. The subjects treated include cost comparisons of plants using powdered coal, oil and gas; coals suitable for powdering; the preparation, feeding, and burning of powdered coal; powdered coal in the cement industry, as fuel for reverberatory and other metallurgical furnaces, and for boilers and locomotives; explosions; and suggestions on how to operate a pulverized-coal plant. Tabular matter and a bibliography of twenty pages are appended.

The use of powdered coal under boilers forms the topic of an interesting chapter. Many plants which use pulverized coal in some furnaces retain the older method of firing for their steam boilers, and Mr. Herington's remarks as to how powdered-coal firing may be adapted to existing boiler installations should receive attention. The chapter on powdered-coal firing of reverberatory furnaces is a little out of date now, and, also, there is no mention of the Garred-Cavers process of using this fuel for copper and lead blast furnaces.

Mr. Herington is Chicago district manager of the Bonnot Company, manufacturers of the Holbeck pulverized-coal system, but it is only fair to say that this apparatus is not given undue prominence. The book will be particularly valuable to those who do not use pulverized coal at present, but who are considering the adoption of that fuel. It should not be considered as a treatise on the more efficient operation of present plants. E. H. R.

Technical Papers

Zinc Smelting Losses—Dr. Otto Mühlhaeuser, smelter superintendent with Georg von Giesche's Heirs, Risdzin, Upper Silesia, has recently collected eighteen papers, written in German, dealing with the sources of loss in zinc smelting, which he contributed to *Metall und Erz*, Halle a. Saale, between 1918 and 1921. The last one, "The Sources of Metal Loss in Zinc Smelting," sums up, tabulates, and concludes the work published in detail during the preceding years. The range of subjects the author has recently discussed in *Metall und Erz*, is shown by the following list of titles: "American Practice in Combining Zinc Ores for Roasting"; Vol. XV, pp. 123-124; 1918, Hft. 15. "The Zinc Content of the Muffle Residue and Its Significance in the Durability of the Muffle"; Vol. XV, pp. 259-265; 1918, Hft. 16. "Zinc Slags"; Vol. XV, pp. 303-305; 1918, Hft. 17. "The Glaze Formed in Zinc Muffles" [when fired with ferruginous coal]; Vol. XV, pp. 393-395; 1918, Hft. 21. "Gases Escaping From Zinc Muffles During the Reduction of Blende"; Vol. XV, pp. 431-436; 1918, Hft. 23. "A Simple Manometer"; Vol. XVI, p. 101-102; 1919, Hft. 5. "The Seger-Aron Differential Manometer"; Vol. XVI, pp. 147-150; 1919, Hft. 7. "The Permeability of Zinc Muffles"; Vol. XVI, pp. 191-195 and 219-223; 1919, Hft. 9 and 10. "Devices for Determining the Volumes of the Gases Escaping From Zinc Muffles"; Vol. XVI, pp. 273-279; 1919, Hft. 12. "Effect of Pressure on the Permeability of a Zinc Muffle"; Vol. XVI, pp. 323-326; 1919, Hft. 14. "The Influence of the Pressure Prevailing Within a Zinc Muffle on the Yield of Metal"; Vol. XVI, pp. 363-373; 1919, Hft. 16. "The Pressure Prevailing Within a Zinc Muffle"; Vol. XVI, pp. 538-544; 1919, Hft. 22. "The Combustion Chamber of the Hegeler Zinc Oven"; Vol. XVII, pp. 1-4; 1920, Hft. 1. "The Determination of the Thermal Conditions of Zinc Ovens"; Vol. XVII, pp. 137-150; 1920, Hft. 6. "The Thermal Analysis of the Charge of a Zinc Muffle During Reduction"; Vol. XVII, pp. 209-212; 1920, Hft. 9. "Determination of the Volumes of Gases Escaping From a Zinc Muffle During Reduction"; Vol. XVII, pp. 415-420; 1920, Hft. 19. "An Experimental Oven for Making Zinc, and the Quantitative Determination of the Resulting Principal, Intermediate and Waste Products"; Vol. XVII, pp. 487-494; 1920, Hft. 22. "The Sources of Metal Loss in Zinc Smelting"; Vol. XVIII, pp. 1-22 and 46-51; Hft. 1 and 2.

Anaconda—"The Anode," published monthly by the Bureau of Safety of the Anaconda Copper Mining Co., Butte, Mont., is running a series of articles describing the company's operations. Weighing, sampling, and concentrating zinc ores is the subject discussed in the March issue.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Taxation Meeting of Mining and Metallurgical Society

R. C. Allen and Others Discuss Problems —Special Committee Appointed To Study Conditions

The New York Section of the Mining and Metallurgical Society of America held a dinner and an animated discussion at the Columbia University Club, on Thursday evening, March 24. Dinner at 6:30 was followed by informal talks and discussion till past 11. The subject of the evening was Mining Taxation. The president of the society, J. E. Spurr, at the request of the chairman of the section, J. A. Church, Jr., opened the discussion by announcing the formation of the society's committee on taxation, consisting of Ralph Arnold, chairman; R. C. Allen, L. C. Graton, B. Britton Gottsberger, H. M. Chance, and H. B. Fernald. The first speaker was Dr. R. C. Allen, recently vice-president of the Lake Superior Iron Ore Association. He explained the broad underlying principles of taxation, pointing out that the problem of the method and rate of mine taxation could be properly evaluated only in connection with the problem of taxation of farms and factories. Dr. Allen was of the opinion that the problems of local and state taxation were of as much importance as Federal taxation and sometimes relatively more important. He called attention to the trend in many states toward practically confiscatory taxation of mines, and pleaded for a broad inquiry into the underlying social theories and their remedy.

Prof. Robert M. Haig, of Columbia University, touched on the principles of taxation, and warned of the tendency which existed toward withdrawing the special consideration of mines existing under the present practice. He outlined the danger that the principle of depletion might be abandoned, in accordance with the English practice.

H. B. Fernald went to the root of the matter by pointing out the total amount of taxes which had to be raised somehow, under our present scale of expenditure. It means that on the average a man has to work two months of the year for taxes, and has only the remainder to support himself and increase the wealth of the country. Mr. Fernald said that under a budget system, carefully adhered to, it was possible to keep down public expenses without serious detriment, and he concluded that the main element of the taxation problem was governmental business management.

The discussion was participated in at length by B. F. Tillson, R. M. Catlin, T. M. Chance, H. M. Chance, L. C. Graton and others. Messrs. Chance and Graton stressed the necessity, to which Mr. Allen had alluded, of the committee forming itself into a vigilance committee to be on the watch for any loss of the taxation privileges which had been granted mines, and to which mines were rightfully entitled—especially the right of charging a depletion deduction and taking into consideration new discoveries subsequent to March 1, 1913. Mr. Graton maintained that although the right to modify valuation as a consequence of new discoveries was an essential one, it was impossible of execution under the present methods, and he proposed that a system of flat "discovery" allowances should be adopted. This would make unnecessary the evidently impracticable effort to prove by maps and figures each discovery.

Colorado Scientific Society Elects Officers

The Colorado Scientific Society has elected the following officers to serve during the year 1921: President, W. F. R. Mills; first vice-president, William A. Johnson; second vice-president, J. Claire Evans; treasurer, Charles W. Henderson; secretary, Robert W. Gordon. The following have been elected members of the executive committee: Hugh B. Lowden and Thomas L. Wilkinson, whose terms expire Jan. 1, 1924; and L. G. Carpenter, whose term expires Jan. 1, 1922. The annual dinner of the society was held at the University Club, Denver, Col., on March 26, 1921.

Institute of Metals Forms a London Section

A London local section of the Institute of Metals has just been formed, with the sanction and financial assistance of the council. The chairman is Dr. O. F. Hudson, of the Admiralty Engineering Laboratory, and D. Hanson, M.Sc., of the National Physical Laboratory, Teddington, is honorary secretary. Membership is open to persons resident within fifty miles of the London General Post Office. No subscription is required of members of the Institute of Metals, but non-members of the parent body, when elected as associate members of the local section, pay an annual subscription of five shillings.

The first paper to be brought before the London Section was read on Feb. 24, by O. W. Ellis, M.Sc., on "60: 40 Brass." On March 31, S. L. Archbutt read a paper on "Aluminium Alloys," and on April 21 Dr. W. R. Ormandy will speak on "Refractories." The London Section already has a membership of over 200, and is proving a valuable meeting ground for metallurgists and engineers who wish to discuss technical problems at more frequent intervals than is practicable in the case of the parent institute.

Saint-Etienne School of Mines To Celebrate Founding Centennial

The national mining school of Saint-Etienne was established by a royal order of Aug. 2, 1816, shortly before the reorganization of the Ecole Supérieure des Mines at Paris. These two schools were intended to replace those of Geislautern and Pesey, which the treaties of 1814 and 1815 removed beyond French boundaries.

The famous school at Saint-Etienne has trained four-fifths of the directing personnel of the mining industry of France, but as its centenary fell in the midst of the Great War an appropriate celebration of the event was postponed. It has now been decided to hold an elaborate official celebration on May 9 and 10. According to *L'Echo des Mines et de la Métallurgie* the arrangements are chiefly in the hands of the Société Amicale d'anciens Elèves and of the school's council. A delegation of engineers, accompanied by the prefect and the senators of the Department of the Loire as well as by the mayor of Saint-Etienne, recently went to Paris to invite the president of the republic and the government to be represented at the festivities.

Jesse Knight Mourned by Utah Chapter of A. M. C.—Officers Elected at Annual Meeting

The Utah Chapter of the American Mining Congress held its annual election of officers on the afternoon of Tuesday, March 14. Arrangements were made to have the chapter represented at the funeral of Jesse Knight, a charter and life member, which took place March 16 at Provo, and a resolution bearing upon the great loss which his death had caused to Utah's mining industry was adopted.

Eight of the twenty-four directors, whose terms had expired, were re-elected as follows: C. E. Allen, Ernest Bamberger, Fred Cowans, R. C. Gemmell, G. W. Lambourne, D. MacVichie, E. J. Raddatz, and V. S. Rood. L. S. Cates and M. R. Evans were elected as directors to fill vacancies. Officers for the coming year are: G. W. Lambourne, president Judge Mining Co., governor; Walter Fitch, president Chief Consolidated Mining Co., first vice-governor; C. E. Allen, general manager U. S. Smelting Co., second vice-governor; J. William Knight, Knight Investment Co., third vice-governor; A. G. M[illegible], secretary and treasurer. The [illegible] committee was named as follows: L. S. Cates, Fred Cowans, Imer Pett, V. S. Rood, and G. W. [illegible] was elected chairman.

MEN YOU SHOULD KNOW ABOUT

D. E. Sutherland, of Ironwood, Mich., has returned from a month's vacation in Florida.

P. J. Shambeau has been elected president of the Sonoma Magnesite Co. of California.

C. W. Purington, mining engineer, formerly of Vladivostok, Siberia, has returned to England.

Walter E. Segsworth, mining engineer, of Toronto, Ont., was in New York City last week.

E. P. J. Burgess, mining engineer, of Butte, Mont., is in New York City on professional business.

E. C. Homersham has left England and will represent Minerals Separation, Ltd., in South Africa.

K. K. Kimball, of the U. S. Geological Survey, is doing co-operative work on Tennessee marbles.

Frederick R. Weekes, mining engineer, has returned to New York City from a professional trip to California.

C. Erb Wuensch, mining engineer, who is developing the Eagle mine at Bonanza, Col., is in New York City on professional business.

L. C. Butler, of New York, is examining mining property in the Lordsburg and Pinos Altos districts of New Mexico.

Henry W. Gould and **John Mocine**, mining and petroleum geologists, have opened offices in the Kohl Building, San Francisco, Cal.

David White, chief geologist of the U. S. Geological Survey, is delivering a series of lectures on fossil fuels at the University of Wisconsin.

William McInnis, of Ottawa, formerly directing geologist of the Geological Survey of Canada, is now director of the museum at Ottawa, Ont.

Frank Estes, mining engineer, is in New York City, and will leave for Salvador, in the near future, to reopen the property of El Salvador Silver Mining Co.

George Hanson has been transferred to the staff of the provincial offices of the Canadian Geological Survey branch. His address is 510 Pacific Building, Victoria, B. C.

P. S. Couldrey, who has been in charge of the Le Roi No. 2 at Rossland, B. C., for the last two years, has gone to Spain to accept a position with an operating company there.

Major-General R. G. E. Leckie, of Vancouver, B. C., has been appointed mining engineer to the British Columbia commission to investigate matters in connection with the price charged for coal in Vancouver.

A. H. Heller, metallurgical engineer, is now associated with **David E. Day** and **Rolland B. Day** in the Day Co., petroleum and oil shale geologists and engineers. The firm has offices in the Hobart Building, San Francisco, Cal., and at 715 19th St., N. W., Washington, D. C.

Viscount Tadashiro Inouye, a prominent Japanese engineer and an advisory director of the South Manchurian Railroad, visited the Mesabi iron range last week for the purpose of studying the methods of mining, as similar conditions exist in Japan relative to coal and iron deposits.

R. C. Allen, of the special committees on the taxation of mines established by the National Tax Association and the American Institute of Mining and Metallurgical Engineers, has just been appointed a member of the committee on taxation of the Mining and Metallurgical Society of America. Mr. Allen was the first speaker on the program at the "Taxation Meeting" of the society in New York City on March 24.

R. C. ALLEN

F. G. Clapp, petroleum geologist, who has been lecturing before the geological department of Harvard University, addressed the geological conference in Cambridge, Mass., on March 15. His subject was "A Geologist's Trip Through China," and he illustrated the talk with lantern views taken by himself.

Philip Henry Argall, manager of the Ozark Smelting & Mining Co., Magdalena, N. M., was one of the members of the recently dissolved firm of Philip Argall & Sons. The other members will conduct a general mining business individually, **George Oates Argall** at Leadville, Col., and **Philip Argall** at Denver, Col.

Among mining engineers recently visiting New York City were: **S. H. Zimmerman**, of Murfreesboro, Ark.; **Glenville A. Collins**, consulting engineer, of Vancouver, B. C.; **M. G. Yatsevitch**, of 23 Drayton Gardens, London; **Philip Silverstein**, metallurgist, of Detroit, Mich.; **Benjamin F. Tillson**, of Franklin, N. J. **Kirby Thomas** and **A. E. Hepburn** recently returned from professional trips.

H. F. Bain, director, and **Dorsey A. Lyon**, supervisor of stations, U. S. Bureau of Mines, will leave Washington on April 10, to visit and inspect a number of the Bureau's experiment stations. While on this trip Director Bain will address the graduating classes at the Michigan College of Mines and at the Missouri School of Mines. At Houghton, Mich., the address will be delivered on April 14, and April 29 is the date set for the Rolla, Mo., address. The Bureau's stations and offices at Minneapolis, Minn., Bartlesville, Okla., St. Louis, Mo., and Birmingham, Ala., are included in the itinerary.

SOCIETY MEETINGS ANNOUNCED

The Mining Society of Nova Scotia will hold its twenty-ninth annual meeting at Halifax, N. S., on April 5 and 6.

The American Association of Engineers will hold its seventh annual convention at Buffalo, N. Y., on May 9 to 11, inclusive. National headquarters, 63 Adams St., Chicago, Ill., is the office of Secretary C. E. Drayer.

The Institution of Mining and Metallurgy will hold its **Annual Dinner** on April 13, in the "Edward VII" Room of Hotel Victoria, Northumberland Ave., London, W. C. 2. The secretary is C. McDermid, 1 Finsbury Circus, E. C. 2. The annual meeting of the Institution will be held on April 21.

The American Chemical Society will hold its spring meeting with the Rochester, N. Y., section in that city on April 26 to 29, inclusive. Rates of one and one-half fares have been granted by all roads except those of the New England and Transcontinental Association. Hotel Rochester, at West Main St. and Plymouth Ave., will be headquarters. The final program will be mailed about April 20, to those requesting it, by C. L. Parsons, secretary, 1709 G St., N. W., Washington, D. C.

The New York Section of the American Institute of Mining and Metallurgical Engineers will meet jointly with the petroleum and gas committee, on April 6, at the Machinery Club, 50 Church St., at 8 p.m. After an informal dinner the meeting will discuss "Petroleum Legislation and International Regulations." Among those expected to speak are Van. H. Manning, director of the American Petroleum Institute; L. H. Woolsey, of Lansing & Woolsey, ex-solicitor of the U. S. Department of State; and J. A. L. Henderson, operator, of London. E. L. Gruver, 25 Broad St. ('phone Broad 6768) is treasurer.

THE MINING NEWS

LEADING EVENTS

Union Sulphur Sues Texas Gulf For Illegal Removal of Ore

Asks $6,678,000 Damages — Action Promises To Be Unique Owing To Process Used

On March 21 the Union Sulphur Co., a corporation of New Jersey, filed suit in the United States District Court against the Texas Gulf Sulphur Co. for $6,678,000, alleging its land in Matagorda County, Texas, has been damaged to this extent by removal of sulphur from it by the defendant. As the sulphur is melted in the ground by hot water approximately 1,000 ft. below the surface and then pumped out through drill holes the attempt to prove that sulphur was removed from underneath the ground of the plaintiff by operations on the ground of the defendant bids fair to be unique in the annals of mining litigation.

Freeport Sulphur Co. Suspends Operations Indefinitely

It was announced on March 24 by C. A. Jones, general manager of the Freeport Sulphur Co., that the plant would be shut down and all operations in the sulphur field suspended on April 1. The shutdown is to be complete, and will last for an indefinite period. The company has two or three hundred thousand tons of sulphur on hand, and can continue to fill orders for some time. It curtailed production to one-third of its total capacity in February. Work on plans for the proposed asphalt plant is being continued.

Engineering Council of Utah Organized

Object To Bring Together Members of Profession Within State

An affiliation of engineering societies in Utah, to be called the Engineering Council of Utah, has been formed to bring together members of the engineering profession throughout the state. It is the purpose of the council to afford the united consideration of matters of common concern to engineers, as well as of matters of public welfare embodying the application of engineering principles, the advancement of engineering practice, and to bring about the correlation of the local activities of the several engineering societies. The council is made up of two representatives from each of the engineering societies functioning in the state. The council,. as appointed, consists of Messrs. Plumb, Ashworth, Burt, Brown, Merrill, Adkinson, Zalinski, Berger, Ulrich and Fisher; Hylom T. Plumb is temporary chairman.

WEEKLY RÉSUMÉ

Two events of similar character marked the developments of the Eilers-Guggenheim controversy in the last week. A second stockholders' committee, headed by Henry Evans, of the Continental Insurance Co., announced its intention of conducting an impartial investigation. A proposal made to A. S. & R. officials by Guggenheim Brothers for a similar investigation, and suggesting the selection of Ex-President Taft to conduct the inquiry, was made, and Mr. Taft, when asked, consented to serve. In Arizona the decision in the Tom Reed-United Eastern apex case was handed down in favor of United Eastern on March 28. In Texas the Union Sulphur Co. has brought suit against the Texas Gulf Sulphur Co., claiming $6,678,000 damages for alleged illegal removal of ore. The Freeport Sulphur Co. shut down on April 1. "Borax" Smith, once dominant in the Pacific Coast Borax Co.'s affairs, has purchased a promising deposit of colemanite discovered near Las Vegas, Nev., in January, an event that may possibly split the control of the borax market. Curtailment by copper companies continues: the Burro Mountain Branch of the Phelps Dodge Corporation has shut down; likewise the Old Dominion, at Globe, Ariz. Magma Copper Co. has also suspended. Anaconda and the Jackling group of porphyries have suspended operations completely. In the Coeur d'Alenes the Hercules and the Tamarack & Custer (lead) mines have shut down, and the Northport smelter and Pennsylvania refinery are expected to follow. In Mexico the Torreon smelter in Coahuila is expected to close following the recent suspension of operations at the Asarco plant in Durango

United Eastern Wins

A decision in favor of the United Eastern Mining Co., of Oatman, Ariz., defendant in the Apex suit brought against it by the Tom Reed Gold Mines Co., was handed down on March 28 by Judge Bollinger in the Mohave County Supreme Court.

More Copper Companies Announce Suspension

Announcement was made on March 29 that the Anaconda, Utah, Ray Consolidated, Chino, and Nevada Consolidated copper companies would shut down completely at once for indefinite periods. The Phelps Dodge Corporation suspended all work at its Burro Mountain Branch at Tyrone, N. M., on April 1 and the Old Dominion Copper & Smelting Co., at Globe, Ariz., largely controlled by Phelps Dodge, is also stopping all production.

Taft To Investigate A. S. & R. Co. At Guggenheims' Request

Invited by Present Board, Which Has Pledged Co-operation of Incoming Directors—New Committee To Make Inquiry

Upon invitation by the American Smelting & Refining Co., Ex-President William H. Taft has consented to act as arbitrator to consider all charges made by Karl Eilers against the Guggenheim management, it being Mr. Taft's understanding that the board of directors elected at the meeting on April 6 will invite him to act in this capacity. Mr. Taft's letter, dated March 26, follows:

"I have yours of March 25, in which you inclose a draft of a circular which has been printed announcing that you have invited me to make the investigation requested in the letter of the Guggenheim Brothers. If I understand the proposal, it is that the board of directors, elected at the next election, shall invite me to act in the capacity of an impartial investigator or arbitrator, to consider all the charges made by Mr. Eilers as former vice-president of the company, as to the transactions of the company. I assume you intend that Mr. Eilers shall be given full opportunity to present such evidence of the transaction as he may choose, and that those whom you represent will have equal opportunity, and that my conclusion shall be a judicial one. With that understanding, and with the further understanding that I may have sufficient time, after my present engagements, to do this work, I shall be willing to accept the task and render a decision upon the issues thus made, as a judge.

"(Signed) William H. Taft."

Edgar L. Newhouse, chairman of the board of directors of the A. S. & R., has advised Mr. Taft that all of his conditions are agreeable to the company, and that Mr. Taft should understand that the invitation to him is extended by formal act of the present board of directors, which, in addition, pledges the co-operation of the incoming board.

NEW COMMITTEE TO INVESTIGATE

The efforts of Karl Eilers to oust the Guggenheims from the control of the affairs of the American Smelting & Refining Co. have been followed by the formation of a second stockholders' committee, headed by Henry Evans, chairman of the Continental Insurance Co. This committee, it is said, is not affiliated with either the management of the A. S. & R. company [illegible] and will conduct an impartial investigation to ascertain the financial position of the company. A statement issued by the Evans committee for publication on March 25 makes this announcement:

"A committee representing the stockholders of the American Smelting & Refining Co. has been organized for the investigation of the affairs of the company, with special reference to the charges of mismanagement which have recently been made by a former vice-president and director of the company. The committee is entirely impartial and is in no way affiliated either with the management or those who are attacking the management.

"The committee is composed of the following: Henry Evans, chairman of the board of the Continental Insurance Co.; Clarence H. Kelsey, president Title Guarantee & Trust Co.; Henry K. Pomroy, of Denny, Pomroy & Co.; Willis D. Wood, of Ladd & Wood; Henry Whiton, president, Union Sulphur Co.

"Title Guarantee & Trust Co. is the depositary for the committee. It is proposed to take immediate and aggressive action, and public announcement of the committee's purposes will be made soon."

Park Sues R. V. Dey Over Grand Reef Claims

Suit for $1,250,000 was begun in the Supreme Court in New York on March 23 by Thomas Park, a mining engineer and operator, against Richard V. Dey of San Francisco. The plaintiff alleges that in February, 1917, he entered into an agreement to purchase from the defendant his rights in twelve mining claims known as the Grand Reef mines in Graham County, Ariz., for $750,000. Dey, he alleges, was to receive 10 per cent royalty on the product of the mines and was to advance $25,000 upon the plaintiff exercising the right of purchase set forth in the agreement, the money to be used to develop the properties.

The plaintiff sets forth that on March 15, 1917, he notified the defendant of his desire to exercise the rights conveyed to him in the contract. The defendant, however, so he alleges, failed and still refuses to do his part, and on March 18, 1920, sold his rights to the Aravapai Leasing Co.

Temiskaming Prospectors Association Holds Banquet

The Temiskaming Prospectors Association has been formed at Haileybury, Ont., with Dr. W. L. Goodwin as honorary president; J. Hill, of the Haileybury School of Mining, president, and T. M. Train, secretary. The association held its first annual banquet at Haileybury on March 20, which was attended by about 100 prospectors and others identified with the mining industries of Northern Ontario. Dr. Goodwin was the guest of honor and gave an account of his work during the winter in holding prospectors' classes at the principal mining centers. Other speakers were M. B. Grover and Fraser D. Reid, two of the pioneers of the Cobalt camp, D. Johns and L. Howey. Indications point to a considerable increase in the number of prospectors at work this summer.

Promising Colemanite Deposit Found in Nevada

"Borax" Smith, Once Dominant Figure in Pacific Coast Borax Co., Buys Property From Discoverers

San Francisco Correspondence

F. M. Smith, familiarly known as "Borax" Smith, once the dominating figure in the affairs of the Pacific Coast Borax Co., now seventy-two years old, on receiving a "hunch" that a promising deposit of colemanite had been discovered, caught the first train to Las Vegas, Nev., and by automobile reached the discovery. The find was made by F. M. Lovell and George D. Hartman on Jan. 23, 1921. Both had been prospecting the Muddy Mountains, Clark County, Nevada, and on inspection of the discovery decided that they had secured a valuable deposit of colemanite. F. M. Smith, on completing his examination, made an offer for the property and arranged an initial deposit of $50,000 to bind the bargain. A rough contract on a sheet torn from Smith's notebook closed the deal by which the West End Chemical Co. secured the ownership of what promises to split the borax market into two dominating factors, the West End Chemical Co. and the Pacific Coast Borax Co. The American Trona Co., at Searles, also produces borax from its potash plants.

The new colemanite deposit is 18½ miles from the Salt Lake railroad, 46½ miles by automobile from Las Vegas, Nev., and 7 miles from the Colorado River. The Muddy Mountains in which the discovery was made are in an area about which little, until recently, has been known. Shipments will be made from Dyke, Clark County, Nevada, pending the building of a spur line to the property.

Half a dozen intending purchasers were outplayed by F. M. Smith. The West End Chemical Co., of which F. M. Smith is the president, is at present operating a potash and borax plant at Searles Lake.

The two prospectors were both grubstaked, one by a woman in Salt Lake and the other by Peter Buol, of Las Vegas. After several months of fruitless prospecting they entered a narrow canyon and came upon outcroppings of a white mineral resembling quartz. The veins were sizable and occurred in one side of a hill approximately 3,000 ft. in length and 300 to 500 ft. high.

Bureau New Movie Films Ready

The Bureau of Mines now has ready for distribution copies of the films entitled "Story of Sulphur," "Story of Ingot Iron," and "Story of Asbestos." These films have been prepared at a cost of more than $40,000. They will be furnished without charge to any responsible persons who are interested in making a showing of them. Since the requests for the use of these films cannot all be met promptly, preference will be given to the showings likely to be most largely attended.

Cobalt Arbitrators Propose Wage Cut Effective April 1

Managers Have Agreed, but Action by Employees Is Deferred

The Board of Conciliation and Arbitration, which has been in Cobalt, Ont., investigating the dispute between the operators and the men, has concluded its sittings. The dispute arose over the proposed cut in wages, which was to have been put into effect on Feb. 15, but, on account of the board having been appointed, the cut has not yet become effective. Much evidence regarding operating costs was introduced by the operators, while the men confined themselves to the slight decrease in the cost of living. The board appeared to be unanimous in the opinion that some measure was necessary to permit the mines to continue operations and to give employment to as many men as possible, as the decline in the price of silver and the consequent shutting down of a number of properties has resulted in throwing about 1,500 men out of employment. Before leaving Cobalt the chairman proposed to the representatives of the men that the proposed cut of 75c. a day should be effective from April 1. The managers agreed to this and the representatives of the men agreed to bring it before the men at a mass meeting about to be held.

Iron Ore Taxation Muddle Worse Each Week

Constitutes Principal Issue Before Minnesota Public

The question of taxing iron ore properties in Minnesota becomes a little more muddled each week. At the outset of the present legislative session the tonnage tax was a paramount issue, but the validity of this was a question and after seeking and devising many ways to tax the iron properties, the advice of the attorney general was sought, with the result that instead of a tonnage tax which is nothing more or less than an additional or super property tax it was advised that an occupational tax was constitutional. With this constitutional weapon two bills were prepared imposing a 6 per cent tax on the occupation of mining, but one bill provides that 50 per cent of the revenue go into permanent trust funds. These two bills passed the House of Representatives and are now in the hands of a Senate committee. The fight has simply narrowed down to a sectional fight between the northern and southern portions of the state. The supporters of the occupational tax forget, it is claimed, that at the present time mineral lands are assessed under the present ad valorem system at the rate of 50 per cent of the true value, which is a 25 per cent higher rate than is imposed on urban real estate and a 50 per cent higher rate than is imposed on rural real estate. If more additional revenue is required the same is procurable through the ad valorem system as the valuation of such property is easily figured and the rate of assessment can be raised to meet any requirements or demand instead of resorting to the system of occupational taxes which, it is said, tends to retard progressive tax legislation as other occupational bills were immediately introduced which created considerable confusion.

Again it is pointed out that the supporters of the bill do not desire to raise the assessment under the ad valorem system as the rate would be so out of proportion to other property that the public would not permit the abuse, so they use other methods with new names and rely on the theory that what is not prohibited by the constitution of the State of Minnesota is permitted, instead of accepting the matter as a principle. The theory of the occupational tax is based on the principle that the tax will reach by indirection a class of people, property or business which under any ad valorem system cannot be made to pay what is considered a tax equivalent to that imposed on other people, properties or business capable of being actually appraised and valued. As stated above, all mineral lands on the iron ranges can be accurately valued by estimates and for that reason should not be considered under the system of an occupational tax. To single out any one industry for abnormal taxation, it is held by some, is a feature that should be avoided in any state or country and the present time is not ripe for higher taxes on any commodity needed for construction in all parts of the world. It is stated by an authority that no extra tax or tonnage tax could be made so low as not to force the low-grade ore interests out of business. It has been proven that various low-grade deposits can be profitably mined and sold by resorting to a process of milling and concentration before shipping. This requires large outlay of money and time and also necessitates the handling of a large tonnage for a profitable business.

Situation on Lake Superior Ranges Doubtful

Navigation Expected To Open April 15, With Ore Moving Slowly at Start

The iron ore situation in the Lake Superior district is still doubtful as far as estimating the tonnage that will be moved during this coming shipping season. Since the demand by the furnace companies will determine the amount of ore shipped the outlook is not very bright but optimism prevails in most places. Many of the furnace companies have sufficient ore in their yards and a considerable tonnage has accumulated at the lower docks, but to offset such a condition it is a fact that many mines have closed temporarily, with a very small tonnage of ore ready to be shipped. Should a demand be created by improvement in general trade conditions during the next couple of weeks many properties will again reopen and a busy season can be anticipated.

Many factors enter into the iron and steel situation at present, but the most prominent one is that of the railroad situation. A just and fair settlement of this controversy would place the railroads in a position where they would feel justified in ordering large quantities of sorely needed rails and equipment.

All indications point to the opening of navigation about April 15, as such ice as remains is rapidly disappearing. Every indication points to a very slow movement of ore at first and only very favorable unforeseen conditions can change this situation, but there is every reason to believe that by July 1 the movement will be greatly increased.

Minnesota Steel and Oliver Companies Seek Reparation

Duluth — Reparation for overcharges amounting to $180,000 during Federal control is asked in complaints filed with the Interstate Commerce Commission by the Minnesota Steel Co. and the Oliver Iron Mining Co. against the Director General of Railroads and the Duluth, Missabe & Northern R.R. The Minnesota Steel Co. asks $82,356.39, covering excess charges on shipments of coal and limestone to its Steelton, Minn., plant from June 25 to Nov. 15, 1918. During this period it was forced to pay $15 per car from Duluth as against $7.50 per car prior to this period. The claim of the Oliver Iron Mining Co., amounting to $95,394.26, is for alleged excess charges on shipments of iron ore from the Arcturus mine to the concentrator at Bovey. The freight rate on these shipments was raised from $5 per car to $18.50 per car it is claimed.

Utah Companies Cut Wages 25c. Per Day

A general reduction of 25c. a day in wages paid underground workers in Utah went into effect on April 1. High costs and low metal prices have forced this step.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Tariff Program Decided Upon by Leaders

Farm Products, Anti-Dumping and Ad Valorem Duties To Be Considered First—Permanent Measure Being Drafted

Tariff plans now have been agreed upon by leaders in the House and the Senate. The emergency tariff bill, covering farm products only, in exactly the same form in which it was vetoed by President Wilson, will be re-passed. Immediately thereafter, attention is to be turned to an anti-dumping bill. Next on the program is legislation providing that ad valorem duties are to be based on American prices instead of on foreign invoice values. Following this, the permanent tariff bill is to be passed, with the revision of the internal revenue laws to await disposition of the tariff.

As the Committee on Ways and Means has completed its tariff hearings, work on the permanent tariff is going ahead rapidly, with the promise that a bill will be reported out within six weeks. The metal schedule is being handled by a subcommittee consisting of Representatives Tilson, of Connecticut; Mott, of New York, and Timberlake, of Colorado. This subcommittee is meeting twice a day, and it is believed that its portion of the bill will be considered before those covering some of the more controverted schedules.

The anti-dumping legislation is expected to give immediate relief in those cases where particular advantages are afforded foreigners to market their goods at a sacrifice, possibly, but for cash, and where they have the advantage of depreciated exchange. It is probable that the anti-dumping measure will provide that each imported article shall pay a tax equal to the difference between the American costs of production and those in foreign countries.

War Mineral Awards

Awards were recommended by the War Minerals Relief Commission during the week ended March 19, as follows (the name of the claimant, the mineral, the amount recommended, and its percentage relationship to the amount claimed is shown): Manganese Metal Co., manganese, [illegible] per cent; A. L. W[illegible], [illegible] $78184.49 per cent; [illegible] Co., chrome, [illegible] per cent; Sawyer [illegible], chrome, [illegible] 18[illegible].67 per cent; [illegible] Co., chrome, [illegible] per cent. The total of the recommendations for the week was [illegible]

International Mine Rescue Meet at St. Louis

Arrangements have been made by the Bureau of Mines to hold this year's International Mine Rescue and First Aid meet at St. Louis Sept. 1, 2, and 3. Delegations representing Canada, England, France, and Belgium will attend. A conference will be held during the meet on standardization of mine rescue methods. There will also be displayed commercial exhibits of mine rescue apparatus.

In conjunction with the meet, the Joseph A. Holmes Memorial Association will hold its annual meeting and awards will be made of its heroism medals.

Mine Products Lead in Railroad Tonnage

In its latest statistical statement showing total freight tonnages for several commodities on Class 1 railroads, the products of mines continued to maintain a long lead over the products of agriculture, forest products, manufactures, and animal products. The figures are for the third quarter of 1920. The total tonnage of products of mines during that period was 346,040,830. This is a decided increase over the tonnage for the second quarter, which was 272,179,656 tons. There was an increase in each separate item making up the total. The number of carloads into which the tonnage from the mines during the third quarter was divided was 7,205,790. The subdivisions of the total are as follows, the figures being given in tons:

Anthracite coal, 31,335,703, bituminous coal, 185,729,568; coke, 11,516,072; iron ore, 54,238,232; other ores and concentrates, 9,296,618; base bullion and matte, 860,091; clay, gravel, sand, and stone, 41,446,060; crude petroleum, 3,313,532; asphalt, 1,329,720; salt, 2,637,821; other products of mines, 4,337,413.

The division of tonnage as between the principal transportation districts is as follows: Eastern district, 208,068,452 tons; Pocahontas district, 19,133,463; southern district, 30,224,414; and western district, 88,614,501.

NEWS BY MINING DISTRICTS

Special London Letter

Tin Price Improves—Mexico Mines of El Oro Report Satisfactory—Strike in Rhodesia Serious — Burma Corporation Again Actively Developing

By W. A. Doman

London, March 15.—A new development has taken place in the tin market. It will be remembered that the Federated Malay States pegged the price, and subsequently withdrew it, announcing at the same time that it would not throw the concentrates on the market. Now the Netherlands Indies Government, in conjunction with the Billiton Company, has concluded a contract with the Federated Malay States not to sell tin for at least three months. The announcement has been followed by a recovery in the price of the metal to about £160 per ton, a rise of £10 in two working days.

Following upon the unfortunate position shown by the Geevor (in Cornwall) report, comes a loss made by the East Pool and Agar last year of £19,421, which, with about £9,000 for depreciation, gives a deficit of approximately £28,000. No one expected such a result from this company, which seems to own the richest property in the Duchy. The loss is due to the fall in the prices of tin, wolfram, and arsenic, and to the advance in working costs. The report of the managers shows that physically the property is in a very sound condition. There is a large quantity of high-grade tin ore in sight, but, at the moment, it does not pay to work it. Dolcoath proposes to issue £17,500 in 1/— preference shares to maintain the plant and for other purposes until matters improve.

Mexico Mines of El Oro issues quite a satisfactory report for the twelve months ended June 30 last. Not only has the company paid 15/— per £1 share in dividends, the same as for the preceding year, but it declares an interim amount for 1921-22 of 4/—. Financially this is good. Little in the nature of development work was done, however, the only disclosures of note being on the new west vein on the eleventh level of Oro Nolan. Ore extracted amounted to 136,265 tons and was not altogether replaced, for the reserves are estimated at 350,100 tons, as compared with 379,100 tons. The value is also rather lower in respect of gold at 10.92s. and silver at 8.82 oz. is .62 oz. higher. The company was fortunate in being able to reduce working expenses slightly, and the percentage of extraction made an improvement from 86.50 to 89.64.

Strike in Rhodesia Assumes Serious Proportions

The miners' strike in Rhodesia has assumed a very serious aspect. The men refused to concede to the owners the right to engage and dismiss anyone they liked, that is, non-unionists, and the consequence is a lock-out. A member of the Legislative Council intervened and put forward fresh proposals to the owners, but these were rejected, and the repatriation of the natives has already begun. The only mines at work are the Falcon, Cam and Motor, and Rhodesia Broken Hill. At Wankie Collieries and Shamva the men are on strike. At the Falcon, development work has ceased owing to the low price of copper.

The Burma Corporation is again becoming active in development and is putting up raises from the No. 6 level at the southern end of the proved orebody. Two of these workings, the 1,679-ft. and the 1,135-ft., are in capital ore, the assays being respectively 36 oz. silver, 39 per cent lead, and 20 per cent zinc for the last 15 ft. in the former, and 34 oz. silver, 35 per cent lead, and 21 per cent zinc for 35 ft. in the latter. The weight of metal, it will be seen, is distinctly high.

CANADA

Ontario

Northern Customs Concentrators in Liquidation—British America Nickel Not To Resume

Cobalt—The report of the La Rose Mines, Ltd., for the year 1920, exclusive of the operations of the University, shows a production of 410,455 oz., having a net value of $313,995, as compared with a production of 289,311 oz., valued at $356,124 in 1919. Costs were reduced from $1.05 in 1919 to 73c. in 1920. The profit was $13,279.

At the annual meeting of the McKinley-Darragh held in Toronto recently little hope of resumption of operations was held out until there had been a very appreciable increase in the price of silver.

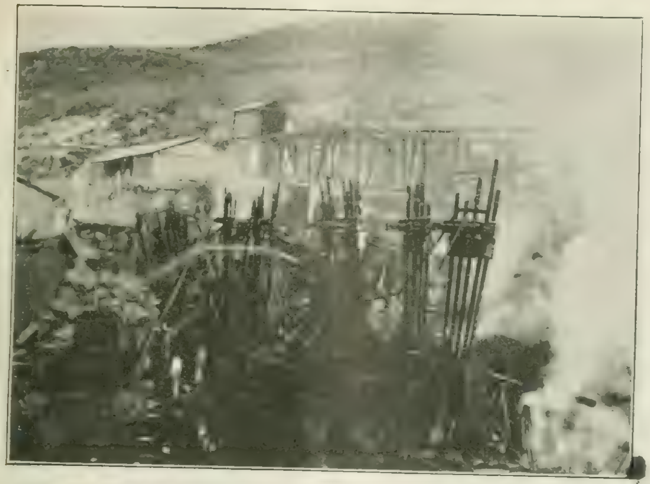
Northern Customs Concentrators, Ltd., has gone into the hands of liquidators. This enforced liquidation was brought about as the result of two actions against the company. Practically the only assets of the company consist of share holdings in the Bailey Silver Mines, Ltd.

The recent rumor regarding the resumption of underground operations at the British America Nickel Co.'s mines in the Sudbury district has been officially denied.

British Columbia

Trail—Shipments to the Consolidated smelter during the week ended March 21 totaled 7,968 tons coming from the company's mines.

Sheep Creek—With reorganization of Queen-Ore Hill Mines Co. to take over and operate the famous Queen mine in conjunction with the Ore Hill group an active summer around the Queen mine is expected. The Queen stamp mill will be put in condition for operation this season, there being a considerable quantity of material ready in the mine for milling.



REMAINS OF SAN RAFAEL MILL DESTROYED BY FIRE AT PACHUCA, HIDALGO, MEX., ON MARCH 6

MEXICO

Zacatecas

Conditions Good Owing to Activities of Mexican Corporation and Bote Mining Co.

Zacatecas—The district as a whole has not been so seriously affected by the drop in the value of silver as might have been expected, owing to the fact that two of the large Anglo-Mexican mining concerns operating in the El Oro district have recently become interested in several of the old properties here, and have been preparing to unwater and generally investigate them. The two companies, namely, the Fresnillo unit of the Mexican Corporation (silver) and the Bote Mining Co. (silver and gold), although having suspended milling operations in December last, have both continued construction work upon their new plants. As a result, the district has, if anything, become more active, and employment conditions are actually better than when silver was at top prices. The new plant of the Fresnillo unit is expected to be ready about the middle of the year. Mr. Cook continues as manager of this important unit, which, when completed, will be one of the largest silver mills in existence.

As in the case of the Fresnillo unit, the drop in the price of silver forced the suspension of the Bote company's milling operations last December. Since then, remodeling of the mill and plant has been under way and new machinery is being added to increase the capacity. Improvements will include tube mills, classifiers, concentrators and thickeners. A change of management is projected, with a view to more energetic operation of the company's properties. Gordon Wilson is closely identified with the general reconstruction and improvement policies.

The La Fe company (silver-gold), which was actively investigating the possibilities of the Guanamatillo district, southeast of Zacatecas, curtailed these operations considerably during the latter part of 1920. This work has again been resumed on a modified scale. The mill, which was finished by the company and only tried out in 1914, when revolutionary conditions rendered further operations impossible, continues inactive, with no indications of immediate resumption of work.

The Los Campos property (silver-gold) ranks as one of the most interesting *antiguas* of the district. It was abandoned thirty or forty years ago, owing to the inability of the native owners to cope with the water problem with the crude animal-power methods they employed. The mine has been consequently under water since then. The El Oro company has taken an option on the property (held by local people) and has been installing hoists. Unwatering has already been started. It is the first attempt in many years to open up one of the famous abandoned Zacatecas properties—and their name is legion. Mr. M[illegible] is in charge. The Veta Grande property (silver-lead-gold) is a famous old group of mines lying a few miles north of the state capitol. For several years, and particularly during the period of peak prices for silver, practically all the large American-Mexican mining corporations at one time or another endeavored to come to terms with the native owners on this group, but without success until recently, when the Dos Estrellas Co., of El Oro, reached an agreement which will permit a thorough inspection of the holdings, covered by option.

Work upon these properties has been carried on spasmodically for several years under primitive conditions. Small lots of silver-lead and siliceous silver ores have been shipped to local buyers, and only from the upper workings, which have been free of water.

The Magistral property (copper) has remained inactive since the death of Mr. Gilbert, and is still involved in litigation.

Work on the Parroquia copper property is practically suspended, owing to the low price commanded by the metal. The closing down of the Aguascalientes smelter, of the A. S. & R. Co., will tend to further curtail chances of shipping ore.

The two ore-buying agencies, representing the American Smelting & Refining Co. and Cia. Minerals y Metales, have practically been forced to close their doors for the present, as the numerous small "shipping" properties which generally sell their ores locally are unable to operate at profit under present prices. The result is that there is practically no exportation or production of silver, gold, copper, or lead in the district at present.

Hidalgo

Pachuca—The San Rafael company, whose mill burned on March 6, employed over 1,000 men.

GENERAL VIEW OF THE DESTROYED SAN RAFAEL MILL AT PACHUCA, WHICH WAS [illegible] IN [illegible]

Durango

Shut Down of Asarco Smelter Serious Blow to Producers

Durango, March 16 — The Asarco smelter of the A. S. & R. Co. at Asarco, Dgo., has been forced to close down this week owing to the lack of shipments of ore and the low prices of metals. This was to be expected ever since the principal mines of the company at Velardeña closed at the end of February. The company's announcement says that the suspension will be for an indefinite period. The effect will be serious for the few high-grade mines that are hanging on; when these close there will be neither mine nor smelter working in the State of Durango. The shutdown is all the more serious as it came without warning. It is reported that the smelter at Torreon, Coahuila, which opened less than a month ago, will also close, leaving the miners without any market whatever for their ore, many cars of which are in transit, but tied up on account of the railroad strike.

"It's an ill wind that blows nobody good," and there are those who have been watching and waiting, and have chosen the present as a most opportune occasion for investment in mines. The present situation (says our correspondent) has favored the investor with an important advantage which will probably not again return to him for some time.

Guanajuato

Removal of Duties Recommended To Aid Mining

Guanajuato—Engineer Antonio Madrazo, governor of the State of Guanajuato, in expressing his opinion regarding the threatened paralysis of the silver mining companies, said that he believed the crisis might be partially, if not wholly, averted if the federal government should immediately legislate in their favor. He recommends the exemption of all export duties on silver and of import duties on mining machinery and supplies. Also that the freight rates on ore be the same as they were in 1910, which was less than one-half the amount charged at present.

Coahuila

Torreon Smelter May Shut Down

Torreon—The Torreon smelter of the Cia. Minerales y Metales continues to operate one copper and two lead furnaces, but a shutdown is threatened unless the fuel supply can be replenished soon. The shortage is occasioned by the strike of railroad employees, which is about ended. This plant has ten furnaces, three copper and seven lead.

WASHINGTON

Chewelah Mining Co. Levies Assessment for Development

Chewelah—Stockholders of Chewelah Mining Co., operating near here, have authorized a 1 mill assessment quarterly in addition to a 3 mill per annum assessment, to provide funds for additional development.

CALIFORNIA

Iron Mountain Mine Closed—Power Company Seeks To Collect Surcharge After April 10

San Francisco—The King tax bill increasing the tax rate upon public utilities has passed the Legislature, and its effect upon mining operations is just beginning to appear. The Pacific Gas & Electric Co., supplying power to a number of mining companies, has asked the State Railroad Commission for authority to continue collecting the surcharge beyond the date, April 10, fixed by the commission. If permission is given mining companies will continue to pay the high rates now prevailing. Other utility companies supplying power may be expected to follow the same procedure.

The Natomas Co. of California dredged 20,459,001 cu.yd. during 1920. The gross gold recovery was $1,680,675; costs, including taxes and insurance, were $1,361,849; net was $318,825. An interesting comparison of cost is given in the following table:

	Gross, cents per cu.yd.	Cost, cents per cu.yd.	Net, cents per cu.yd.
1914-17	9.16	4.57	4.59
1918	8.31	5.46	2.85
1919	8.66	6.41	2.25
1920	8.21	6.65	1.86

On gold-bearing ground not owned by the company 2,510,199 cu.yd. was dredged, realizing a profit of $12,000 to the company. The remaining proven lands of the company total 142,000,000 cu.yd. and in addition 40,000,000 cu.yd. will be dredgable if pre-war costs again prevail. The peak of high costs has been passed, and net returns may be expected to increase. This conservative, well-managed company received a net return of $902,646 from all of its operations, which include farm lands and rock crushing plants. After paying fixed and sundry charges and before charging depreciation and exhaustion the profit for the year totaled $104,242.

At the Parr Terminal, Oakland, a shipload of 6,554 tons of sulphur from Freeport, Tex., is being unloaded. This is one of a number of similar shipments received by the San Francisco Sulphur Co. The sulphur supplies the coast market, chiefly satisfying agricultural demands and the Hercules Powder Co. and General Chemical Co. Sherwin Williams and other companies import sulphur from Texas and Louisiana. Ocean freights on sulphur range between $7 and $8 per ton.

Marigold—On Feb. 18 a 24-ft. section of the bucket line of No. 5 dredge of the Marysville Dredging Co. was removed in two days, thirteen hours. The dredge was digging to a depth of 87 ft. The bucket line contained ninety-eight 15-cu.ft. buckets, each weighing 4,400 lb.

Grass Valley—Idaho-Maryland has uncovered the 1,500 level in the Canyon shaft. Assistance of old miners familiar with the former work in the Idaho-Maryland has been had to locate old ore-shoots. The Grass Valley Consolidated is reported to have secured working options on ground south of the Allison Ranch mine.

Redding—The Iron Mountain mine of the Mountain Copper Co. has been closed indefinitely, and the company's Hornet mine is producing pyrites for sulphuric-acid manufacture. The Utah-California Gold Mining Co. has recently purchased mining property near Callahan, Siskiyou County, and is preparing for active work. A heavy snowstorm late in February interfered with the operations of the Valdor dredge through breakage of power lines and ditches.

NEVADA

Work on United Comstock Mines Adit Progressing

Virginia City—The United Comstock Mines Co., at Gold Hill, is driving its adit from seven headings. A Hoar shoveling machine is at work in the portal heading which has reached a point 1,100 ft. from the portal. The haulage adit is 8 ft. high, 9 ft. wide at the bottom and 7 ft. at the back. Three shifts of five men each, one machine man, two muckers and two hammers, are being used at the portal action. The round consists of three 6-ft. back holes, three 6-ft. breast holes, three 8 to 9-ft. cut holes, two 4-ft. easers and three 6½ to 7-ft. lifters. Forty per cent gelatine dynamite, 1⅛ in. diameter, is used, 126 sticks per round being required. Bear brand fuse and electric delay exploders are used. Sixty 1,800-lb. cars are usually filled per round. Twelve-pound rails are used, double track being laid to within 300 ft. of the face. The haulage adit will be 9,000 ft. long. In the near future 40-lb. rails will be laid, and then a storage-battery locomotive and five-ton self-dumping cars of the Granby type will be installed. Ten or twelve months will be required for the completion of the adit.

Mina—Mineral County, Nevada, has bonded itself for sufficient money to purchase the hydro-electric power line that is already constructed from the power plant at Lundy, Cal., to Hawthorne, Nev., and to construct the line from Hawthorne, through Luning, Mina, and to the Simon district. Work on this will be started at once. It is said that this assures adequate electric power for the operation of the new Simon Silver Lead mill and the mines in the Simon district and elsewhere throughout the county.

MONTANA

Further Curtailment in Production in Butte District

Butte—The North Butte Mining Co. suspended copper production on March 28, laying off 400 men. About sixty will be retained on upkeep work. Anaconda closed its mines April 1. The smelters will run for a week longer and the Great Falls refinery about a month. More than 5,000 men will thus be rendered idle.

IDAHO

Coeur d'Alene District

Hercules and Tamarack & Custer Mines Closed; Northport Smelter Expected To Follow Suit

Wallace—The Western Union Mining Co. has let a contract to crosscut 200 ft. north from the vein from which shipments are now being made, believing that the main vein will be reached within that distance. Since last November lessees have shipped thirteen cars of lead-silver ore that produced a net smelter return of $33,000. The company receives a royalty of 25 per cent.

The Brady Development Co., after a suspension of about a month, has resumed work. The company has a bond on the Olympia group and the Rose claim, situated between the Green Hill-Cleveland and the Tamarack & Custer. The company is driving a crosscut from the Headlight workings which will cut the vein at a depth of 1,200 ft. The crosscut has now been run 1,450 ft., and is expected to reach the vein soon. Patrick Brady, of Wallace, is manager of the company, which is being financed by Pennsylvania capitalists. J. C. Parsons, of Pittsburgh, is president. The vein on surface is 30 ft. wide and a shaft 100 ft. deep shows considerable lead carbonate ore.

The Idaho Group Mining Co. is the name of a new corporation which has taken a bond and lease on the Idaho group of claims, situated on Pine Creek. The property is owned by Charles McKinniss. The Idaho group at one time was under bond to the Nabob Mining Co., which started a crosscut tunnel from the main Nabob tunnel to cut the vein at a depth of 1,400 ft. This was abandoned when within about 500 ft. of the vein and the bond forfeited. One of the conditions of the bond was that if it was given up the owners of the Idaho group should have a perpetual right to the use of the Nabob tunnel in the development and operation of their property. In the upper tunnel on the Idaho there is a splendid showing of lead-silver and zinc ore, and it is expected to make shipments of the former to the Bunker Hill smelter, which is only about fifteen miles away by wagon road. If the work in the upper tunnel proves satisfactory, the crosscut from the Nabob will be completed, and ultimately if an orebody is developed it is regarded probable that the use of the Nabob mill may be secured.

W. C. Siderfin, of Butte, manager of the mining interests of Senator W. A. Clark, recently inspected the Sunset mine, near Wallace, owned by Senator Clark. The West Sunset Mining Co., which is controlled by the Days, is extending a drift from the 1,000 level of the Sunset into the West Sunset and in doing so has opened quite an important body of lead-silver ore, all of which is reported within the Sunset ground, the face of the drift being near the common end line of the two properties. The ore-shoot is reported to be 3 ft. wide and of practically clean lead-silver ore, a showing which it is believed will induce Senator Clark to develop the Sunset further.

The Hercules and the Tamarack & Custer mines closed down on March 20, and the Northport smelter, at Northport, Wash., and the Pennsylvania refinery, at Carnegie, Pa., will soon follow. The low price of lead and the absence of a market, together with the excessive freight rates on bullion to the East, are given as the reason. Seven hundred men are out of work as a result. A considerable number will be retained on development work.

COLORADO

Chipeta Company at Ouray Cuts Milling Ore on H. A. C. Property—Camp Bird Remains Shut Down

Ouray—Camp Bird remains entirely shut down, though rumors persist that development will be resumed before many months. Good ore has been developed at the main tunnel level in the west drift under the largest of the old orebodies.

The Atlas and Mountain Top properties continue active operation, running mills at or near capacity. Unusually high freight and treatment rates on high-grade products work severe hardship on the Mountain Top, which survives only because of a very fine body of high-grade silver and lead ore; development continues to increase ore reserves and justifies the management's intention of enlarging the milling facilities soon. These two are the only mines making any production steadily.

The Lundberg-Wilfley Lease on the Barstow has developed a large body of very good gold-silver ore. The force has been increased and stoping is going forward actively. The bins and stopes are being filled with ore which will be milled during the summer.

The Eurades Mining Co. has by active development since last summer opened up several promising veins. Recently the Blanchard vein was reached from the main crosscut and showed where cut a 3-ft. streak of heavy bismuth-iron ore carrying good copper and high silver values. This is likely to develop into a good orebody. R. S. Harding is now superintendent.

The Paymaster-Whitecloud company has suspended operations since the violent death of Superintendent Fred Jacob. Ore has been discovered and was in process of development; work will be resumed this spring.

Work on the old Guadaloupe will soon be resumed under James A. Lannon, who completed a power line to the property last fall and installed an air compressor.

The long-continued exploratory work of the Chipeta M. & M. Co. on the H. A. C. property has been rewarded by the discovery of a wide vein of milling ore where the crosscut reached the Oak Street vein. The ore is a simple gold-silver ore carrying no other mineral but pyrite, in a quartz gangue. A power line is now being constructed and an air compressor and drills will be put in; development will then be pushed with the expectation of erecting a milling plant later. This is a promising property, hitherto undeveloped.

Development by hand on the Hidden Treasure, the Thomas F. Walsh property near the Camp Bird, continues steadily. An air compressor and other necessary equipment were delivered at the mine last fall but installation was deferred until the severe winter snows should abate. It is the intention of this company to put the air compressor in commission early this year and develop actively, with a milling plant in the near future a very likely possibility.

Telluride—The Smuggler-Union Mining Co. will resume more active development work in the Humboldt property, and may be in the market for about fifty additional miners.

Sawpit—John L. Stivers, of Montrose, has been appointed receiver of the Colorado Vanadium Corporation, which failed last fall, owing about $400,000 to creditors in San Miguel County, including many laborers and merchants in Telluride.

Silverton—The Red Mt. Silver Mines Co. is considering the installation of a reduction and refining plant, having a capacity of 500 tons per day. It is planned to erect the plant during the coming spring as soon as the condition of the roads and weather permit. J. J. Cusick is general manager and C. L. Tripp metallurgist.

Central City—Development of the East Notaway mine will be resumed under the direction of Thomas Martin. The east heading on the 600 level will be advanced.

Crested Butte — The Allied Mines Corporation is planning to erect a 50-ton flotation plant at the Augusta mine. It is reported that substantial reserves of broken and unbroken ore are available in the mine, and that much of the material on the dump can be treated to advantage.

Silver Plume—Development work has been resumed on the Dives-Pelican property, under the direction of G. L. Cole.

Lawson—The Little Giant Mining Co. has leased its Tabor property to John Smith, who is driving a crosscut to cut the St. James vein.

UTAH

Utah Apex Stops Development Owing to Market Conditions

Mammoth—The old Mammoth mine has practically ceased work upon an order from the smelters reducing monthly shipments of siliceous silver ores to 100 tons, as they have been receiving a disproportionate amount of ores of this character. The Mammoth has a good [illegible] per ore, at pr[illegible] work may be [illegible] the tunnel level and h[illegible] is not necessary.

Park City—Shipments for the week ended March 18 were 1,864 tons as compared with 1,836 tons the week preceding. Shippers were: Judge allied companies, 832 tons of ore and concentrates and 15 tons of zinc; Silver King Coalition, 476 tons; Ontario, 431; Naildriver, 110. The Daly West, it is reported, will pass its coming quarterly dividend, owing to the low price of metals. A large amount of development work is planned, as more labor is now available. Funds at present on hand amount approximately to $145,000.

Eureka—Tintic shipments for the week ended March 18 amounted to 155 cars; Tintic Standard, 55; Chief Consolidated, 29; Dragon, 18; Iron King, 16; Eagle & Blue Bell, 10; Iron Blossom, 6; Victoria, 5; Grand Central, 3; Gold Chain, 3; Bullion Beek, 3; Colorado, 2; Ridge & Valley, 1; Gemini, 1; Alaska, 1; Swansea, 1; Sunbeam, 1.

Bingham—The Utah Apex has suspended development work and shaft sinking as well as ore shipments, owing to the unfavorable state of the lead market.

ARIZONA

Magma Copper Down March 31—Development Progressing at Hill Top

Hill Top—The lowest of the three tunnels of the Hill Top Metal mining company has been driven 3,600 ft. into the mountain and will cut the main vein carrying silver-lead in about 700 ft. This will give about 1,500 ft. of back. Plans for a lead smelter and rail connections are still under advisement. The Hill-Colvin group of four claims that adjoins the Hill Top ground on the east is under examination by prospective purchasers.

Superior—The Magma Copper Co. shut down March 31 because it has a substantial supply of unsold copper on hand and cannot dispose of its production. The company will continue to operate the mine pumps and a limited amount of development work will be done. The labor force will be reduced from about 210 men to about sixty men. Old employees will be given first choice whenever the company is ready to resume operations. W. C. Browning is general manager.

Chloride — The long-drawn-out legal difficulties involving the Tennessee and Schuylkill mines have finally been adjusted out of court. The latest litigation was that of Frank A. Garbutt vs. the Schuylkill Mining Co. In this action judgment was entered in favor of Mr. Garbutt for the full amount of various mortgages held by him against the properties. These, with incidental costs, amounted to over $340,000.

Mr. Richard H. Cole has entered into contract with the Schuylkill Mining Co., to finance and operate its properties. The preliminary step in this has consisted in the purchase by Mr. Cole of the mortgages and judgment held by Mr. Garbutt. Mr. Cole is now in charge of the mines. He and his associate, C. A. Burke, recently made a thorough inspection of the workings of the Schuylkill and Tennessee. Mr. Cole is now in the East completing financial arrangements while Mr. Burke remains at the properties. Former Superintendent Keile, of the Tennessee, has been brought to Chloride, and plans are being worked out for the prompt resumption of operations.

Winkelman — The Continental Commission Co. has not sold the old 79 mine, as has been recently stated. The company is installing some new mining equipment, as the market conditions are unfavorable for shipping ore. The Little Treasure Mining Co., east of Winkelman, is preparing to bring in its mining equipment. Isaac Rogers, formerly superintendent at the Dripping Springs Copper Co. property, has taken a lease and bond on the Cow Boy mine, owned by C. W. Megraw, from which much gold has been taken. The small milling plant will have additions to improve capacity. The Riggins gold property on the other side of the Gila River is also under lease and bond to Rogers. The Adjust Mining Co., operating the Shepherd-Whiteman lease on Deer Creek east of town, will increase its operations in charge of Blanford C. Burgess.

NEW MEXICO

St. Joe Lead Co. Preparing To Develop Warnock Property—Burro Mountain Down April 1

Magdalena — Unusual interest is being manifested in mining in this section. Dr. Samuel C. Appleby, of Baltimore, Md., was here recently in the interest of capitalists of that city and principally to investigate the Rosedale Gold property. In former years this was a good producer but was closed down indefinitely after the second mill was destroyed by fire. Dr. Appleby was accompanied on his return by Messrs. Exter and Crawford, who are to close the sale of the property. It is understood that immediately after the sale the mine will be reopened and a new mill built.

The Copper Belt Silver & Copper Mining Co., which has been doing development work for two years, is preparing to do core-drilling on its property, which is three miles from town. A great deal of prospecting and assessment work on the new location is in progress.

A few months ago a deposit of vanadium ore was discovered on the Redemer & Dugger claims and much development work done. A number of recent offers for this property have been rejected as the owners are undertaking to block out the ore.

Lordsburg—The Co-operative is hauling what is its third car of silver-lead ore for this month for shipment to the El Paso smelter. Returns on the last car showed 75 oz. silver per ton, the total return being about $2,400. Lessees in this district are active in seeking to supply the demand for siliceous ores required at the smelters at Douglas, Ariz.

Tyrone—Final payment on the Cora Miller mine has been made by the Montclaire Mining Co., of New York. This property was purchased from the Mangas Mining Co. in February, 1920. A 35-ton cyanide mill has been erected. Development work consists of a tunnel, shafts and winzes. High-grade silver ore is reported on the 275 level.

The Burro Mountain Branch of the Phelps Dodge Corp. shut down tight on April 1. Arrangements are being made for a considerable period of inoperation. The general store will close and the electric lights will be shut off April 15. A gas engine will be installed to pump water for fire protection. Mexican labor will be sent at company expense to any point on the border desired. The move is regretfully made, as an excellent force had been built up and living conditions were most satisfactory. It was a model camp and conducted by the management upon liberal lines that made it one of the most desirable places for mine workers to be found in the whole Southwest.

Alamogordo — The St. Joseph Lead Co. of Missouri, which purchased the George W. Warnock lead property in January, is building roads and laying a water pipe line. Core drilling will be started soon, as $20,000 has been allotted for development. Should conditions justify, a mill will be installed and concentrates shipped to Herculaneum, Mo., for final treatment.

MINNESOTA

Mesabi Range

Bennett Mine at Keewatin and Utica at Hibbing Closed

Duluth—The Minnesota Steel Corporation has announced the erection of a new wire mill at its plant. C. F. Blackmer, assistant superintendent of the American Steel & Wire Co.'s plant at Waukegan, Ill., will have charge of the new addition.

Keewatin—The Bennett mine of the Pickands Mather Co. has temporarily closed owing to the slack market. Some repair and development work will continue to be done, but over 100 men were thrown out of employment.

Hibbing—The Utica mine of the Pickands Mather Co. has closed down indefinitely. At first the mine was placed on a four-day-a-week basis, but this week received notice to cease all operations.

Cuyuna Range

Strikers Return at Croft Mine at Reduced Wages

Crosby—A number of mining crews have been put back at work at the Croft mine, John A. Savage & Co., following a shutdown resulting from strike of the miners upon reduction of wages. Those returning to work have accepted the company's new wage schedules, which are in line with the reductions that have been made all over the district. Production is being carried forward from raises and slices above the new 333 level and a substantial daily hoist obtained.

THE MARKET REPORT

Daily Prices of Metals

March	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
24	12.00	28.75	30.25	4.20	3.95@4.10	4.70
25	12.00	28.75	30.25	4.20	3.95@4.10	4.65
26	12.00@12.25	28.75	30.25	4.20	4.00@4.10	4.65
28	12.00@12.25	28.50	30.00	4.20@4.30	4.10	4.65
29	12.25@12.50	28.00	29.00	4.20@4.30	4.10@4.15	4.65
30	12.50	27.75	29.25	4.20@4.30	4.10@4.15	4.65

*These prices correspond to the following quotations for copper, "delivered": 12.25, 12.25, 12.25@12.50, 12.25@12.50, 12.50@12.75, and 12.75c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

March	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
24	69⅜	68½	71½	165½	168	20¼	20¾	25½	26⅝
25	...	...	...	....	....	...	..	..	...
26	...	...	...	....	....	...	...	...	...
28	..	.	...	...	.	.	..	.	..
29	69⅝	69⅛	71½	161½	165	20⅛	20⅜	25¼	26½
30	70⅝	70	72½	159½	162½	20	20½	24¼	26

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Mar.	Sterling Exchange	Silver			Mar.	Sterling Exchange	Silver		
		New York, Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York, Foreign Origin	London
24	391	99½	57¼	33⅛	28	391	99½	57¼	..
25	390¾	99½	57¼	.	29	391	99½	57¼	33¼
26	390¾	99½	57¼	...	30	392½	99½	57⅜	33⅜

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, March 30, 1921.

The firmer tone which we mentioned last week has continued, and despite absence of demand the prices of copper and lead have advanced. Tin and zinc remained practically stationary. It is too early yet to say that the prices of these metals have reached their low, but it is extremely doubtful if purchases can be made any more advantageously by waiting longer.

Copper

The most important news of the week is chronicled elsewhere. The closing down of Anaconda and the porphyries, together with the other companies recently mentioned, will result in a production about 40,000,000 lb. per month less than has been the output up to now. Assuming the current production of the two Americas at 110,000,000 lb. per month, this will mean a cut of 36 per cent, even if no other companies decide to cease operations. This is large, but the figures must be compared with the copper stocks on hand, which amount to close to 1,000,000,000 lb., and to the current domestic and export sales, which have been estimated at about 60,000,000 lb. for February. A study of the situation will reveal that until business conditions revive, hope of any great improvement in the copper market is unwarranted. Even should all producers cease operations, the world could get along under present conditions for the best part of a year. Then, too, we must consider what has happened to zinc since production was cut down to 35 or 40 per cent of normal: the price has not yet begun to react. Therefore, we cannot expect any runaway copper market, and present prices are not likely to be materially altered for some time. The curtailed production will bring high prices much sooner than they would have come otherwise, however, and had production continued on the scale of the last few months we might have had 12c. copper for years.

Consumers remain uninterested, and inquiries in the last day or two have been largely because of curiosity. Export, and, to a less extent, domestic demand, has taken up the available stocks of the smaller producers, who have been cutting under the 13c. level of the large interests, and the price has naturally reacted toward the higher figure. The sentimental effect of the announced shutdowns aided the price recovery, but was not the principal cause. Demand from France and Germany has been good in the last week. A cable today states that the Copper Export Association is quoting 12.75c. delivered in Europe, which is equivalent to about 12.50c. f.a.s. New York.

Lead

On Monday, March 28, the American Smelting & Refining Co. increased its official price of lead from 4c. to 4.10c., New York and St. Louis.

No supplies of lead appear to be pressing on the market at present, and in some quarters a shortage seems to exist. Sales have not been numerous, but the price has firmed somewhat, and second hands are getting even slightly better prices than we quote, for small lots. Chemical lead has not advanced in quite the same proportion as the ordinary grades, and is now quoted at 4.30@4.35c. St. Louis, or 20 points premium.

A novel incident of the week has been the appearance in the local market of representatives of the Penarroya interests, who have been trying to dispose of Spanish lead in this country at the equivalent of the London price. Although they have been more anxious to sell in large quantities—over 1,000 tons—it is said that they are also contemplating keeping a local stock to supply carload demands, and that a shipment of 2,000 tons is now on the way for this purpose. Lead from Spain can be delivered here at about the same price as that for which it can be shipped to London, but under present conditions the price cannot be cut under that at which domestic lead can be obtained. It would appear that this Spanish lead can now be laid down in New York for 4.25@4.35c. per lb.

Zinc

The market is dull and quiet, and consumers are indifferent to the low prices. Quotations this week represent a loss of 5 points from the closing quotations of last week. No immediate improvement in the market is in sight, despite the low rate of current production, which is estimated by one large producer at about 20 per cent of capacity—and that at a loss. Scrap material is still available, and is an important element in satisfying market requirements. Steel prices have not settled down to a level that warrants any demand from galvanizers, the most important zinc consumers. High-grade zinc is quoted at 7c.

Tin

With the London holidays and the absence of demand in this country, tin has had a quiet week. Electrolytic is practically off the market, the producer quoting 30c. per lb.

Straits tin for future delivery: March 24th, 30.50@31c.; 25th, 30.50@31c.; 26th, 30.50@31c.; 28th, 30.25@30.75c.; 29th, 29.50@30c.; 30th, 29.75@30.25c.

Arrivals of tin, in long tons: March 22d, Straits, 30; 23d, Straits, 20.

Silver

Since our last report, the London market has been closed for three days for the Easter holidays, which have also been observed in the Far East. As a result, business has been on a small scale, although prices have been well maintained, both in London and New York. The buying inquiry which was in evidence a week ago has fallen off, and the market closes quiet.

Mexican Dollars—March 24th, 43¾; 25th, 43¾; 26th, 43¾; 28th, 43¾; 29th, 43¾; 30th, 43¾.

Gold

Gold in London: March 24th, 104s. 11d.; 29th, 104s. 11d.; 30th, 104s. 6d.

Foreign Exchange

The Easter holidays kept the foreign exchange market quiet. Sterling strengthened further and reached the highest point quoted since last summer. On Tuesday, March 29, francs were 6.975c.; lire, 4.135c.; and marks, 1.58c. New York funds in Montreal, 13 per cent premium.

Other Metals

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 23@24c. per lb. Market quiet.

Antimony — Chinese and Japanese brands, 5¼@5½c.; market dull. W.C.C. brand, 5¾@6c. per lb. Cookson's "C" grade, spot, 9⅝c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony (200 mesh), 6@6½c. per lb. Demand light, with heavy supplies available.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 7c.

Bismuth—$1.50@$1.65 per lb., 500-lb. lots.

Cadmium—Nominal, $1.10 per lb., in 1,000-lb. lots. Price reduced as a reflection of London drop. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $4.50 per lb.; black oxide, $3@$3.10 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $250@$300 per oz.

[1]**Molybdenum Metal in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.**

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 38@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—$72@$75 per oz. Very strong.

Quicksilver—Nominally, $46@$47 per 75-lb. flask. San Francisco wires $45.50.

[1]**Rhodium—$200@$225 per troy oz.**

Ruthenium—$175@$200 per troy oz.

[1]**Selenium—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.**

[1]**Thallium Metal—Ingot, 99 per cent pure, $20 per lb.**

[1]**Tungsten Metal—Wire, $35@$60 per kilogram, according to purity and gage.**

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 45@50c. per long ton unit, f.o.b. Atlantic ports.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $7.45; Mesabi bessemer, 55 per cent iron, $7.20; Old Range non-bessemer, 51½ per cent iron, $6.70; Mesabi non-bessemer, 51½ per cent iron, $6.55.

Magnetite Ore, f.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5.80; old bed concentrates, 63 per cent, $6.70; Harmony, cobbed, 63 per cent, $6.70; new bed low phosphorus, 65 per cent, $9.50.

Manganese Ore—30@35c. per unit, seaport; chemical ore (MnO_2) $60 per gross ton, lump; $70@$75 per net ton, powdered. Market dull.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores—Ilmenite, 52 per cent TiO_2, 1¾@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.**

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon—Washed, iron free, 3c. per lb.**

[1]**Zirkite—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.**

Zinc and Lead Ore Markets

Joplin, Mo., March 26—Zinc blende, per ton, high, $24.20; basis 60 per cent zinc, premium, $22.50; Prime Western, $21; fines and slimes, $20@$17.50; average settling price, all grades of blende, $23.33.

Lead, high, $43.45; basis 80 per cent lead, $40; average settling price, all grades of lead, $41.61 per ton.

Shipments for the week: Blende, 6,347; lead, 1,545 tons. Value, all ores the week, $212,520. Shipments for three months: Blende, 69,611; lead, 12,476 tons. Value, all ores three months, $2,453,160.

Blende shipments three months are 89,813 tons less than for the corresponding three months of 1920; calamine 2,567 less, and lead 9,702 less.

The market is lifeless and featureless, with 2,200 to 2,500 tons of zinc produced in excess of the purchase each week, which has averaged 5,375 tons per week. A firm demand for lead is again taking up the weekly production, and sellers are accepting the $40 basis offered.

Platteville, Wis., March 26—No market for zinc or lead ore. Shipments for the week: Blende, 772; lead, 40 tons. Shipments for the year: Blende, 9,570; lead, 550 tons. Shipped during the week to separating plants, 371 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $2,000@$3,000; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton f.o.b. Atlantic seaports. Western grades, $24.50.

Chalk—English, extra light, 5@5½c. Domestic light, 4¾@5c.; heavy, 4@4½c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$10; washed, $10@$12; powdered, $15@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $15@$20, f.o.b. Virginia points. **Domestic lump, $10@$20; powdered, $25@$30; imported lump, $15@$25, f.o.b. American ports; powdered, $35@$45, f.o.b. New York.**

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20 per ton, f.o.b. Illinois mines, and $20, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, $60; lump, $17.50, f.o.b. Heathden, N. M. In Canada 85 per cent calcium fluoride sells for $20 per ton, f.o.b. Madoc; output limited. Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines.

Fuller's Earth—$16 per ton, carload lots, f.o.b. mines. California grades, Floridon, $43 per ton; Medina, $39. Local grades, $15@$25, f.o.b. mines. Large oil companies use Floridon grade.

Graphite—Ceylon lump, first quality, 8@9c. per lb.; chip, 7c.; dust, 5½c. No. 1 flake, 7c.; high-grade amorphous crude, 3c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$2 per net ton; 1½ in., $1.50@$2. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — High - grade caustic calcined, lump form, $30@$35 per ton, carload lots, f.o.b. California points. In Chicago district, $57.70; Atlantic seaboard, $60.

Dead - Burned — $38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); all f.o.b. New York.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $7.35; 68 per cent, $6.85; 68@66 per cent, $6.60.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 16c., c.i.f. Atlantic seaport; furnace size, 16½c.; Spanish lump, 14@15c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$40, talcum powder grade. Southern talc, powdered, carload lots, $10@$14 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 8½@9½c. per lb. in carload lots.

Sodium Nitrate—$2.75@$2.80 per cwt. ex vessel, Atlantic ports. Market quiet.

Sodium Sulphate—For 95 per cent material, $20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; $30 per ton, New York.

Potassium Sulphate—Domestic, $220@$230 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 15c. per lb. of chromium contained; 4 to 6 per cent carbon, 16@17c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $90@$95, f.o.b. furnace; resale, $90, delivered; English, $90@$95, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $30, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $50@$55; 50 per cent, $85@$90; 75 per cent, $145@$150.

Ferrotungsten—Domestic, 70 to 80 per cent W, 48@50c. per lb. of contained tungsten, f.o.b. works. Foreign, 60c.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—Basis 30 to 40 per cent, $5 per lb. of V contained, plus 75c.@$2 differentials and according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York list price, 20¼@20⅝c. per lb.; wire, 14.50@15c.

Lead Sheets—Full lead sheets, 8c.; cut lead sheets, 8¼c. in quantity, mill lots.

Nickel Silver — 33½c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets 18¾c.; sheathing, 17¾c.; rods, ⅝ to 3 in., 15¾c.

Zinc Sheets—$11 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $80 per net ton, shipping point; arches, keys, wedges, $85; splits, soaps, $100.

Fire Brick—First quality, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $45@$50.

Magnesite Brick—9-in. straights, $90@$100 per net ton; 9-in. arches, wedges and keys, $105; soaps and splits, $120.

Silica Brick—9-in., per 1,000: $45@$55 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, March 29, 1921.

Demand for steel products has continued to broaden, but by a barely perceptible amount. There is no forward buying, and scarcely any buying for construction purposes. The demand comes chiefly by way of releases on orders previously suspended.

The improvement is too slight to arrest the decline in steel production. Operations by the independent mills are practically stationary, at about 20 per cent of capacity, and the Steel Corporation's operations are decreasing slightly.

On carload lots with desirable specifications the market stands approximately as follows: Bars, 2c.; shapes and plates, 2.10c.; blue annealed sheets, 3c.; black sheets, 3.85c.; galvanized sheets, 5c; wire nails, $3; hoops, 2.80c. Standard steel pipe is now being shaded $2 to $4 a ton, by an extra discount of 2½ or 5 per cent.

Pig Iron—Control of prices of basic pig iron has passed to the steel works, which have accumulations they prefer to sell, as it is more economical for them to sell their cold iron and supply their own wants from time to time with fresh molten iron. A few sales have been made at about $23, Valley, against $25, the price the merchant furnaces have been maintaining. Bessemer is offered at $25, or $2 under the former quotation, while foundry is offered at $25, Valley, a decline of 1 [illegible]

Semi-finished Steel—The [illegible] nominal, with asking [illegible] sheet bars and [illegible] for small billets.

Coke

Connellsville—[illegible] $5.25; foundry, [illegible]

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[1] Foote Mineral Co., Philadelphia, Pa.

Erratic Behavior of Tin

Element of Speculation an Important Factor in the Market—The Failure of the Price-Control Policy of the Federated Malay States—Electrolytic Tin Being Tried Abroad, and Its Use Criticised

EDITORIAL MARKET STUDY

TIN LENDS ITSELF ADMIRABLY to speculation. It is a metal that is more valuable than most of the important non-ferrous metals such as copper, lead, and zinc, and as a consequence a smaller volume may be stored for an equivalent value. Unlike silver, another speculative metal, tin is actually consumed and in a large measure destroyed, so that its production and accumulation for a period of, say, thirty years or more is not of the importance in the general tin situation, as it is for silver. Furthermore, statistics covering the movements of tin from producing to consuming centers, and its disposal, are available to anyone who cares to make a study of the market.

Tin is one of the few metals produced in any volume the world over in which the United States produces from its own resources a negligible supply but consumes a greater quantity than any other country. Trading in tin is thus chiefly in the hands of the world's most important producing country—the British Empire—which produces about 60 per cent of the world's output of tin, and is safely lodged in the London metal exchange, where conditions are fully adequate to both speculative and commercial trading.

An Easily Misjudged Market

One has but to glance at the curve of London tin price fluctuations for, say, ten or fifteen years to realize what an important market factor speculation must be to account for the violent increases and decreases in price over short periods. The tin market in the United States, being largely dependent upon British supplies of the metal, conscientiously reflects the state of the London market, so that prices in New York correspond closely to those in London.

Tin is undeniably cheap when compared with prices current for the period of five years before the war, and has reached a price which but few interested market observers would have been willing to predict a short time ago. To show how companies directly concerned have misjudged the market it is only necessary to consult the recent report of a large American dredging company which has begun operations in the Federated Malay States, and whose probable future returns are estimated upon a basis of 40c. tin (the lowest basis given). However, not only tin producers but tin consumers have erred in predicting the market. Last year, when tin was 40c. per lb. and had declined from 63c. in January, consumers thought the metal an excellent purchase and usually did not hesitate in filling more than their immediate requirements. Consequently, when tin declined further they were subject to a loss that tended to make them wary of further purchases.

The total yearly production of tin in the world averages about 115,000 tons, which, weight for weight, would be equivalent to about one month's world copper production, showing how much easier it is to "corner" an important share of the world's tin than it would be to control its copper supply, and hence how much better tin is adapted to speculative purposes.

Regardless of the influence of speculation upon the tin market, the low prices at present are due to an unusual absence of demand for the metal by the tin plate, solder, and bearing-metal manufacturers, which are the most important consumers both in the United States and in Europe. An upward turn in prices is not expected until industrial conditions improve.

There are two principal methods for improving any market: the first to lessen production, thereby decreasing the available supply, and the second by stimulating and increasing consumption. The latter method is seldom used, but the former is a natural result of a poor market.

Price Control Ineffective in the Straits

The Federated Malay States government recently resorted to the first method, and has concluded an experiment endeavoring to decrease the available supply of tin, thus indirectly raising the price of the metal to a level commensurate with the cost of production. With this idea in view, early last December the F. M. S. government agreed to pay £235 per ton to the producers of tin for such metal as they were unable to market, but without inducing a market response, and so, about the middle of January, the purchase price was reduced to £205 per ton. In the meantime, however, exchange had risen so that, reduced to a dollar basis, the reduction in price was unimportant. No stimulation of the market was noticeable, and finally, late in February, the F. M. S. government abandoned the attempt to aid the local tin producer, thus acknowledging its ineffectiveness. Doubtless considerations of revenue as well as of the market prompted the government to release its indirect price control, for one of its chief sources of revenue is a tax on tin exports. The world's tin market is now again free to reflect the play of economic forces, but the trend has been notably downward.

Electrolytic Tin Being Used in Europe

Although the United States has no domestic tin resources, large amounts of imported tin concentrates are smelted by the Williams Harvey Corporation and the American Smelting & Refining Co. The latter company is the only one in the world producing large amounts of electrolytic tin, and in 1920 had an output of 18,511,160 lb. Several hundred tons of American electrolytic tin were recently exported to England, provoking interesting comment from British trade, which raised the question whether this variety of tin is suitable for tin-plate manufacture, although admitting its fitness for soldering purposes. Criticism was made that molten electrolytic tin is too mobile and runs too rapidly from the surface of the plate to be coated, leaving only a thin coating. The prejudice against its use is somewhat comparable to that met by electrolytic copper when it was first introduced. Electrolytic tin is sold on practically the same basis as Straits tin, but occasionally a concession is made in the price. It is of similar high purity. As tin consumers become more familiar with the characteristics of electrolytic tin, foreign objections to its use, if any, will assume more definite form. Judging from the reception accorded its introduction here, electrolytic tin is making splendid progress. It is interesting to observe that American-made tin is competing in a stronghold of tin production and smelting.

COMPANY REPORTS

Bingham Mines Co. Earnings Better

Lead; Utah

A report of the operations for the Bingham Mines Co. for 1920 shows gross earnings of $208,304.73 and net of $153,330.11. The company received interest on loans amounting to $12,216.87 and $299,373.40 in dividends from the Eagle & Blue Bell Mining Co. ($170,655.10 of which was paid from net earnings). Total net operating gain and income amounted to $464,920.38, from which depletion and depreciation charges amounting to $76,674.81 were deducted. Earned surplus balance on Dec. 31, 1919, was $261,231.43, and on Dec. 31, 1920, is given as $520,758.60. This considers the dividends from mining stocks paid from the net earnings ($170,655.10) and not the dividends amounting to $128,718.30 received as "return of capital."

Production from the Dalton and Lark mines amounted to 479,242 lb. copper, 311,289 lb. lead, 82,214.2 oz. silver, and 1,927.4 oz. gold, from 16,307 dry tons of ore. The Victoria mine produced 9,787 lb. copper, 1,540,022 lb. lead, 183,063 oz. silver, and 1,503.8 oz. gold, from 12,068 dry tons of ore. Yosemite mines produced 6,422 lb. copper, 93,762 lb. lead, 2,509 oz. silver, and 25.5 oz. gold. Operating statement follows:

Gross earnings		
Ore shipments, Dalton and Lark, gross value	$178,432.58	
Less deduction for smelting, freight, etc.	55,038.55	$123,394.03
Ore shipments, Victoria, gross value	$293,002.99	
Less deductions for smelting, etc.	134,259.70	158,743.29
Total		$282,137.32
Revenue		
Royalties	$ 65,507.61	
Rents	2,174.85	67,682.46
Gross earnings and revenues at properties		$349,819.78
Operating expenses		
Mining operations (Dalton and Lark)	$ 48,317.42	
Mining operations (Victoria)	44,894.18	
Management, legal exp., taxes, etc.	31,711.20	
Insurance and misc. taxes, etc.	16,592.25	141,515.05
Net earnings and revenues		$208,304.73
Mine development		
Prospecting and development of mines (Dalton and Lark)	$ 27,825.72	
Prospecting and development of mines (Victoria)	27,148.90	54,974.62
Net operating gain		$153,330.11

No dividends were paid during 1920.

Chief Consolidated Mining Co.

Silver, lead; Utah

A report of the Chief Consolidated Mining Co. for the year 1920 states that 12,717,410 lb. of lead, 2,622,132 oz. of silver, 212,906 lb. of zinc, 4,461 oz. of gold and 3,814 lb. of copper were produced from 82,430 dry tons of ore. Net returns from the smelter amounted to $2,242,708.58 and after deducting charges the return was $357,380.45.

Surplus Dec. 31, 1919, amounted to $1,638,022.65, and on Dec. 31, 1920, was $1,641,710.30. Four dividends were paid during the year, totaling $353,692.80 on the $884,232 in capital stock outstanding.

Mass Consolidated Mining Co.

Copper; Michigan

A report of the operations of the Mass Consolidated Mining Co. for the year 1920 states that the work of closing the mine was completed early in the year. Income from real estate sales and sundries amounted to $27,338.92, and expenses totaled $75,742.26. A balance sheet (for an unspecified date) states that copper amounting to 1,626,973 lb., valued at 13c. per lb., is on hand.

Mining Dividends for March, 1921

The following is a partial list of dividends paid by American mining and metallurgical companies during March, 1921:

Companies in the United States	Situation	Per Share	Totals
American Smelting & Refining	U. S.	$1.00Q	$609,980
American Smelting & Ref., pfd.	U. S.	1.75Q	875,000
Calumet & Arizona, c.	Ariz.	.50Q	321,260
Federal Min. & Smelt., pfd., s,l.	Idaho	1.00Q	120,000
Hecla Mining, s,l.	Idaho	.15Q	150,000
National Lead	U. S.	1.50Q	309,831
National Lead pfd.	U. S.	1.75Q	426,433
North Star Mines, g.	Cal.	.20Q*a*	50,000*a*
Oroville Dredging, g.	Cal.-Colombia	9d.A	£25,745.18
St. Joseph Lead, l.	Mo.	$0.25Q	$352,367
United Verde Copper	Ariz.	1.50Q	450,000
Utah Copper	Utah	1.00Q	1,624,490
Companies in Canada, Mexico and South America			
Cerro de Pasco Copper	Peru	0.50Q	449,141.90
Exploration Co., Ltd., s,l.	U. S.-Mex.	1 s.	£37,500
Nechi Mines (Colombia), Ltd., pfd. g	Colombia	5 s.	£35,000

a, Capital distribution; Q, quarterly; A, annual.

March dividend lists continue to reflect the depression in the mining and metallurgical industries; Federal Mining & Smelting, St. Joseph Lead, Utah Copper, and Cerro de Pasco Copper all show a reduction from previous dividend rates, and Chino Copper, Kennecott Copper, Nevada Consolidated Copper, Ray Consolidated Copper, and Mining Corporation of Canada all passed the dividends usually paid at this time.

Isle Royale Paid No Dividends in 1920

Copper; Michigan

A report giving the result of operations of the Isle Royale Copper Co. for the year 1920 states that 10,621,801 lb. of copper was produced, at a cost of 20.10c. per lb.; 10,026,284 lb. was delivered during the year, for which 18.61c. per lb. was received, and 8,690,848 lb. remained at hand Dec. 31, 1920. Earnings statement follows:

Received for copper delivered			$1,865,445.56
Cost of copper delivered:			
Production cost at 18.24c.		$1,829,022.04	
Selling and delivery cost at 0.56c.		55,958.20	1,884,980.24
Loss on copper delivered, 0.19c. per lb.			$19,534.68
Loss by reduction to market value (13c.)			617,145.22
Miscellaneous receipts			69,010.54
Net loss			$567,669.36
Increase in capital investments:			
Construction		$88,932.56	
Less obsolescence		2,660.00	
		$86,272.56	
Lake Milling, Smelting & Refining Co.		26,443.58	112,716.14
			$680,385.50
Increase in reserves for depreciation and depletion			[illegible]
Decrease in balance of current assets			[illegible]
Balance of current assets as in annual report for 1919		[illegible]	
Adjusted by Federal regulations:			
Increase in value of copper	$162,914.51		
Less reserve for [illegible] tax	10,313.64	[illegible]	[illegible]
Balance of current assets Dec. 31, 1920			[illegible]

No dividends were paid in 1920.

South Lake Mining Co.

Copper; Michigan

The annual report of the South Lake Mining Co. for the year 1920 states that no active mining operations were carried on at the property during the year. Assessments amounting to $67,089 were collected, leaving uncollected assessments to the value of $156,91[illegible].

MINING STOCKS

Week Ended March 26, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Adventure	Boston	*60	*60	*60		
Ahmeek	Boston	47	45	45	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	9/16	7/16	9/16		
Allouez	Boston	21	19	21	Mar. '19	1.00
Anaconda	New York	38¼	36¼	36⅜	Nov. '20, Q	1.00
Arcadian Consol	Boston	2½	2⅜	2⅜		
Ariz. Com'l	Boston	8	7⅝	8	Oct. '18,	.50
Big Ledge	N. Y. Curb	5/16	5/16	5/16		
Bingham Mines	Boston	...	...	8¼	Sept. '19, Q	.25
Calumet & Arizona	Boston	46	45	45	Mar. '21, Q	.50
Calumet & Hecla	Boston	225	216	221	June '20, Q	5.00
Canada Copper	N. Y. Curb	....	....	*13		
Centennial	Boston	...	...	9	Dec. '18, SA	1.00
Cerro de Pasco	New York	25½	24¾	25½	Mar '21, Q	.50
Chile Copper	New York	10⅜	9⅞	10¼		
Chino	New York	21	20¼	20¼	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*25	*24	*24		
Con. Arizona	N. Y. Curb	....	....	3/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	...	...	1⅞		
Copper Range	Boston	32¼	31¾	32¼	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*35	*32	*34		
Davis-Daly	Boston	5⅞	5½	5½	Mar. '20, Q	.25
East Butte	Boston	8¼	8	8	Dec. '19, A	.50
First National	Boston Curb	*85	*70	*85	Feb. '19, SA	.15
Franklin	Boston	2	1⅞	1⅞		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol	New York	19⅞	19	19	May '19, Q	1.25
Greene-Cananea	New York	21	20½	20½	Nov. '20, Q	.50
Hancock	Boston	...	...	3		
Howe Sound	N. Y. Curb	...	...	2¼	Jan. '21, Q	.05
Inspiration Consol	New York	33¼	32⅛	32⅛	Oct. '20, Q	1.00
Iron Cap	Boston Curb	...	...	6½	Sept. '20, K	.25
Isle Royale	Boston	18	17	17	Sept. '19, SA	.50
Kennecott	New York	18½	17¾	17¾	Dec. '20, Q	.50
Keweenaw	Boston	...	...	1¼		
Lake Copper	Boston	...	...	2½		
La Salle	Boston	...	...	2¼		
Magma Chief	N. Y. Curb	...	...	*21		
Magma Copper	N. Y. Curb	18¾	17¾	17¾	Jan. '19, Q	.50
Majestic	Boston Curb	....	....	*10		
Mason Valley	Boston	....	....	1¼		
Mass Consolidated	Boston	1⅛	0.90	0.90	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	4	4	4		
Miami Copper	New York	17⅞	17½	17⅝	Feb. '21, Q	.50
Michigan	Boston	....	....	3		
Mohawk	Boston	47½	45¼	45¼	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5	4½	4⅞		
Nevada Consol	New York	10	9⅝	9⅝	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	14	13½	14	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....	....	*5		
North Butte	Boston	10¼	8	8½	Oct. '18, Q	.25
North Lake	Boston	....	....	*25		
Ohio Copper	N. Y. Curb	....	....	3/16		
Old Dominion	Boston	18	17	17	Dec. '18, Q	1.00
Osceola	Boston	25½	23¾	23¾	June '20, Q	.50
Phelps Dodge	Open Mar.	†180	....	....	Jan. '21, Q	2.50
Quincy	Boston	38	37½	37½	Mar. '20, Q	1.00
Ray Consolidated	New York	12¼	11⅞	12⅛	Dec. '20, Q	.25
Ray Hercules	Boston Curb	*40	*40	*40		
St. Mary's Min. Ld.	Boston	32	32	32	June '20, K	2.00
Seneca Copper	Boston	15½	15	15⅛		
Shannon	Boston	1	1	1	Nov. '17, Q	.25
Shattuck Arizona	New York	6	5½	5½	Jan. '20, Q	.25
South Lake	Boston	....	....	1½		
Superior Copper	Boston	.		3	Apr. '17,	1.00
Superior & Boston	Boston	2	1¾	1⅞		
Tenn. C. & C. cfs.	New York	8	7⅜	8	May '18, I	1.00
Toulumne	Boston	*50	*48	*50	May '13,	.10
United Verde Ex.	Boston Curb	25	23¾	23⅝	Feb. '21, Q	.50
Utah Consol	Boston	4	3½	3½	Sept. '18,	.25
Utah Copper	New York	49⅞	47¼	47¼	Mar. '21, Q	1.00
Utah M. & T.	Boston	1⅞	1½	1½	Dec. '17,	.30
Victoria	Boston	.		1 7/16		
Winona	Boston	.	..	*50		
Wolverine	Boston	12	11	11		
		NICKEL-COPPER				
Internat. Nickel	New York	15⅜	14⅝	15	Mar. '19,	.50
Internat. Nickel, pf.	New York	.	...	80	Feb. '21, Q	1.50
		LEAD				
National Lead	New York	72¾	71½	72¾	Mar. '21, Q	1.50
National Lead, pfd.	New York	102¼	102⅛	102¼	Mar. '21, Q	1.75
St. Joseph Lead	New York	12	11⅞	11⅞	Mar. '21, Q	.25
Stewart Mining	Boston Curb		...	*6	Dec. '15,	.05
		ZINC				
Am. Z. L. & S.	New York	9	8¾	9	May '20,	1.00
Am. Z. L. & S, pfd.	New York	28	27	28	Nov. '20, Q	1.50
Butte C. & Z.	New York	4	4¼	4¼	June '18,	.50
Butte & Superior	New York	12	12	12¼	Sept. '20,	1.25
Callahan Zn-Ld.	New York	5	5	5	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb	138½	138½	138½	Feb. '21, Q	2.00
Success	N. Y. Curb	*3	*2	*2	July '16,	.03
Yellow Pine	Los Angeles	‡		*50	Sept. '20, Q	.03

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra

Stock	Exch.	High	Low	Last	Last Div.	
		GOLD				
Alaska Gold	New York	1¼	1⅛	1⅛		
Alaska Juneau	New York	1⅝	1½	1⅝		
Carson Hill	N. Y. Curb.	....	....	22¾		
Cresson Consol. G.	N. Y. Curb	1⅛	1 1/16	1⅛	June '20, Q	$0.10
Dome Extension	Toronto	*57½	*57½	*57½		
Dome Mines	New York	16¼	15½	16	Jan. '21, Q	.25
Golden Cycle	Colo. Sprgs.	†*66	†*64	*65	Dec. '20, Q	.02
Goldfield Consol	N. Y. Curb	*9	*7	*8	Dec. '19,	.05
Hollinger Consol	Toronto	6.95	6.75	6.94	Feb. '21, M	.05
Homestake Mining	New York	60	55	60	Sept. '19,	.50
Kirkland Lake	Toronto	*49½	*49½	*49½		
Lake Shore	Toronto	1.16	1.15	1.15	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	1.96	1.92	1.95	Jan. '21, K	.05
Porcupine Crown	Toronto	*21	*21	*21	July '17,	.03
Portland	Colo. Sprgs.	†*47	†*43	*45	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*5	*3	*4	May '19,	.05
Silver Pick	N. Y. Curb	*6	*4	*5½		
Teck Hughes	Toronto	*10	*10	*10		
Tom Reed	Los Angeles	‡....	....	1.26	Dec. '19,	.02
United Eastern	N. Y. Curb	2⅞	2 9/16	2 11/16	Jan. '21, Q	.15
Vindicator Consol	Colo. Sprgs.	†*19	†*18	*19	Jan. '20 Q	.01
West Dome Consol.	Toronto	*7	*7	*7		
White Caps Mining	N. Y. Curb	*8½	*7	*8½		
Yukon Gold	Boston Curb	....	....	1	June '18,	.02½
		SILVER				
Arizona Silver	Boston Curb	*17	*15	*15	Apr. '20, M	.03
Batopilas Mining	New York	¾	¾	¾	Dec. '07, I	.12½
Beaver Consol	Toronto	*37½	*37½	*37½	May '20, K	.03
Coniagas	Toronto	....	....	2.00	Nov. '20, Q	.12½
Crown Reserve	Toronto	....	....	*16	Jan. '17,	.05
Kerr Lake	Boston	....	....	2⅜	Jan. '21, Q	.12½
La Rose	Toronto	*23	*22	*22	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	....	....	*30	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.00	1.00	1.00	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	8	7¼	7¾	Jan. '21, QX	.50
Ontario Silver	New York	....	....	4⅞	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	1 7/16	1⅜	1 7/16	Jan. '12,	.10
Peterson Lake	Toronto	....	....	*7	Jan. '17,	.01½
Temiskaming	Toronto	....	....	*24½	Jan. '20, K	.04
Trethewey	Toronto	*15	*15	*15	Jan. '19,	.05
		GOLD AND SILVER				
Atlanta	N. Y. Curb	*2	*1	*1½		
Barnes-King	Butte	‡....	....	1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*66	*59	*64		
Cashboy	N. Y. Curb	*8	*7	*8		
El Salvador	N. Y. Curb	⅜	5/16	⅜		
Jim Butler	N. Y. Curb	*16	*13	*14	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*8½	*6	*8	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	¼		
MacNamara M. & M.	N. Y. Curb	*16	*15	*15	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1⅝	1 7/16	1½	Jan. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1 5/16	1 3/16	1 5/16		
Tonopah-Extension	N. Y. Curb	1½	1 5/16	1 7/16	Jan. '21, Q	.05
Tonopah Mining	N. Y. Curb	1½	1⅜	1½	Oct. '20, SA	.05
West End Consol	N. Y. Curb	1 1/16	1	1 1/16	Dec. '19, SA	.05
		SILVER-LEAD				
Caledonia	N.Y. Curb	*12	*10	*11½	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	....	....	1.10	Dec. '20,	.15
Chief Consolidated	Boston Curb	2½	2½	2½	Feb. '21, Q	.05
Consol. M. & S.	Montreal	19	18	18	Oct. '20, Q	.62½
Daly Mining	Salt Lake	....	....	2.50	July '20, Q	.10
Daly-West	Boston	....	....	3	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	....	....	2⅛	Dec. '20, K	.25
Electric Point	Spokane	*7	*7	*7	May '20, SA	.03
Federal M. & S.	New York	9	8¼	9	Jan. '09,	1.50
Federal M. & S., pfd.	New York	25	25	25	Mar. '21, Q	1.00
Florence Silver	Spokane	*17	*16	*16	Apr. '19,	.01½
Grand Central	Salt Lake	....	....	*37½	June '20, K	.03
Hecla Mining	N. Y. Curb	4	3¾	3⅞	Mar. '21, Q	.15
Iron Blossom	N. Y. Curb	*20	*17	*18	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	....	....	3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*8	*6½	*7½		
Prince Consol	N. Y. Curb	5/16	¼	5/16	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*6½	*6	*6	Feb. '19,	.01
Rex Consol	N. Y. Curb	*8	*7	*8		
South Hecla	Salt Lake	*80	*68	*80	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*20	*20	*20	Oct. '17,	.05
Tamarack-Custer	Spokane	1.80	1.50	1.80	Jan. '21, K	.04
Tintic Standard	Salt Lake	3.00	2.70	3.00	June '20, Q	.10
Utah Apex	Boston	2¼	2 1/16	2 1/16	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*4	*3	*4	Nov. '17,	.01
		QUICKSILVER				
New Idria	Boston	....	....	*95	Jan. '19,	.25
		VANADIUM				
Vanadium Corp.	New York	31½	27	31	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal	78	75¼	75½	Jan. '21, QX	3.50
Asbestos Corp., pfd.	Montreal	90	90	90	Jan. '21, QX	3.75
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref.	New York	40⅞	36⅞	36⅞	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf.	New York	76¼	74⅞	74¼	Mar. '21, Q	1.75
Am. Sm. pf. A	New York	64½	63¾	64½	Jan. '21, Q	1.50
U. S. Sm. R. & M.	New York	30¾	29¾	29⅞	Jan. '21, Q	.50
U S Sm. R & M. pf.	Boston	43	41¾	42¼	Jan. '21, Q	.87½

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Popularizing Science

IN RECENT YEARS the demand on the part of the public for information of a popular character concerning the progress of science has been continually increasing. This demand has even been appreciated by the various Government research bureaus, and efforts have been made to popularize their publications, but thus far with indifferent success. The concise detailed form of the Government scientific report has become almost unintelligible to many of the people whom it was intended to assist.

Although, to some extent, research work for the sake of the discovery of new facts with no regard to their application is subsidized by the Government, the major part of the work is supported because of its practical utility. There is, consequently, an obligation resting upon the workers to have their contributions expressed in the most readable form, although it must be admitted that such obligations are not always accorded due consideration. Little progress has thus far been made in popularizing the Government scientific publications, and quotations of abstruse technical verbiage, meaningless to the ordinary person, are often made in periodicals for the purpose of ridiculing Government research work.

When the scientific investigator has endeavored to write for the layman he has frequently found it difficult to express his ideas accurately without the use of his technical vocabulary, and the defining of all the technical terms has often so seriously encumbered his article as to make it uninteresting to the casual reader. When the "hack writer," after reading a few articles or interviewing some prominent research worker, has tried to inform the public of the new and startling discoveries of science, the results in many cases have been ludicrous. Non-important matters have been mistaken for important ones, facts and theories have been confused, gross exaggerations, due to the too vivid imagination of the writer, and a general lack of proper discrimination have been the rule rather than the exception. Articles by the non-scientific writer are not all bad, and many of the popular descriptions of new researches in the supplements of our Sunday newspapers are of great value, but too frequently they are so misleading as to embarrass the scientific investigator and to seriously discredit him among his fellow workers.

Notwithstanding these difficulties, it is generally recognized that some way must be devised by which the intelligent reading public may become acquainted with the new developments of science. Apparently this must be done by means of articles written as far as possible in non-technical language. If in addition this can be done by the usage of a distinctly literary style, the results will be far-reaching in their effects. It may well be that the time will soon arrive when research workers will be made to feel that the acquisition of a simple readable style is as important as the ability to conduct research for the purpose of adding to the sum of human knowledge. At least it is to be hoped that some of the most glaring defects of present-day scientific contributions may be overcome.

An interesting example of the work of a distinctly literary man in the field of science is afforded by H. G. Wells in his recently published "Outline of History," in which there is a résumé of the entire field of Historical Geology. In the preface the writer states that "his disqualifications are manifest," but adds that every chapter in the work has been revised by a "more competent person than himself," and whom he seems to have regarded as properly qualified for the task.

Notwithstanding the fact that the work bears evidence of considerable preparation by extensive reading, and that the style is far superior to that of our ordinary books on geology, the result is far from satisfactory, and seems to show the necessity of having our geological literature popularized by geologists rather than by literary people who seek to inform themselves by a short course of intensive reading. The literature of geology is too vast to permit one to master it sufficiently to write such a review as Mr. Wells has prepared without the expenditure of far more time than he evidently had at his disposal.

Admittedly, when an author reviews the history of the world from the beginning of geologic time to the present in two 600-page octavo volumes he is to be excused for dogmatic assertions and the failure to include many of the numerous theories of science, but it is unfortunate when preference is given to discredited or at least unsatisfactory theories. The observant reader must be surprised to learn in Mr. Wells' work that the nebular hypothesis is accepted without question as the correct explanation of the origin of our solar system; that *Eozoon Canadense* "is nothing more than a crystalline marking"; and that the Pleistocene Ice-Age was brought about by the greater ellipticity of the earth's orbit, the change in the obliquity of the equator to the orbit, and the precession of the equinoxes. Other errors have crept in, despite the critical reading of his scientific friends. Nevertheless, we commend Mr. Wells for his courage in undertaking such a monumental task, but in regard to the facts of geologic history we are still waiting for the accurate and popular literary account.

Standardization

WE HAVE BEEN HEARING a great deal about standardization during the last few years, but the movement has not progressed very far in actual practice. Theoretically, the elimination of a multiplicity of styles and shapes would certainly make for efficiency and economy of production, and we should be that much better off. Are we, however, willing to have ourselves and our business standardized? Any degree of [illegible] is easily possible, if we desire it. The fact that there is still an endless variety of all manufactured articles makes it proper to question whether we want standardization.

Take men's clothing, for example: there are hundreds of patterns, each of which demands separate adjustments of machinery, with waste of time and material. If we could reduce the patterns to twenty, instead of many hundreds, the cloth would be much cheaper, and as good; and clothing would come down. Standardized homes would mean cheaper homes. We should pay less rent. Standardized brands and sizes of groceries would mean that we should get our foods cheaper. In operating mines, reduction of the number of sizes of tracks, locomotives, nuts, bolts, jigs, stamps, and other devices would enable quantity production on the part of the manufacturer; we should mine more cheaply, and the price of metal would come down.

All this means that the average man would make more money—perhaps. What would he do with it—or what would his wife do with it? What does anybody do with money? Those who possess it spend it on a minimum of necessities and a maximum of luxuries. The definition for an acceptable and desirable luxury is that it be *not standardized*—indeed, that it be distinctive and "different." When your wife buys a dress, or when you buy a suit, she likes to think or you like to think that the cloth is a special weave, and that the modiste or the tailor has secured from France or from England only enough for one dress or one suit. Both she and you are willing to pay for this reactionary feeling against standardization. That is the psychological necessity, as potent in the world as the material need—yes, much more potent. Rare and costly articles, clothes, jewelry, works of art, variety of diversion, of language, of education, are the things for which the real struggles are made. In a prison, or a like institution, one gets real standardization of clothes, food, and life.

In industry also, in machinery, it is a question whether an unnatural urge toward standardization would not mean a loss of flexibility and a decrease of ingenuity and invention. Certainly, we shall have to go slow, if we are not to injure the advantages of individuality. For those who are interested in the advantages gained from standardization we recommend the adoption of the metric system. After that is accomplished, we can decide what to adopt next; but the expectation of universal standardization all at once would appear to be a will-o'-the-wisp.

Power in the Mining Industry

A RECENT SURVEY of the power situation in the United States showed that 277 mining companies which replied to questionnaires were using as prime movers electric motors developing 204,268 hp., steam engines developing 176,272 hp., internal-combustion engines developing 17,601 hp., and water wheels furnishing the negligible amount of 1,000 hp. The respective percentages were 51.2, 44.2, 4.4, and 0.2. Electric power has demonstrated its superiority despite such handicaps as water shortage and high cost of coal. Mining companies are buying their power when they can, and, in general, increasing power rates have caused no inclination on their part to install their own plants. Apparently there are more believers in electric power than ever before. Bought power has proved itself the most reliable and satisfactory, and, in most cases, just as cheap as or cheaper than any that the consumers could themselves generate.

It is interesting to note the manner in which conditions differ throughout the country. In the copper district of northern Michigan there are no hydro-electric installations, all power, instead, being generated by steam and for the most part by the mining companies themselves. In recent years low-pressure and mixed-pressure steam turbines using exhaust steam from the large steam stamps have come into use. The great quantity of water used in the concentrators makes available an abundance needed for cooling in the condenser equipment. On the Mesabi Range all companies buy power save the Oliver and on the Cuyuna Range about 80 per cent of them. Similarly, in Wisconsin all operators buy, although protesting against a temporary raise in rates.

In southeast Missouri the mining companies have their own plants, using cheap Illinois coal. Here there are no hydro-electric installations. In the Joplin district there is a large power company with two hydro-electric plants and one auxiliary steam plant, and the zinc companies find it cheaper to buy than to generate. In Arkansas the mines provide their own power. In the Black Hills of South Dakota the Homestake company has two hydro-electric installations, and the other companies generate their own power by other means. In the mountains of Colorado power transmitted at high tension has easily proved itself superior where the topography is rugged and the winter severe. At Leadville, electricity is being substituted for steam when operations long suspended are being resumed.

In Utah, Montana, and Idaho the operator finds power conditions much the same, in general buying his power. In Washington the situation is somewhat mixed. Of forty operators all generating their own power seven are using straight electric, ten water, eleven steam, ten gas or distillate, and two crude oil. Here the trend is naturally to hydro-electric installations. In Arizona it is said that the question of operators generating their own power, either individually or on a co-operative basis, is receiving much attention.

Though electrical power has come to stay, it is possible that the use of oil or similar engines for intermittent operations might be found profitable, particularly for coarse crushing. The value of this idea, according to a correspondent, lies in the fact that highest efficiency from the power seller's point of view comes from steady operation and steady demand for power. This is reflected in power rates. Large consumers especially are constantly trying to average up their load, and those who are coarse crushing only part of the time have trouble. On the other hand, small operators are less able to finance the extra cost of oil-engine installation. Power companies might possibly be able to alter their rates so as to make such auxiliary equipment needless.

It seems inevitable that eventually electric power, whether generated by water or by burning coal directly at the mine and transmitted at high tension to all points, will be used by all. The progress report on the Superpower Survey made by the retiring Secretary of the Interior, John Barton Payne, in the latter part of February, indicates what can be done in the Boston-Washington industrial region. The problem of securing a larger supply of cheaper power and of fully using the country's resources, and at the same time conserving its fuel, is one that affects the mining industry, and in its solution the industry will profit.

The Diesel Engine in the Mining Field

A RECENT SURVEY, in *Power*, of the Diesel engine industry brings out the interesting fact that out of a total of more than 370,000 hp. attributed to Diesel-engine installations in the United States, somewhat over 10 per cent is utilized by mines. For the most part these are situated in the Southwest, where the present prices of fuel oil offer an advantage over the prevailing rates for coal. Another field which shows an increasing utilization of this type of prime movers is that of oil-pipe lines; in fact, compiled figures show that something over 98,000 hp., or nearly 31 per cent, is furnished by the Diesel engine in pumping stations.

There are many arguments for the use of this type, and much of the former prejudice of engineers which was based on the lack of performance of the earlier designs has been overcome. Especially is the Diesel type adapted to the small- or medium-powered central plant. The operating cost per kilowatt is considerably less than that of a steam installation, and the overhead charges, as compared with steam plants, are not excessive.

It is to be expected that petroleum prices will advance with an increased demand and decreased output, but the several predictions as to the ultimate exhaustion of the oil fields are dependent on so many factors that it is safe to assume that in favorable localities the Diesel engine will continue to hold its own on the cost sheet, as compared with the steam plant, for many years.

Homeopathic Treatment Fails The Copper Producers

ONLY COMPLICATED CALCULATIONS will show whether or not a mining or metallurgical enterprise should be kept in operation when it is losing money. Not only must known factors be considered carefully by competent executives clothed with the responsibility of rendering a decision, but the unknown future of demand and prices must be intelligently prognosticated. Even though many years of loss are in prospect, it may still be advisable to keep a plant running.

For some time, careful students of the metal market have believed that copper production should be curtailed to a much greater extent than has heretofore been considered necessary. Most of these men have no understanding of the difficulties of further curtailment or complete shutdown, and the common idea seems to be that the only important thing to consider is the possibility of the mine filling with water. Deterioration is an unknown factor to which they give little thought, and the economic and social problems which usually worry the management more than any other are not mentioned. But as interpreters of the law of supply and demand, their opinions merit attention, and are no doubt being given proper weight in determining policies of complete cessation of operation.

We are sorry to see conditions in the copper market so bad that practically all of the largest producers have either completely stopped work or are considering taking that step. But it would appear to be for the good of the industry; if production were maintained, even on the curtailed scale of the last few months, it might take years to return to proper copper price levels, for a surplus will be present for a considerable period, owing to the time required for the absorption of the large war and post-war production.

Of the companies which operated up to the close of 1919, a complete cessation of mining and smelting operations is extremely unlikely to be more than temporary. However, resumption cannot be expected as soon as the market begins to improve, for the large unsold production of the last few years must be marketed. There is little cause for hope of a resumption during 1921 by those companies now ceasing operations, in our opinion, but they are entitled to the thanks of the industry as a whole for their martyrdom.

There are two systems of medical practice: allopathy and homeopathy. If we have a fever the allopath endeavors to give us something of a cooling nature which will neutralize the fever. The homeopath, on the other hand, gives us a small dose of medicine which would normally induce a fever. The idea seems to be the same as that which prompts prescribing "a hair of the dog that bit you" for early morning disorders. Copper producers have been taking the homeopathic treatment. It has failed, and now the allopaths are being consulted.

The Copper Fabricator Disclaims Responsibility for High Prices

THIS WEEK we are including in the communications published under the heading "What Others Think" an anonymous contribution to the discussion of the high prices of copper products. Ordinarily we pay no attention to unsigned communications, but in this instance we believe the letter to be worth printing. We regret that space limitations make it necessary to omit certain relatively unimportant portions.

On reading the first paragraph we had hoped that someone had risen to explain some of the questions which we have asked in previous editorials, but it seems that the writer has sought only to absolve the large copper manufacturing interests from blame for the present condition of the copper market. Nowhere is any reason given or suggested as to why copper screens retail at 15c. per sq.ft., compared with 4c. for iron, to mention only one product. Our questions still remain unanswered.

The reported sale of a piece of sheet copper by a hardware dealer in Houghton at 70c. per lb. while tons of copper were lying on the docks near by which could not be sold at 13c. per lb. is mentioned. Then comes this extraordinary statement: "How anyone can give a transaction of this kind serious consideration as a reflection of existing market conditions is remarkable, to say the least." To us, this seems the crux of the whole matter and of great importance as a condition which limits the use of copper products. If they were cheaper they could better compete with substitutes. At present they are regarded as a luxury.

At no time have we said that the fabricator was to blame for existing high prices. But *someone* between the producer of crude copper and the ultimate consumer is responsible; or if not someone, some condition. Whoever or whatever it is should be eliminated. A proper co-operation between all of the factors in the situation, from the producers to the retail dealers, should solve the problem. The matter should be actively pushed, and not allowed to drift. [illegible], when the demand for copper becomes [illegible] upon a resumption of industrial activity, there will be less incentive to develop a market. [illegible] are sold as well as bought. Why cannot the same be said for copper?

WHAT OTHERS THINK

The Copper Situation as Seen By the Fabricator

(We have received for publication the following contribution on the subject of the copper situation. As it is anonymous, we ordinarily would not give it space; nevertheless, as it presents a vigorous defense of the consumer, it is perhaps not improper to present this side of the question, although we regret that the writer has not supplied us with his identity, which would, in any case, have strengthened his position.—EDITOR.)

At frequent intervals, in various trade journals and newspapers, articles have appeared dwelling upon the unsatisfactory condition of the copper industry. Most of these have read as though they were inspired for the purpose of creating the belief that the consumption of copper has been materially reduced because those concerns who are the largest customers of the copper producers, and who convert the raw copper into commercial shapes, have been and are demanding exorbitant prices for their products.

The largest direct consumers or purchasers of copper from the copper-producing companies are those concerns engaged in the conversion of copper and alloys of copper, such as brass, Muntz metal, nickel-silver, and bronzes, into sheets, plates, rods, bars, wire, tubes, and like forms. Among these may be mentioned the American Brass Co.; Chase Rolling Mills; the Scovill Manufacturing Co.; the Bridgeport Brass Co.; the Standard Underground Cable Co.; Roebling's Sons Co.; Rome Brass & Copper Co., and the Detroit Copper & Brass Rolling Mills. Most of these concerns have large investments and able and valuable organizations. Their very existence depends upon their ability to keep producing a commodity in which copper is essential. Not a single concern of this character is engaged in the manufacture of a substitute or substitutes for items made from copper. Is it reasonable to suppose that all or any of them would deliberately fix prices on their output that would restrict its consumption? Hardly.

Let it first be understood that there is a limit, as to the price, at which articles made from copper or its alloys find a ready market. This fact was either unknown or ignored by the producers of copper and those who fix the prices for copper to the fabricators.

To illustrate: In the matter of plumbing, brass and copper pipe is brought in competition with iron pipe, which under any conditions can be sold for less than brass pipe. It is quite generally known that the life of a brass pipe is much longer than that of an iron pipe, but the item of original investment or cost enters, and where the difference in first cost is comparatively great the iron pipe is almost invariably used.

In roofing and cornice work, copper is brought in direct competition with galvanized iron, tinplate, gravel, and various composition roofings. Copper is undoubtedly superior to anything, but so high a price may be reached that its use is curtailed enormously.

Take the case of household utensils. Copper is brought in competition with tinplate, aluminum, and so-called agate or granite ware. A copper utensil will last much longer than any other, but how much more will be paid for the copper utensil than for any of the other kinds? It is contended that copper has soared in price to such an extent that its use in household utensils has been curtailed enormously, and this, no doubt, is true.

What is the cause for the so-called exorbitant prices for copper products? From various newspaper articles one would believe that the cause lies in exorbitant prices charged by those concerns that convert the raw copper into the various commercial shapes. In analyzing this particular feature, and using sheet copper as a basis, it will undoubtedly be conceded that the price of sheet copper, fundamentally, lies in the price of raw copper. What relation has the price of sheet copper borne to the price of raw copper? This, perhaps, is best demonstrated by the following tables:

PRICES OF RAW AND SHEET COPPER FOR TEN YEARS

In Cents per Pound

	Raw Copper		Sheet Copper	
	High	Low	High	Low
1910	13.80	12.20	19.00	16.65
1911	14.25	12.00	19.00	16.00
1912	17.75	13.95	23.00	19.00
1913	17.60	14.12	23.00	19.75
1914	14.87	11.10	20.25	16.50
1915	23.00	12.80	27.50	18.75
1916	36.00	23.00	42.00	29.00
1917	37.00	23.50	42.00	31.50
1918	26.00	23.00	35.25	31.50
1919	23.00	14.75	33.50	22.50
1920	19.02	13.48	29.50	22.50

Although it is true that, fundamentally, the price of sheet copper is governed by the price of raw copper, there also enter into the cost of sheet copper other items, manufacturing costs, which include labor; the cost of fuel, lumber, and supplies of all kinds. It is difficult to secure comparative quotations on these items, but figures obtained from a leading mill are given below, which show the differences prevailing as of July 1, 1914, and Sept. 1, 1920:

COSTS OF LABOR AND SUPPLIES IN 1920 AND 1914

	July 1, 1914	Sept 1, 1920	Increase, per Cent
Coal, per ton	$2.20	$10.80	391
Coke, per ton	4.50	15.75	250
Fuel oil, per bbl	3.25	11.50	254
Lumber, per 1,000 ft	19.00	51.00	169
Miscellaneous supplies	.....	.....	123

For the same periods the following advances appear in wage rates:

	Increase per Cent
Common or general labor	244
Mechanical labor	151
Direct sheet copper-mill labor	261

On Sept. 1, 1920, the price for copper was 18½c., and on Sept. 1, 1920, the published base price for sheet copper was 29½c., a spread of 11c. In February, 1921, leading sellers of copper were quoting 13c. per lb., and the base price of sheet copper was 20½c. per lb., showing a spread of 7½c. per lb., which would indicate that the fabricators, by reducing their spread, were doing what they could to meet the conditions with which they were confronted.

Note that in 1917 the price of raw copper reached

37c. per lb., or, in other words, in three years it had more than tripled in price. To what was this enormous increase due? In these three years the cost of labor to the producers had not tripled, neither had there been such an increase in the cost of fuel or supplies that enter into the copper-mining industry. The Great War started in 1914, and with it came the demand for copper which was absolutely essential in the manufacture of ammunition. It is safe to say that mining companies, finding themselves confronted with a demand unparalleled, lost sight of the normality of the copper industry. They forgot all about the future, or the time when war needs would be over, and simply took all that war necessities made it possible for them to take.

Not only did high prices for copper in 1916 and 1917 lead to the use of substitutes for manufactures of copper, but this was intensified by Government action when fabricators were prohibited from disposing of any of their products unless they were for use in war work. Every order emanating from any source other than Government departments had to be submitted to the Brass Section of the War Industries Board for approval or disapproval, which resulted in many consumers of copper products being denied their requirements, and these consumers at once sought substitutes. Steel, in various shapes, either brass or copper plated, found a market where it was never thought of before, and in many cases steel is so firmly intrenched that it will be very difficult, if possible at all, to dislodge it, as there is hardly a chance that copper or brass articles can be produced at a cost anywhere near the cost of steel.

That the producers of copper should note with alarm the shrinkage in the demand for copper can be easily understood, but it is difficult to understand why, in their efforts to seek the cause, and find, if possible, some remedy, they should lose sight of every other element and factor and attribute all their alleged troubles to their largest customers, whose very existence lies in their consuming the largest amount of copper possible.

No merchandising proposition in the copper industry of recent years has been given more publicity than the alleged sale of a piece of sheet copper by a hardware dealer in Houghton, Mich., at around 70c. per lb., while, it is claimed, tons of copper were lying on the docks within a stone's throw of the hardware store, which mining companies were unable to sell at 13c. per lb. It is cited as a typical case of where, somewhere between the mining company and the ultimate consumer, 57c. per lb. was absorbed. How any one can give a transaction of this kind serious consideration as a reflection of market conditions is remarkable, to say the least.

Fabricators have been charged with unfairness, and of being guilty of a policy that has embarrassed and worked a hardship upon the producers, by reason of their unwillingness to purchase copper in anticipation of possible future requirements, and carry same in their yards or warehouses. It has been pointed out that prior to the war it was the practice of fabricators to carry liberal quantites of copper in stock, but this policy had been discontinued, with the result that producers were compelled to carry millions of pounds which formerly were carried by the fabricators. The answer is a simple one: the fabricators had a better knowledge of the underlying conditions than did the producers. They knew of the enormous quantities of secondary metals that would have to be absorbed, they knew that, on account of high prices, substitutes were being extensively used, and their purchases were being prompted by this knowledge, and still they were criticised for displaying just ordinary business intelligence.

The consumption of copper has decreased, but do not accuse fabricators of "killing the only goose that lays their eggs." The men who dictate the policies of the fabricating companies should be given credit for ordinary business intelligence; their past achievements entitle them to this at least. Instead of spreading broadcast the incident of the hardware dealer who charged 70c. per lb. for perhaps five pounds of sheet copper, as conclusive evidence that some one is charging prices that are to a serious extent curtailing the consumption, and insinuating that the brass and copper mills, which are the producers' largest customers and the natural outlet for perhaps 80 per cent of the copper consumed, are charging prices that result in curtailment of their regular and only business, why do not those men who shape the policies of the mining companies sit in with those who operate the copper mills, and indulge in a heart-to-heart showdown, and in this way find out actual conditions, the causes and remedies, if any? It must be evident that the interests of these two factors, the producer and the fabricator, are almost identical.

There has been under consideration the formation of an organization—a Copper Institute—the membership to be made up of copper producers and copper consumers; in fact, every one directly interested in copper in its various angles. It is believed by those who have given the subject serious consideration, that, by such an organization, if conducted along lines that would bring about active participation of the "big men" of all the elements, much could be accomplished for the good of the copper industry; but if, in an organization of this kind, the "big men," the dictating factors, the men with authority, will only lend their names, and delegate subordinates with no authority, with no knowledge of the needs of the industry, to handle the active work of the organization, it would be a waste of time even to consider it.

The rehabilitation of the copper-producing and copper-fabricating industry is a business proposition pure and simple that can be handled by business men if they will go about it in a businesslike manner. The industry awaits the appearance of a sincere and concrete movement, aiming to a betterment of conditions. The time is ripe. Will those who should be most interested grasp the opportunity?

A Pronunciation Echo

A user of our Century Dictionary at Palo Alto has lately called our attention to an article in *Engineering and Mining Journal* of Dec. 11, 1920, on page 1115, on the pronunciation of the word "bauxite." We procured a copy today, but find that the article is only one of a number which have dealt with the subject. As we are sending to press some material in which we wish to give the correct pronunciation of the word, we ask if you will let us know the ultimate decision as to the *English* pronunciation. An authority quoted in your Dec. 11 issue says "boxite." Does this mean bōke′sīt (long o) or bawk′sīt? Or is it possible that *bauxite* has become shortened in sound to box′it (o as in [illegible])?

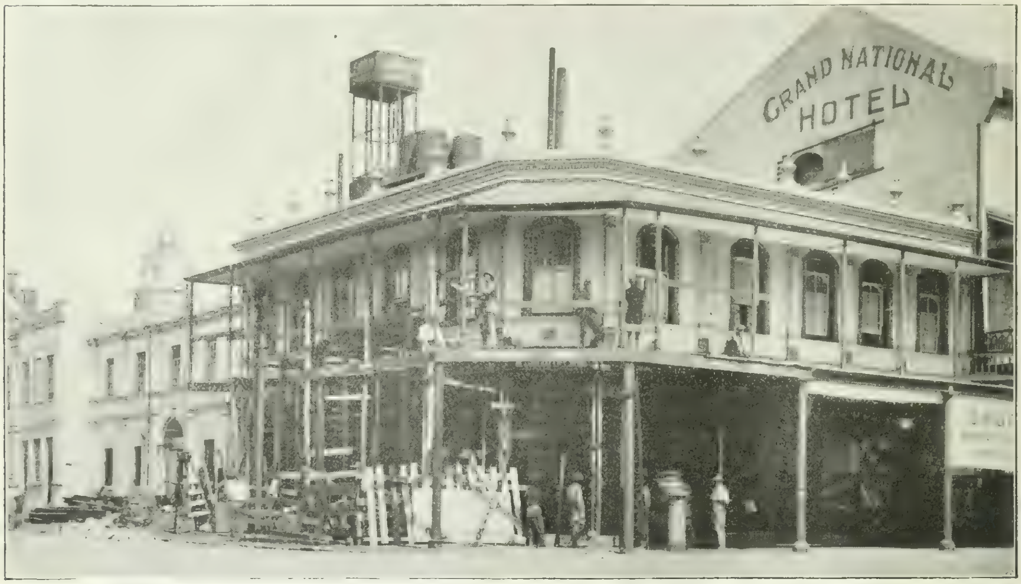
New York

THE CENTURY CO.

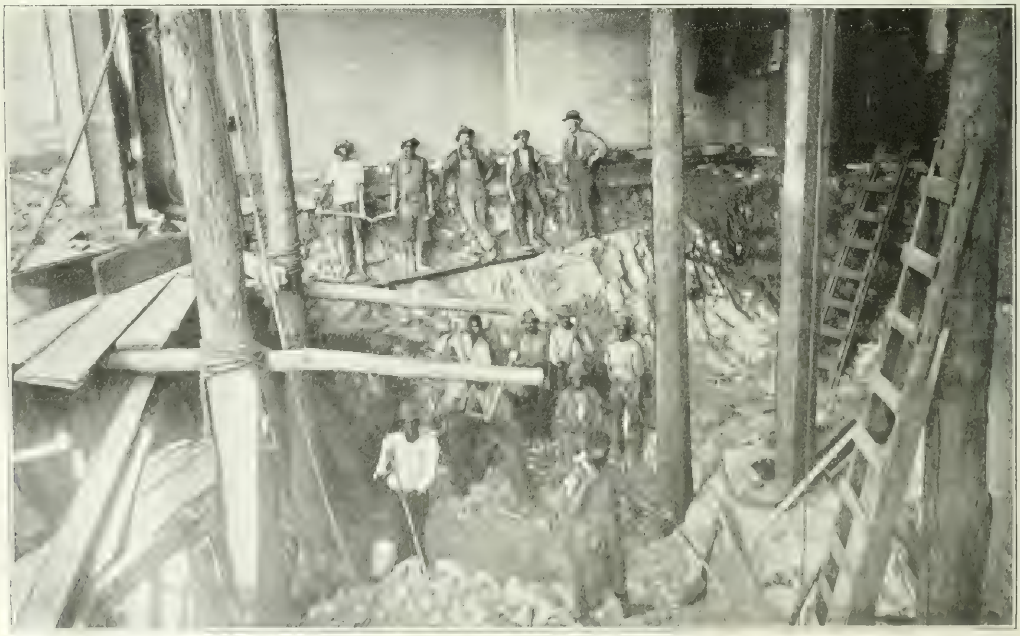
H. G. Emery, Dictionary Department.

In reply to this inquiry we would say as follows: "The current American pronunciation seems to be practically exclusively bŏx′īte."—EDITOR.

Photos From the Transvaal



THE GRAND NATIONAL HOTEL, JOHANNESBURG, ON WHICH REPAIRS WERE RECENTLY MADE
During the work of excavation, what is believed to be a part of the Main Reef was discovered.



DISCOVERY OF THE GOLD REEF WAS MADE IN THIS EXCAVATION

THE 300-STAMP MILL AT SIMMER DEEP, WHICH IS BEING MOVED TO THE MODDERFONTEIN EAST, ON THE WITWATERSRAND

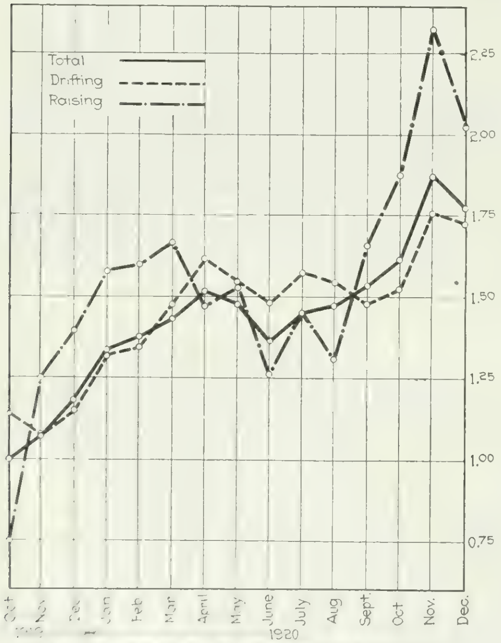
PART OF THE WORK OF MOVING THE STAMP MILL OF THE SIMMER DEEP, LTD., AND [illegible]

Development Methods at Morenci Branch Of Phelps Dodge Corporation

Conclusions Reached as the Result of Work Conducted by This Company In Carrying on an Intensive Campaign of Operations Show the Advantages Of a Bonus System and the Importance of Careful Training for the Men

BY JOSEPH P. HODGSON AND P. B. LORD
Written for *Engineering and Mining Journal*

THE mines, concentrator, and smelter of the Phelps Dodge Corporation at Morenci, Ariz., were operated almost continuously for thirty-eight years until placed upon a non-productive basis on Sept. 15, 1919, at which time an intensive development campaign was initiated. The principal reasons for this step were: The depressed condition of the copper market after the armistice; the interference with the prosecution of necessary development during the years 1915 to 1919 by strikes and scarcity of labor; the necessity of keeping production at a maximum during the war period, thus making it virtually impossible to do enough development work to maintain satisfactory reserves; and the decrease in the copper content, which made it necessary, for the future successful operation of the properties, either to increase largely the reserves of fair-grade ore or to develop a sufficient tonnage of lower-grade ores to warrant the erection of new plants or enlarging existing equipment.



FEET PER MAN PER SHIFT IN DRIFTING AND RAISING OPERATIONS

During the period from Oct. 1, 1919, to Dec. 31, 1920, there was driven 69,725 ft., or 13.2 miles, of drifting and raising. It was felt at the outset that on account of the relatively small amount of development work which had been done for several years prior to the cessation of production, it was necessary carefully to train both bosses and men in approved methods to assure satisfactory results. About 78 per cent of the men employed underground at the property were Mexicans, the rest being Italians and Spaniards. The foremen and bosses were Americans.

Drilling methods and types of rounds had been extensively studied by the Copper Queen staff during the time Mr. Hodgson was mine superintendent there, and as this work had been continued with great success under the able supervision of Gerald Sherman and Arthur Notman, it was decided to secure one of the best practical drill instructors from the Copper Queen branch of the corporation. Much credit is due to E. E. Burgess, who was loaned by the Copper Queen branch, and also to Foremen Bennetts and Chesterfield, as well as to the shift bosses, for such success as was attained.

It was decided that every shift boss should take training under the drill instructor, for the management felt that to instruct the men intelligently the bosses must first be proficient. The bosses willingly consented to the plan, and were placed with the drill instructor until he was satisfied they were thoroughly competent to do the work. This training required from one to two weeks for each boss. They were trained one at a time, together with two miners, in as many working faces. This initial training consumed about three months.

GROUND UNIFORM, FOR PRACTICAL PURPOSES

No exhaustive classification of ground was attempted, for in general the ground is neither excessively hard nor very soft. As compared with the Copper Queen classification, for instance, at which branch the ground ranges from Class "A-plus," the hardest ground, to Class "D-minus," the softest, the hardest ground at Morenci would probably compare to the Copper Queen Class "B" and the softer ground to Copper Queen Class "C-minus." The Morenci ores are almost entirely porphyritic, very little being in the limestone; hence the range of density and hardness does not run to the extreme. In general, the softer ground is in the Arizona Central and Colorado mines, and the hardest ground in the Ryerson and Yankie mines.

It was decided that none of the heavier types of drilling machines were necessary for development purpose at Morenci, so those in use were retired. For drives in hard ground it developed that the Waugh Clipper No. 50 was the best, and for medium ground the Ingersoll-Rand Jackhamer B. C. R. W. No. 430 was most satisfactory. These drills, all being of the water type, were mounted when used in hard ground and were supported when used in soft ground by a device invented and patented by one of the shift bosses. No dry drills were used in drifting. For raise work, the Waugh No. 73 and the Ingersoll-Rand CC-11 and BC-21, equipped with sprays to allay the dust, were employed.

Hexagon hollow ⅞-in. steel with double-taper bit was used in the drifting machines, and 1-in. grooved solid steel with a similar bit was used by the stoper machines in raises. This simplified the steel problem, as it was necessary to use only two types of steel in the entire operations.

Compressed air for drilling purposes was provided by a 6,400-ft. Nordberg Carels Diesel compressor carrying 98 lb. pressure at the power house, the pressure at the drills varying from 85 to 92 lb., according to the size and friction in the air lines. The powder used was Hercules 1-in. ammonia, 40 per cent and 30 per cent, with some 60 per cent and 40 per cent gelatin in the hard drifts. Consumption of powder varied from 6.1 lb. per foot in November, 1919, the highest, to 4.4 lb. in October, 1920. Tamping, or stemming, consisting of sand in paper cartridge sacks, was used in all headings.

The daily rate for timbermen and mounted machine runners was $4.98, for miners $4.79, and for muckers $4.08, for the period covered in this article.

OPPOSITION TO CONTRACT SYSTEM OVERCOME

About 92.3 per cent of the work was performed on contract and the remainder by company account. The daily rate of wages was guaranteed to the contractors. Labor was very difficult to handle, on account of conditions obtaining at the property after the war, as during that period it had been impossible to enforce discipline, men being very scarce and very independent. Practically all work theretofore had been conducted upon the company-account plan, so that the well-known union opposition to piecework had to be overcome. However, it developed that as the contractors' earnings gradually increased, practically all opposition was withdrawn.

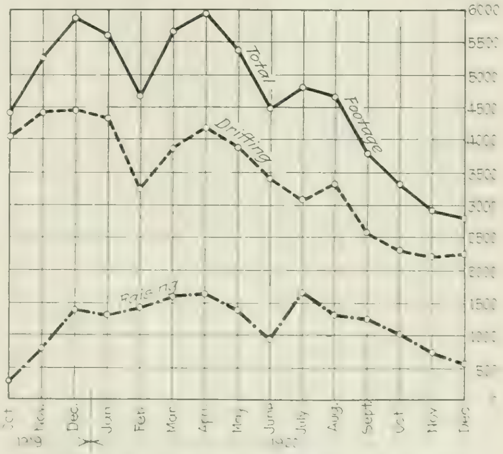
A map was prepared projecting the development work to be done in the different parts of the property, and calculations were made of the speed that should be made monthly in every heading or face, and were noted upon the map. The actual advance made in each face was also placed thereon. If a drift or drifts were behind the schedule, the reason was ascertained if possible. It might be because a strata of ground harder than usual was encountered, or because a miner was not quite up to the average in drilling methods, or, possibly, because the mucking was not being done properly. This map was found very beneficial to the staff, as it was possible to keep a close check upon the advance made, and it assisted, as well, to visualize the work. It was quite surprising how closely the work as predicated upon the map was carried out.

MEETINGS FOR DISCUSSION ADVANTAGEOUS

Weekly meetings of the heads of departments were held, at which discussions or criticisms of the work were invited. Monthly meetings of department heads, engineering department, foremen and bosses, and other operating officials, were also held for the purpose of discussing the different phases of the entire operations. At these gatherings papers bearing upon different parts of the work were read and discussed. The meetings were very helpful, in that every department had an opportunity to acquire the necessary knowledge of the operations and of its relation to them.

Each face was measured daily, the advance was reported, and daily cost tabulations were made, this information being supplied to the foremen and bosses. This was of great assistance, as it provided them with quick and reliable information, both as to advance and costs.

The standard size of untimbered level drifts was 5 ft. x 7 ft., with the exception of a few haulage drifts 5½ ft. x 8 ft. Stope development drifts in the Arizona Central division were 4 ft. x 6 ft. Raises were driven 6 ft. x 4 ft. over-all with a lagged manway 2 ft. x 4 ft. Stope development raises less than 50 ft. in height were 3 ft. in diameter, with no manway, but timbered raises with four-post 5-ft. center sets were provided, with a lagged manway 4 ft. 8 in. x 1 ft. 6 in. Winzing constituted less than 1.5 per cent of the total footage driven, and for that reason is not considered in this article. Timbered headings, both drifts and raises, constituting less than 10 per cent of the total footage, included all drifts timbered within four months of the time driven, the shifts in such operations being charged to the heading and forming a part of the total advance per man-shift for that period.

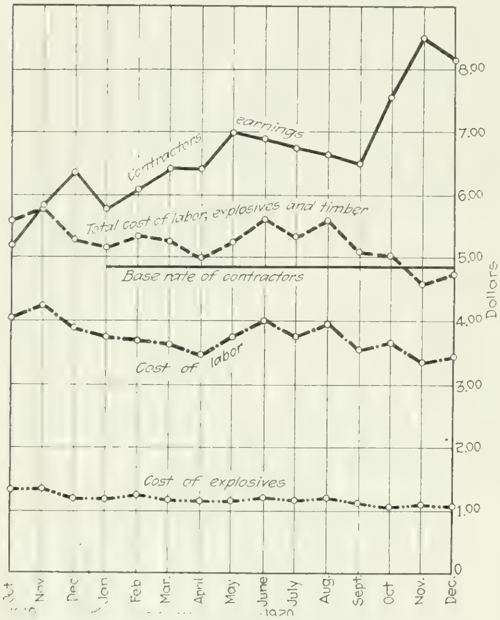


FOOTAGE BY MONTHS IN DRIFTING AND RAISING

CONSIDERATION OF BONUS SYSTEM

At the beginning of the development campaign it was deemed advisable to place as much work as possible on a contract or bonus basis. The following factors were considered in formulating a system: First, the necessity and the justice of guaranteeing every man day's pay; second, the temperament of Mexican laborers, which makes them suspicious of any bonus system in which the unit price is constantly varied; third, the advisability of placing the unit price sufficiently low, so that as men increased in proficiency under instruction it would not be necessary for it to be reduced; fourth, the uniform character of ground in a few large sections of the mines, which would necessitate only three or four rates for the same sized headings.

The plan adopted might be called a bonus system as distinguished from the straight contract, as all men were guaranteed day's pay. It was possible to divide the ground broadly into three classifications as regards hardness, drilling speed, breaking qualities, and other working factors, calling for three different rates, and in general to confine these to separate sections. The price per foot included the cost of explosives, drilling, mucking, and tramming, the latter very seldom exceeding 150 ft. Each heading was regarded as a separate contract. The company deducted from the contractor's settlement the expense of explosives and mucking labor, this latter being figured at day's pay rate for muckers. Settlements were made on engineers' measurements twice a month.



CONTRACTORS' EARNINGS PER SHIFT PER FOOT AND COSTS ON ADVANCE WORK

For the first three or four months the number of faces in which it was necessary to make up day's pay was rather high, but these decreased to a small percentage as the men improved in breaking ground. Only one general cut was made in the first rate established, which was in the Arizona Central division, where experience proved the initial price had been placed too high. It may be stated here that extreme care is necessary in first establishing a rate of a piece of work, as later reductions are highly injurious to the confidence and morale of the men.

It is realized that this system is not perfect, the principal objection being the lack of flexibility which would enable the company to share in the advantages to be gained from improved methods or equipment without lowering the contract rate. In ground which was more changeable from day to day in breaking qualities and other working conditions, it might be necessary to use a bonus system with frequent classification of ground, as at the Copper Queen branch, even though this involves considerable expense. However, it is felt that in general the practice here has proved satisfactory in operation, to both the men and the company.

The accompanying graphs illustrate the total footage, footage by classes, feet per man-shift, cost of labor and explosives of men on advance work, and contractor's earnings for the period under discussion.

The work may be divided into three periods: From Oct. 1, 1919, to May 15, 1920; from May 15, 1920, to Sept. 1, 1920, and from Sept. 1, 1920, to the end of the year.

In the first period the maximum amount of footage was driven each month with the labor available. This included both prospect work and stope development, the latter reaching a maximum in April of 31 per cent of the total. The feet per man shift steadily increased and the cost per foot decreased. The monthly footage and the contractors' earnings increased, except in February, a shorter month, during which it was necessary to break in a larger number of muckers than ordinarily on machines to replace withdrawals from the force.

On May 15, 1920, all men on stope development in the Arizona Central division were transferred to the Ryerson-Yankie division. During June no stope development was done, and only a small amount in July and August. The drifts and raises in the Ryerson-Yankie division were larger than those driven in stope development, and the ground on an average harder, which was reflected in the cost curves, contractors' earnings, and footage per man-shift graphs. Less footage per month was driven during this period.

LOW COPPER MARKET FORCED CURTAILMENT LAST FALL

Beginning Sept. 1, 1920, curtailment was deemed advisable, owing to the status of the copper market, so that from this date no new men were hired, and a few were dropped. No stope development was done after Sept. 1. In this period the best results were obtained, due to the greater experience of the men and also to the fact that the men represented the pick of the organization. As a rule, increased earnings by the contractors have meant lower costs per foot to the company, as indicated by the two graphs.

From the experience gained in this work the following conclusions have been drawn:

First—Some form of contract or bonus system which will repay increased individual effort is preferable to day's pay work, both to the employer and employee. Better results are obtained if contracts are given to individuals rather than to a group of men.

Second—Careful instruction and training of men more than repays for itself in the results obtained. Some of the best machine men were developed from surface laborers after several weeks' instruction and a few months' experience underground. This is a factor of increasing importance in the mining industry of the southwest, where skilled underground labor is scarce under normal conditions. It is felt that intensive training will develop better men for stoping work, just as it has for development work.

Third—Daily cost records and progress maps and weekly and monthly conferences of bosses and foremen and department heads are advantageous for co-ordination and a better understanding of the work. That cost records can be carried to extremes in detail and expense consistent with the results obtained from them is conceded and understood, but when not carried to extreme they are of great assistance in indicating the daily progress of the work in hand.

Recent Metallurgical Practice on the Rand

Less Amenable Ores of the Far East Area Causing Changes in Long-Established Practice—So-called "All-Slime" Treatment Under Consideration—Innovations and Improvements in Precipitation Methods

Written for *Engineering and Mining Journal*

PRACTICALLY all of the development which is now taking place in the Witwatersrand gold fields, in South Africa, is confined to the Far East section of the Rand, and as the ores of this new area are developed it is becoming evident that the prevailing milling practice so long in vogue is to be subject to modifications which by contrast may appear to metallurgists as radical departures. With few exceptions, there have been practically no changes of note in metallurgical practice on the Rand for the last ten years. An exception may be mentioned in Bosqui's adoption, at the new plant of the New Modderfontein, of direct leaching in the sand collectors without transfer. Although viewed at first with considerable skepticism by other metallurgists, this simplification appears to be operating with entire satisfaction, and is likely to be adopted by other plants to be built in the near future.

FAR EAST RAND ORES REFRACTORY

The underground development of several large new properties on the Far East Rand is now reaching a point warranting milling equipment, and the design of this equipment for the efficient treatment of these ores has become a vital problem. The ores from this section of the Rand are materially different in character from those appearing in the older mines of the Central and West Rand. The pyrite is more compact and more finely disseminated. Also, there is frequent occurrence of arsenical pyrite, and the presence of nickel has been repeatedly noted. Unquestionably, the ore is of a more refractory nature and not entirely suitable to prevailing metallurgical practice. At the Geduld mine, one of the older properties situated in this area, the ore has always been recognized as presenting metallurgical difficulties, and these have become intensified in the newer properties at Modder East, Springs, West Springs, and to a somewhat less extent in the New State areas. These ores require finer grinding, and the time of contact required for a satisfactory extraction by the cyanide process is considerably prolonged.

It so happens that careful investigation into the possibilities of eliminating, or in a measure eliminating, stamps in favor of ball mills and tube mills is also being made, and, therefore, in deciding upon the new plants which are to be built in the next two or three years, the following problems are presented:

First—Somewhat finer crushing in the primary rock breakers, followed by the complete elimination of stamps, or at least by a thorough screening by which only the oversize, which would represent perhaps 25 per cent of the original ore, would be crushed by stamps. In this connection it should be noted that the stamp battery on the Rand at present is really more of the character of a breaking than a crushing device, as most of the batteries are equipped with screens having apertures of from [illegible] to [illegible] in. Starting with such a feed to the tube mills, it seems only logical that, with certain modifications, it may be possible to grind a product passing a [illegible] to [illegible]-in. ring, and eliminate stamps entirely. This is the experiment which is now being made on a working scale. The principal modification being tried is to enlarge the aperture in the discharge grates of the tubes, allowing a considerable amount of partially rounded, unground material to leave the mill. This material is screened from the pulp as usual, but, being in much greater quantity, it is sent to rolls, whence it is returned to the original tube mills, thus establishing a closed circuit.

The results of these experiments have been encouraging, and it seems at least possible that by increasing the diameters of the tube mills, or, probably better still, by using primary and secondary grinding units, the former from 8 to 12 ft. in diameter and the latter 5 ft. 6 in. in diameter, the innovation may prove to be an economical method of crushing and grinding these ores. It has the undoubted merit of removing practically all metallic iron from the crushing circuit, provided the mine-run "banket" can be used in both stages for pebbles, as it is now used in the tubes.

Second—The percentage of amalgamation from these ores has dropped from the normal of 70 in other portions of the Rand to little better than 35. This automatically increased the cost per ounce of gold recovered, to a point where it becomes a serious question whether amalgamation should not be eliminated entirely. Practically the same plate area and operating crew are required, irrespective of the percentage recovered by amalgamation, and of course the danger of theft and loss in handling amalgam has always been a serious problem on the Rand. The finer grinding which these ores require in any case for cyanide treatment makes it certain that practically all of the free gold would be recovered in the cyanide plant, and more economically than by amalgamation.

Third—With the finer crushing it is practicable to leach only about 25 or 30 per cent of the material as sand. This compares with at least twice this percentage in the older plants. Here again the cost of building a complete classification, sand-leaching, and sand-residue-disposal plant for such a small proportion of the total ore renders the cost per ton of sand treated out of all proportion to previous costs. With little additional grinding it is entirely possible to handle the total ore as an "all-slime" product in the settlers or thickeners, agitators and Butters filters, as now used, and it seems probable that this modification could profitably be adopted at these mines. Certainly the cost of the plant would be reduced, and the simplified operation is obvious.

With the elimination of amalgamation, and the adoption of "all slime" treatment, most of the [illegible] crushing in cyanide solution are overcome. The point, formerly raised by older metallurgists on the Rand, that crushing in solution would make it difficult to obtain a satisfactory head sample [illegible] automatically disappeared, for it is obviously impossible to obtain a reliable head value [illegible] crushing through [illegible] and [illegible]. Also, other and perfectly reliable methods of determining the value of the ore have now been developed in other mills where ore is crushed in solution. It still, however, remains to be proved whether or not crushing in cyanide solution would entail a higher cyanide consumption due to water-soluble cyanicides in the ore, which are largely removed by crushing in water and neutralized with lime.

CROWE VACUUM PRECIPITATION PROCESS EFFICIENT

Considering the metallurgy on the Rand as a whole, unquestionably the most important development which has taken place in recent years is the introduction of the Crowe vacuum precipitation process. During 1919 and 1920, careful trials with this process were conducted at the City Deep by a metallurgical committee of the Chamber of Mines, and the results demonstrated clearly that a material saving could be effected in zinc, in cyanide, in labor for clean-up, and in refining, and that the loss of soluble gold in the slime tailings could be materially reduced. In particular these trials demonstrated that the so-called "white precipitate," which has been the chief obstacle to efficient precipitation by zinc shavings on the Rand since the early days of the process, completely disappeared from the boxes even in the coldest weather. In other words, that the presence of this product is due entirely to dissolved oxygen in the solution, and that when this dissolved oxygen is removed by the Crowe process, the "white precipitate" automatically disappears. As the result of these trials the Crowe process is now being installed by a number of plants on the Rand, including City Deep, Van Ryn Estates, Geduld, Modder B, and Brakpan.

Brakpan and Modder B are equipped with the Merrill precipitation process using zinc dust. From results obtained by the Crowe process under similar conditions in other parts of the world, both with the Merrill process and zinc shavings, and from trials at the City Deep, it is now possible to state with certainty that the use of the Crowe process with zinc shavings will reduce the zinc consumption from 30 to 40 per cent, and will reduce the zinc consumption in the Merrill process from 40 to 60 per cent. The consumption of zinc shavings on the Rand varies from 0.12 to 0.26 lb. per ton of ore milled, the higher figure being caused usually by the necessity of removing shavings from the boxes to recover the gold for financial reasons before the full efficiency of the zinc has been obtained.

CROWE PROCESS CUTS ZINC PRODUCTION

At the plants on the Rand where the Merrill process is in use, the consumption of zinc dust varies from 0.10 to 0.14 lb. per ton of ore, and there is of course no question of gold tie-up in the Merrill process, as all of the precipitated gold is completely removed at each clean-up. It seems certain that with the Crowe process installed, the consumption of zinc by the Merrill process will be reduced to one-half of the above figures, which in turn will result in raw precipitate from the presses containing from 30 to 40 per cent gold. This product is economically melted direct, after a simple calcining, with the entire elimination of the expensive and troublesome acid treatment which is now universally practiced on the Rand.

Up to the beginning of 1921 the more general use of the Merrill process on the Rand had been hindered by reason of the fact that the slime solutions are extremely low in cyanide and alkali content and that such solutions without the Crowe process are more effectively precipitated by means of the lead-zinc couple always used in the zinc boxes for this purpose. By removing the dissolved oxygen from cyanide solutions, the precipitation of the metals becomes, within practical limits, independent of both alkalinity and cyanide strength. Thus, it would appear that the only existing objection to the Merrill process in Africa has now been eliminated, and that the other obvious advantages of the process will lead to its adoption at least in many plants to be built. Whether the savings will be sufficient to justify the alteration of existing older plants depends not only upon the process itself, but upon the future price of gold in Africa and upon mining costs as a whole.

RAND GOLD BRINGS PREMIUM

In this connection it is interesting to note the effect of increased costs of labor and supplies upon this vitally important gold-producing district. The standard value of an ounce of gold is approximately 86s., and of the forty-two operating mines on the Rand at the end of 1920, only eighteen were producing gold at a cost of less than 86s. per ounce. The costs at the other properties varied from 88s. to as high as 112s. per ounce.

The gold produced from the Rand is mostly sold in the open market in England, and for some time has commanded a premium above the standard price. This premium is a function of the current rate of exchange between England and America, and in February of 1920 gold reached the record price of 127s. per ounce. As the rate of exchange between England and America approaches normal the premium on African gold decreases, and it is, therefore, obvious that unless operating costs, principally labor and supplies, recede at a rate at least equal to the premium decrease, a large number of the mines will either have to suspend operations or operate at a material loss. The relation of these two curves, realization and operating costs, is now the principal topic of interest among the mining and financial men of the Rand.

South African Gold Mines Show Gains

Operations of the gold mines of South Africa for December, 1920, show a substantial financial gain over results for 1919, despite the disadvantageous factors resulting from strikes by native laborers, shortage of native workers, increased costs, falling off in grade, and the loss of two days' time through two holidays at the Robinson Deep, according to the report of Transvaal Chamber of Mines for December, 1920.

The total tons milled in 1920 was 24,096,277, against 24,043,638 in 1919. Dividends in 1920 amounted to £8,450,006, against £6,075,765 in 1919.

Alaska an Important Copper County

During twenty years of mining, Alaska has produced 545,000,000 lb. of copper, according to the U. S. Geological Survey. The reserve of copper in the deposits so far developed is small, but the evidence of strong copper mineralization in several accessible mining districts and the widespread distribution of copper ores give ample assurance of considerable future production, so that it may be confidently predicted that Alaska's copper industry will grow when transportation has been improved and general industrial conditions have become better.

Tunneling Through Soft Ground

Excavating for Subways Presents Problems Differing From Ordinary Mine Drifting—Two Methods, One Involving the Use of a Metallic Roof Shield and the Other Depending Upon Timbering for Needed Support and Protection, Are Described

By Robert W. Jones
Written for Engineering and Mining Journal

DURING THE CONSTRUCTION of the New York subways it has been necessary to work under normal air conditions and under abnormal air pressure. The greater part of the work, however, has been carried on under normal air by tunneling, open cut, and cut and cover. These three methods of normal air work entail few conditions that differ from the ordinary rock tunneling as understood by the mining engineer. There are conditions of foundation and street preservation, however, that the average mining engineer does not appreciate, and many times we have heard criticisms regarding the rate of progress, and these would indicate that facts concerning the work were not understood. The following short descriptions of methods in driving through unconsolidated materials, under normal air, should be of interest:

The tunnel under discussion was to be carried through a morainal deposit varying from a clean sand to heavy gravel, with pockets of loam and in spots an abundance of boulders up to three and four feet in diameter. Water was encountered in places, but not in quantity. The dry sandy sections were unstable, and the tendency of the ground to run as soon as the support was released was quite evident. The boulder section made dangerous roof conditions. The wet sand and loam would hold up for a time without support and then unexpectedly fall.

The tunnel was opened from two main faces, or rather under two conditions. At one face a metallic roof shield was used and at the other the entire support and protection depended upon timbering. The descriptions simply give the general ideas as laid out in advance of active work and maintained remarkable consistency throughout construction.

The shield-driven tunnel was mainly through material that was of a loamy nature, but which carried an abundance of medium size gravel. Some distance from the shaft the material changed in character and boulders predominated, the strata being that of a typical water-sorted glacial deposit.

Lateral operations were begun by driving from the bottom of the shaft two side drifts, *A*, and one center drift, *B*, as shown in Fig. 1. The face of each drift was opened in one cut, using horizontal breastboards, and the sides between bents were supported in the same manner. Hay and straw were used as a backing to prevent flowage of sands. The posts and caps of drifts were either 8 in. x 8 in. or 8 in. x 10 in., with bents placed 2 ft. 10 in. center to center. Caps of side drifts were 7 ft. 4 in. and center drift caps were 9 ft. in length. The inner posts of side drifts were cut 8 ft., with the outer posts 7 ft., and the center drift posts were 6 ft. The roof was driven with poling boards, the boards being driven half way, the material excavated, and the boards driven home. A new bent was then erected, and the work carried on as before. Owing to the short distance between bents, there was little difficulty in supporting the sides. Two-inch poling boards were used.

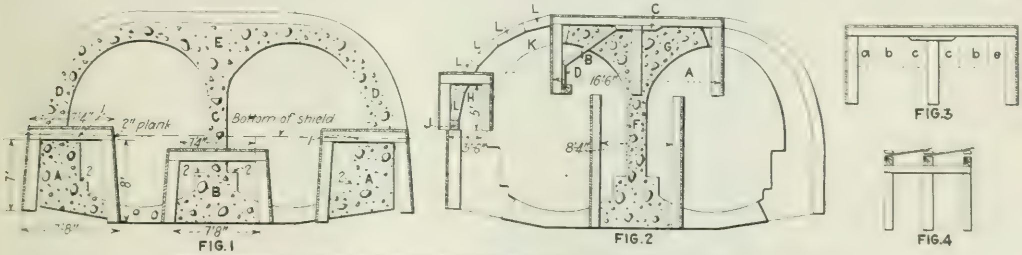


FIG. 1 FIG. 2 FIG. 3 FIG. 4

CROSS-SECTIONS OF SUBWAY EXCAVATIONS AND METHOD OF CONCRETING

On completion of the drifts, forms were erected and the concrete was placed to finished form. The concrete benches of side drifts were prepared to support the bearing surface of the roof shield. The bottom of the cross-piece of the shield passed 2 in. above the top of the side drift posts and approximately 1 ft. above the cap of the center drift. After the shield was in place the entire top heading was removed for a depth of about 32 in. and downward to the bottom of the shield cross-piece. Horizontal breastboards were used when necessary.

Tracks were carried at approximately the elevation of the top of the invert, allowing side-dump cars to be pushed in between the posts of the side and center drifts. The material excavated under the shield in the top heading was passed through the shield cross-piece into the cars. As the top heading was being cleaned up to allow the shield to be pushed ahead, the lower headings between the side and center drifts were removed, using breastboards with straw and hay.

Benches of the side and center drifts were prepared to carry the bearing surface of the erector for the metallic concrete forms. These forms were erected immediately back of the advancing shield, and the entire center wall *C*, side walls *D*, and arches *E* were blown in at one operation. There was little danger in the preceding method of excavation as the face was the only area exposed, and the finished concrete was carried up close to the shield. As the shield advanced the drift posts were removed, and the invert *F* was advanced in sections. The tunnel was carried forward in a finished condition ready to be turned over for the rails.

The timber-driven tunnel face was carried through flowing sand, sand and loam, and gravel. The main and first point of attack is the top heading *A*, in Fig. 2, with a width of 16 ft. 6 in. and a height of 8 ft. 6 in. If the material was fairly well consolidated, the entire face was taken out in one cut. It not, the face was divided into two equal areas, but carried very close to each other. If it was necessary to remove the face in two cuts, the upper was taken out in five vertical cuts (*a*, *b*, *c*, *d* and as shown in *e*, Fig. 3). Fig. 4 shows a section along the center line of tunnel in the top heading. The center cut (*c*) of the upper cut is made either 4 ft. or 6 ft., depending upon the material. The five cuts were made with breastboards and straw, and the lower part of the face is taken out in one cut. Side and center posts and caps are placed, and the face is ready for another cut. Twenty feet back of the face the center posts are removed, and the braces *B*, top pieces *C*, and uprights *D* are placed in position, taking the pressure on the sill *E* and side posts of the drift. The supports *B* consist of 6-in. iron pipe filled with concrete.

Throughout the distance where the center posts are removed (for a distance of twenty feet), a trench is dug to subgrade, using either vertical sheathing or 8-in. x 8-in. uprights, 5 ft. 4 in. center to center and boarded as side supports. This interval of twenty feet is maintained and the concrete center wall *F* is carried forward to the top of the trench and upward to the cap as a concrete post in place of the original center post. Back of the open trench the pipe braces *B* are then removed and the umbrella *G* is then blown in.

DRIVING THE SIDE DRIFTS

Simultaneously with excavation in the main face, the side drifts *H* are carried forward with the face held about 40 ft. back of the main face. In this drift the 12-in. x 12-in. wall plate *J* is laid. These side drifts are driven 3 ft. clear, with inside posts at the top, 3 ft. 6 in. at floor, and 5 ft. high. The two segments *K* are then excavated down to the top of the side drifts, and the arch timbers *L* are placed bearing against the cap of the first excavation and the wall plate in the side drift. The excavation for the segments *K* is carried on in a similar method to the first excavation, using breastboards and straw, with vertical sections varying with the material. Twenty feet back from the face of this excavation it is carried down to the level with the floor of the side drifts. In another twenty feet the cut is carried to the subgrade, side posts are placed, forms are erected, and the side walls concreted.

Aluminum Production Increased in 1920

The value of primary aluminum produced in the United States in 1920, according to reports received by the U. S. Geological Survey, was $41,375,000, as compared with $38,558,000 in 1919. This increase of approximately 7 per cent shows a return to more normal operations and indicates what may be expected in the future. The market prices throughout the year were nearly constant, ranging from 32 to 33c. per lb.

Blue-Sky Legislation

Over-Regulation Often Proves as Great a Depressant On Mining Industry as Lack of Laws Controlling Promotion and Stock Selling

BLUE-SKY LEGISLATION was the subject of an interesting paper read by J. P. MacGregor at the recent meeting of the Canadian Institute of Mining and Metallurgy, and the ensuing discussion brought out many reasons why such laws should or should not be enacted. The object, as explained by Mr. MacGregor, was to prevent unfairness, imposition, and fraud on the part of corporations seeking to sell stock. Over-regulation, he pointed out, was as bad as under-regulation, for it would prevent the flotation of legitimate speculative enterprises and discourage the development of prospects. On the other hand, the evils of no regulation were well known; a company could make any statement, regardless of fact, and sell stock where there was no indication whatever of ore.

The consensus of opinion at the meeting seemed to be that such legislation should not go further than compelling a stock-selling company to stick to the facts in its publicity matter. The property should be investigated by government agents, and if not evidently an illegitimate proposition, the company should be given a license to sell stock, to be retained as long as fraud was not practiced on the public. The resources and prospects would be openly known, and intending buyers would understand something of the chance they were taking. At the same time, it would be possible to secure money for the development of the poorer prospects, for the granting of a license would in no way imply that the property had merit—merely that its backers were honest. Facts, not theories or opinions, would be considered.

T. W. Gibson, Deputy Minister of Mines for Ontario, refused to recommend such legislation, and said that he believed a fool would lose his money anyway, intimating that he might as well buy worthless mining stock as real estate in the middle of a swamp. Others disagreed, saying that fraudulent mining promotions made it more difficult to sell legitimate mining stock to careful investors.

Mogollon Silver District Productive

The Mogollon district, in New Mexico, is one of the oldest and most productive silver-mining regions of the Southwest, according to the U. S. Geological Survey. The pioneer prospector in this district was James Cooney, an old Indian fighter, who first discovered rich silver-copper ores there in the canyon of a stream that was christened Silver Creek. The region was then inaccessible and was infested by Apaches, so that for the first ten years mining was complicated by Indian warfare. During the last forty years, however, the district has been producing a steady output of metal, chiefly silver, and the estimated value of the total product is more than $15,000,000.

The region is rugged and mountainous and the nearest railroad station is eighty-five miles away. The rocks are chiefly lavas of various types and are much broken by faults. The mineral-bearing veins, however, are well defined and continuous, the combined workings on one vein aggregating over a mile and a half in length.

Government Officials Prominent in Mining

Senator Samuel D. Nicholson

BY PAUL WOOTON

Written for *Engineering and Mining Journal*

IT IS NOT uncommon to find a United States Senator who is a self-made man, but it is uncommon for one who was once an uneducated mine laborer to gain a seat in that body—a position regarded by many as the most desirable within the gift of the people, with the single exception of the Presidency itself. Samuel D. Nicholson, who has just taken his seat as one of Colorado's Senators, forty years ago trudged into Leadville in a snowstorm. He was then twenty-two years old. He had been working in Nebraska on a farm. He heard about the boom in Leadville, and invested his entire capital in making the trip to the Colorado mining camp. In fact, twenty-five cents was all he had left on his arrival. He had no overcoat and possessed only remnants of shoes to withstand the rigors of winter at an altitude of 10,000 ft., but this did not deter him from going immediately to work as a section hand. He admits that it took all of his grit to stay with this job in the open during the long Leadville winter. It was not until spring that an opportunity came for him to secure work in a mine—his objective. His first job was in the Colonel Sellars mine, a property of which he later became an owner.

SENATOR SAMUEL D. NICHOLSON

Mr. Nicholson's term as a mine laborer was not a transitory one. For five years he polished the heads of drills, did mucking and anything else that he could do in his effort to amass enough capital to undertake operation on his own account. The accumulating process was hastened finally by an increase in salary which he was able to demand on the strength of his experience and his ability to act as foreman. It was a lease on the Sellars mine and an adjoining property that gave him the financial foundation to become an operator.

Later Mr. Nicholson organized the [illegible] Mining Co. Success finally crowned this operation after he had strained his credit to the limit in an effort to carry forward the work. Afterward he was able to extend his operations until they included a large number of properties in Colorado and in other states. He was prominent among those operators responsible for the application of concentration methods to Colorado ores. He assisted in the development of the first carbonate of zinc ores found in the Leadville district, and was the discoverer of the zinc ore which bears his name—nicholsonite. Senator Nicholson was born on Prince Edward Island, at that time a direct dependency of Great Britain. He emigrated to the United States when he was seventeen years old. He took up his residence at Bay City, Mich., where he completed the grammar-school course. That constituted his entire formal education. Nevertheless, the new Colorado Senator has a reputation of being well educated, although self-taught. Mining is at a lower ebb than at any time in his recollection, Senator Nicholson says, and as a consequence he had not been in Washington twenty-four hours until he was urging the utmost haste in adopting some form of legislation which will close American ports to the metals and ores produced abroad with cheap labor. He is an advocate of immediate, stop-gap tariff legislation. He does not believe the country can afford to let an unnecessary day pass without affording the relief which he thinks a protective tariff will give the miners of the United States. He says that metal miners have suffered more than have manufacturers or coal miners, in that they have had no unusual profits to spread over this lean period.

In announcing his candidacy Senator Nicholson said: "Residing in this state since boyhood, I am indebted to Colorado and her people for whatever success I may have enjoyed, and appreciating that fact, and believing I know the needs of both, my life work will be devoted to their interests. Having no college degree, the only diploma which I possess is that of moderate success awarded me by the University of Experience after many years of honest toil and honorable business enterprise which had its beginning with a miner's pick. My life among you for forty years has been an open book, and upon it and upon the principles [illegible], I stand as a candidate, with the assurance that the party [illegible], whoever he may be, will receive my cordial and hearty support on election day."

BY THE WAY

Just Out of Spite

"Did I ever tell thee, m'son," said Cap'n Dick, "baout tha time Billy Nancarrow wuz drafted? No? Well, I'll tell 'ee. Billy wuzn't drafted for tha h'army—'e wuz too bloody h'ole for that. T'wuz jus' tha h'opposite o' bein' drafted for the h'army an' put to work. 'E wuz drafted from 'is job, an' it 'appened moor'n a score o' years h'ago to tha North Star mine. Those days tha standin' h'orders wuz, 'H'if she don't pay, shut 'er daown,' an' w'en tha super 'ad to make 'er pay month by month 'e 'ad to do a bit o' figgerin' a'tween pay days. So tha custom come o' draftin' h'off part o' tha crew to cut h'expenses naow an' again. 'Owsomeh'ever, t'were usually made fair h'all raoun' by drawin' foorth tha names from a 'at, with married men lef' h'out w'en possible. This 'ere time I speaks o' the boys 'ad been h'expectin' a draf' for moor'n a fortnight, so Billy wuzn't a bit 'mazed w'en Cap'n Joe Trebilcock, makin' 'is las' raoun' for tha day, sez, 'Well, Billy, m'son, there's a bit o' a draf', an' you're h'in it.' Billy goes 'ome to supper an' tol' tha missus 'e'd been caught in the draf'. ''Oo h'else got drafted,' sez she. 'Don't naw yet,' sez Billy, 'but jus' so soon h'as I finish this 'ere bit o' pasty I'll go foorth to taown an' fin' h'out.' 'Baout ten h'o'clock that night Billy comes 'ome, lookin' some wish't an' daown'earted. 'Is misses wuz waitin' h'up for 'im to 'ear 'baout tha draf'. 'Mother,' sez Billy, 'I belong bein' tha 'ol bloody draf'. I don't wish to h'appear spiteful, naow, min' you, but I can't 'elp 'opin' that tha new super, 'oo b'longs commin' foorth next week, will draf' that h'uppity beggar Joe Trebilcock tha firs' bloody day h'after 'e do come.' "

Dreams and Humbugs

The foundation of the fortune finally acquired by the late Jesse Knight, of Utah, came through a property popularly known as the Humbug, and christened the Dream mine. According to Whitney's "History of Utah," Mr. Knight, who was by birth a member of the Church of Latter-Day Saints, had grown careless and forsaken his affiliation with his church. In the fall of 1886 "he was shown in a dream that certain persons, among them a young man he had known from boyhood, had combined to defraud him in a mining deal. The next day, after denouncing them on the mere strength of his dream—which subsequent developments justified —he walked over a mountain to trace the outcroppings of a vein (the Humbug vein) he had previously located. . . . In the midst of his mournful reflections he was astonished to hear a voice speaking to him as from the mid-day heavens," counseling him not only to remain true to the Latter-Day Saints, but to refuse to sell his claims. Mr. Knight and his sons worked intermittently seven years on the Humbug claim.

Cast Up by the Sea

Beach combers meet with a variety of experiences, but one, recently reported from Velasco, Tex., is exceptional. Fishermen returning from Quintana Beach are said to have reported that thousands of tons of fresh asphalt have been washed up on the coast. Blanket-like strips of twenty-five to fifty feet in length and varying in thickness up to several feet were cast up on March 20 along several miles of the beach, they report. H. J. Parks, one of the fishermen, experienced difficulty in making his way through the surf and to shore after the first strip of asphalt had bowled him over as he was adjusting his tackle far out in the surf. A kerosene bath was necessary as a result of his encounter with the viscous flotsam. The temperature of the asphalt indicated that its origin was close to the coast, according to the fishermen. As one result of the deposit, the beach for a stretch of approximately ten miles will take on the characteristics of a motor speedway.

From the German

Oil prospectors should watch the trees. According to a recent writer in the *Stuttgart Neues Tageblatt*, one of the most valuable criteria for the discovery of oil pools is the complexion of the trees of the forest:

> Wisber found that all the trees of the little forest of Höpen had a white alkaline efflorescence. Associating this with the existence of salt, he next discovered two extensive salt beds—in Fleested and from Tötensen to Meckelfeld. Since petroleum is always associated with such minerals, he sought farther and found oil seepages which he correlated directly with the gas occurrence at Neuengammer. It is probable that this gas occurrence, discovered ten years ago, has its origin in the Meckelfeld oil deposits, whose oil often seeps to the surface. Tests confirmed the significance of the discovery. According to the view of those who know, it is the best oil thus far discovered in Germany, and when this deposit is worked there will develop in the south of Harburg a great oil industry.

It would evidently pay the divining-rod experts to discard their hazel wands in favor of a strip of red litmus paper, and to wander leisurely through the woods after a rainy season, testing the hydroxyl-ion concentration on the epidermis of any unusually pale confrères of the genus "chestnut."

The Song of the Drill

By Thomas A. Doxey, Jr.

I've taken the rocks as I've found them,
On top or deep under the ground;
I've opened the passage for thousands
To where untold riches were found.
I'm little and heavy and noisy,
And I jar 'till I make the brain reel;
But I point out the way to the ground that will pay,
And my finger's a finger of steel.

I'm at work away up in the Arctic,
Where the ice doesn't melt all year 'round,
And the blood that drops from the finger
Freezes ere reaching the ground;
Where the sunlight is fitful and watery
And the nights are six dark, cold months long;
The colors and whites of the Far Northern lights
Have harked to my rattling song.

My work is also in the tropics,
In lands that are kissed by the sun,
Where the palm fronds stir in the breezes
And the coral reefs have to be "run";
Where the skies are as blue as the sapphire
And the sands are hot-dazzling white—
I uncover the ore on island and shore;
I bring riches up into the light.

My song is a song of achievement;
I sing from the mountains and plains;
The air that is breathed by the millions
Courses like fire through my veins.
I'm little and heavy and noisy
But I'm working away with a will.
Through foul weather or fair—just give me the air—
And I'll sing you the song of the drill.

HANDY KNOWLEDGE

Steps Toward the Elimination of Forced Delays in Copper-Nickel Blast-Furnace Operation

BY E. T. AUSTIN*

In every smelter, the great factor in making satisfactory progress is that of continuous operation, and consequently a great deal of energy is directed toward cutting down to the minimum all delays or shutdowns. If a furnace or converter is shut down for a few hours it means that just so much less ore or furnace matte, as the case may be, is treated during the period of the shutdown, while operation costs remain practically unchanged. Thus the saving of an hour or even of a few minutes during any forced shutdown is of considerable importance and is directly reflected in the monthly statements.

One of the forced delays in furnace operation has been that of making repairs to the brickwork of the furnace spout. This has necessitated tapping the furnace, tearing out what remained of the old brickwork, and replacing it with new, after which the new brick had to be thoroughly dried before restarting the furnace. This procedure usually took from four to ten or twelve hours, depending on the design of the spout.

The blast furnaces at Coniston have a cast-iron breast-jacket 2 ft. 9 in. by 3 ft. 2 in. by 3 in., in about the middle of which is an opening 6 in. by 7 in., surrounded by a system of 1-in. water-pipes imbedded in the jacket. The jacket fits tight against the brickwork at the end of the furnace crucible, and the opening in the jacket comes in line with the opening through the brickwork of the crucible. Water circulating through the pipes in the jacket keeps the jacket cool around the opening, and thus protects it from being corroded rapidly by the molten matte and slag passing through.

The furnace spout, which is also of cast iron with 1-in. water pipes imbedded in it, is 4 ft. long and U-shaped in cross-section. It is lined with brick and is set tight against the breast-jacket in such a position that the opening in the breast-jacket is about flush with the bottom of the trough of the spout. Wedged-shaped brick is used for lining the bottom of the spout, and from the opening in the breast-jacket the brickwork rises at a slope of about 15 deg. to the end of the spout. This construction provides a trap through which the molten materials pass, at the same time preventing any of the air-blast from escaping.

It has been found necessary to renew the brickwork in the spout at intervals of from four to six weeks, and by the old method this meant tapping the furnace, tearing out the old brickwork and replacing it with new, and then thoroughly drying the new brickwork before putting on the blast again, thus losing from four to six hours. At present the Coniston furnaces are all equipped with a spare spout and trolley, also one two-ton chain-block that is transferred from one furnace to the other as needed. The trolley travels on the bottom flange of a 10-in. I-beam that is bolted to the cross-girders of the charge-floor on the center-line of the furnace and from the end of the furnace out over the settler. The spare spout is always kept bricked ready for use and well dried. It usually is placed beside the settler until the day before it is needed, then it is picked up by the chain-block and placed on top of the settler. Here it becomes thoroughly warmed before being put in place. When it is decided to change spouts the furnace is tapped; then the old spout is disconnected, raised by the chain-block, pushed back, and set down by the settler. The extra spout is then set in place. After pouring some grout around the joint between the spout and breast-jacket, the blast is put on again, the whole operation taking from twenty to forty minutes. We believe it possible that, with all conditions favorable, the breast opening could be "budded" while the spouts were being changed, and the whole operation accomplished without tapping the furnace.

The settlers are equipped with two separate tap-holes, each of which consists of a magnesite block, 8 in. by 8 in. and from 6 in. to 10 in. long, set in the brickwork of the settler, the outside face of the block being flush with the outside of the brickwork. In the center of each block is a tapered hole, 1¾ in. at the outside face. When the block is in place this hole is in line with the opening through the brickwork of the settler. As the matte is tapped, it gradually wears the hole larger, until it becomes difficult to "bud." The second tap hole is then put in use, and the worn one is cooled by means of a jet of air and gradually chipped back. This process of cooling and chipping is slow and must be done carefully. But it may be accomplished successfully, and when completed a new block is placed in position. It is then grouted and is ready to replace the other block when required. In this way any shutdown, with consequent lost time due to draining the settler, is avoided when repairing the tap holes.

These improvements result in increasing the capacity of the furnace, and at the same time they practically eliminate two of the most frequent causes of the forced delays in operating blast furnaces.

The Cassius Purple Test for Gold

BY JOHN DIXON

Written for *Engineering and Mining Journal*

Although the Cassius purple reaction is being used at many mills for the determination of gold in precipitated cyanide solutions, I have never seen the method published. Perhaps the following description of the determination as used at the Kirkland Lake Gold Mining Co., Ltd., will be interesting:

Take 750 c.c. of solution to be tested in a 1,000-c.c. Erlenmeyer flask (a painted mark on the flask makes it easily measured). Add 20 c.c. saturated cyanide solution and two to four drops of saturated lead acetate solution. Shake well. Add 0.5 gram of zinc dust and shake until the lead sponge is formed, and invert in a

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*A paper read before the Sudbury branch of the Canadian Institute of Mining and Metallurgy, and printed in the *Bulletin* of that institute for March, 1921.

3-in. porcelain casserole. Let air into the flask until the casserole is half full and allow the sponge to settle out into the casserole. A stand with a rounded hole open at the front makes a convenient holder.

After the sponge has settled, remove the mouth of the flask quickly from the casserole and allow the solution to run to waste. Decant the remainder of the solution from the sponge in the casserole and add 10 c.c. aqua regia (under a hood). Evaporate until a thick brown syrup remains. Add 5 c.c. conc. HCl and evaporate until 5 c.c. remains. Pour into a test tube and cool under the tap. Allow the precipitate of lead chloride to settle and add two to four drops of stannous chloride from a dropper. From the color ring formed, estimate the gold in the sample.

	Per Ton.
Colorless	0 cents.
Straw yellow	0 to 2 cents.
Light purple	2 to 4 cents.
Dark purple	over 6 cents.

The color disappears quickly, but can be brought back again by adding more stannous chloride.

Reagents: Aqua regia; 7 parts conc. HNO_3 to 3 parts conc. HCl.

Stannous chloride: Make a saturated solution of the c.p. salt in 1 part conc. HCl and 15 parts distilled water. Place a few shavings of metallic tin in the bottle to keep it in stannous form. Not over two weeks' supply of stannous chloride should be prepared at a time, as it deteriorates on standing.

If a hot plate is not available, a soldering torch furnishes a satisfactory heater if the casserole is set in a hole cut in a piece of asbestos board to prevent the direct flame from striking against the sides of the casserole.

The determination can be made in about fifteen minutes, and if desirable, several samples can be handled at the same time.

Improvising a Blowpipe and Charcoal

By S. H. Hamilton

Written for *Engineering and Mining Journal*

A blowpipe may be improvised for mineralogical determinations in the following manner: Break about one inch off the end of an old-fashioned, straight stem, penny clay pipe. Fit a cork or piece of wood into the bowl and bore a hole in this stopper into which the piece broken from the stem will neatly fit. This will make as good a blowpipe with a moisture trap as any scientific tramp could wish.

Likewise, a piece of charcoal neatly shaped may also be readily made as follows: Put some charcoal from a quenched fire in a piece of paper and crush it under the heel. Mix the charcoal dust with a little flour and make it into a stiff dough with water. Mould this into the form desired and bake it in the camp oven. After it is baked, toast it before the fire until it no longer gives off fumes.

Preventing Vibration of Balances

"To protect the fine chemical balances from the vibrations of our office building we have placed these balances on a heavy slab which is supported by three balls of solid rubber which rest in turn on a strong table top," says Walter C. Durfee in the *Chemist-Analyst*, issued by the J. T. Baker Chemical Co. "The weight of the slab which we use is about 30 lb. and the rubber balls are about 1½ in. in diameter, such as are used as dog balls. After a time the balls become somewhat flattened, so that there is no danger of the balances rolling off the table. In the beginning, of course, the balls should be fastened in some way, as for example by a short nail from underneath or by saucers. We used for this purpose a packing of cotton between the table and the slab, which we thought was also helpful in damping the vibrations. Before installing this simple device we were unable to use the balances except at night, but have found that the objectionable vibrations are satisfactorily subdued in the way mentioned."

Comparative Cost of Mine Supplies

The comparative cost of mining supplies in the years 1914, 1917, 1918, 1919, and in April and December, 1920, is given in the following table taken from the *Bulletin* of the American Zinc Institute, Vol. 4, Nos. 1, 2 and 3, p. 14:

COST OF MINE SUPPLIES, BY YEARS

	1914	1917	1918	1919	April, 1920	December, 1920
Coal, mine run	$2.10	$3.60	$3.15	$3.30	$3.75	$6.39
Dynamite:						
40 per cent pulp	$11.00	$18.25	$19.25	$19.25	$17.50	$18.50
40 per cent gelatine	$11.50	$20.50	$22.50	$21.50	$19.80	$20.00
80 per cent gelatine	$15.50	$31.75	$39.50	$32.50	$26 25	$27.75
Fuse, per case, 6,000 ft.	$7.57	$14.58	$14.58	$16.28	$18.40	$18.40
Screen jackets:						
Light, sq.ft.	$0.18	$0.60	$0.60	$0.52	$0.72	$0.53
Heavy, sq.ft.	$0.22	$0.72	$0.86	$0.91	$1.10	$0.71
Slotted jig sheets	$0 30	$0 80	$0 87	$0.76	$0.97	$0.90
Sheet steel spouting, per joint	$3.00	$6.00	$6.00	$5.00	$8 20	$7.00
Elevator cups, per inch	$0.30	$0.07	$0.07	$0.07	$0.11	$0.085
Sheet steel, to order, per lb.	$0.05	$0.10	$0.10	$0.08	$0.11	$0.07
Elev. bolts, ¼ by 1 in., per 100	$0.70	$1.40	$1.50	$1.50	$1.50	$1.75
Elev. bolts, $\frac{5}{16}$ by 1½ in., per 100	$1 00	$2.00	$2 10	$1 90	$2 10	$2 55
Hard iron, jaws, sheets, and side plates, per lb.	$0.02½	$0.04½	$0.04½	$0.04	$0.03½	$0.03½
Belting, rubber, first quality, per cent	50–10–5	45	30.5	40	40	40
Belting, rubber, second quality, per cent	60–10	50–5	40–5	45	40–5	40–5
Belting, canvas, per cent.	70	60	50	DT	50	50
No. 2 carpenter scoops, dz.	$5.50	$11.00	$11.50	$11.50	$11.50	$11.50
Pipe, black, base, per cent.	75	34	27	27	27	33
T-rail, No. 8, per ton	$35.00	$80.00	$80.00	$80.00	$80.00	$80.00
Track spikes, $\frac{5}{16}$ by 2½, keg	$6.50	$13.50	$16.50	$15.50	$16.00	$14.00
Fittings, malleable, off list, per cent	65	45	30	35	List	List
Fittings, cast iron, price list, per cent	65	30	20	10	5	12½
Jenkins brass valves, per cent	60	35	List	5	10	10
Lunkenheimer clip gate, per cent	50	25	10	15	13	35
Drill steel:						
Solid, per lb	$0.07½	$0.16	$0.17	$0.16	$0.14	$0.14
Hollow	$0.10	$0.23	$0.23	$0.22	$0.20	$0.20
Rubber, wire-wound air hose, 1-in., per ft.	$0.25	$0.40	$0.40	$0.45	$0.65	$0.53
Norway iron, per pound	$0.05	$0.15	$0.20	(a)	(a)	(a)
Tool steel, per lb	$0.08	$0.20	$0.20	(a)	$0.20	$0.14
Hammers, No. 8, rock, ea.	$0.55	$1.12	$1.12	......	$1.60	$1.20
Machine bolts, off list, per cent	60	25	30	25	List	10
Carriage bolts, off list, per cent	60	25	25	20	List	5
Carbide, union, per ton.	$82.00	$90.00	$108.00	$115.00	$115.00	$135.00
Galvanized corrugated iron, No. 28, per square	$3.50	$10.00	$8.00	$7.50	$8.00	$8.00
Nails, per keg	$2.35	$5.25	$4.70	$4.75	$5.50	$5.80
Drill cable, per lb	$0.18	$0.37½	$0.40	$0.37	$0 35	$0.33
Wire cable, per ft., per cent	50–10	15–5	List	10	List	List
Manila rope, base, per lb.	$0.15	$0.35	$0.40	$0.37	$0.41	$0.39
Perfection gates, 2-in., per doz.	$8.00	$12.00	$12.00	$15.00	$16.00	$12.00
Dart unions, per cent	60	35	30	30	25	5
Common bar iron, base, per hundredweight	$2.25	$5.50	$6.00	$5.50	$6.45	$5.30
Common soft steel, per hundredweight	$2.25	$5.50	$6.00	$5.50	$6.45	$5.30
No. 4 babbitt, per lb.	$0.08½	$0.15	$0.12	$0.10	$0.13	$0.11
Jig wire, per sq.ft.	$0.20	$0.28	$0.30	$0.30	$0.36	$0.30
Trimo pipe wrenches, per cent	75	60	50 5	50 10	50	45
Wood pulleys, per cent	60 10	50	30	25	10	10
Steel pulleys, per cent	40	15	15	15	10	10
White waste, per lb.	$0.09	$0.17	$0.18	$0.17	$0.21	$0.20
Oil:						
Castor, machine	$0.13½	$0 23½	$0 291	......	$0 238	$0.548
Gas engine oil	$0 24	$0 271	$0 36		$0 498	$0 618
Cylinder oil	$0 27	$0 35	$0 50		$0 748	$0 868
Red engine oil	$0 14½	$0 20	$0 35		$0 368	$0 438
Compressor oil	$0 20	$0 25	$0 289		$0 368	$0 618
Gasoline	$0.11	$0.20	$0.225	......	$0.280	$0.286
Coal oil	$0 06	$0 08	$0 11	.	$0 183	$0 183

(a) Not on the market

THE PETROLEUM INDUSTRY

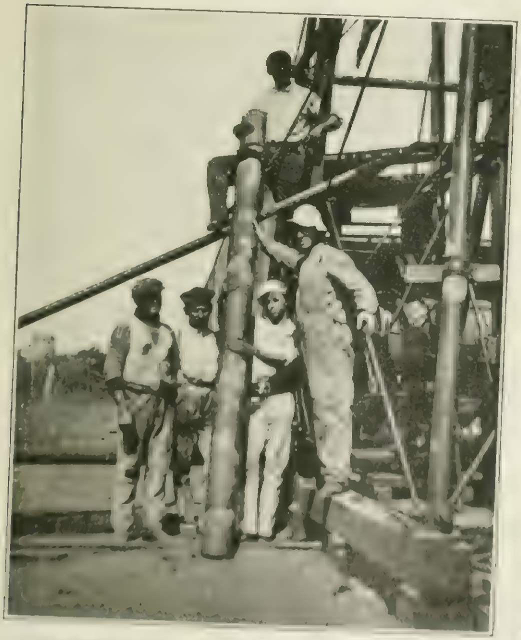
Core Drills in the Petroleum Industry

By Herbert T. Abrams

Written for Engineering and Mining Journal

THE ADVANTAGE of prospecting for mineral deposits in advance of actual mining operations is well recognized and universally followed. Several articles have recently appeared in the technical press suggesting that methods similar to those used in determining the depth and extent of ore deposits might be employed for the same purpose in searching for oil.

The time and money expended in unexplored fields, or in partly developed territory, and lost in putting down wells of the ordinary production size, amount to a considerable figure, and it is reasonably certain that if operators in general could be made to realize that there was any practicable method offered for overcoming or reducing their exploration costs, they would not fail to see the advantage of such a preliminary outlay, which would determine, in advance, the underground conditions, and make it fairly possible to judge whether or not extensive drilling of deep holes was warranted.



ELEVEN FOOT CORE AT RIO CLARO, BRAZIL

All published articles which have thus far come to my attention suggest that the diamond drill is the only method adapted for prospecting oil fields, and no mention has been made of that class of core drills which employ chilled steel shot (calyxite) as the cutting medium in hard formations instead of diamonds. On account of the absence of all reference to this class of drills (at least one of which—the "calyx" drill—employs not only the chilled shot method for hard formations, but an auxiliary bit, called the "Davis" cutter, which is a steel bit of special composition with forged teeth for use in soft materials) it would appear that this type of machine is not generally known among engineers.

CALYX DRILL AT BROACH, INDIA

The "calyx" drill has several advantages over the diamond drill in the search for oil, in that it not only is capable of furnishing records which are as good as or better than those obtained by the diamond drill, but with a drill of this type it is possible to put down holes of larger diameter at less cost than with the diamond drill. Another reason why the "diamondless" drill should be considered is that no expensive carbons are used or lost in the hole, and no skilled diamond setter is required. Chilled steel shot does the cutting, the cost being negligible, even if some is wasted, and, possessing this advantage over diamonds, it is possible to put down holes of large diameter, which indicates that a larger core can be secured for examination and test purposes. Furthermore, there is a possibility that a bore of such size as is permissible with a diamondless drill might easily be turned into a production well.

I do not mean to suggest that core drills can be generally used to supplant churn drills, or other commonly accepted types of oil-well drills, but for purposes of securing data of underground conditions, and to reduce the "dry hole" risk, it does seem that the type of drills mentioned deserves careful consideration, not only from operators engaged in the petroleum industry, but also from the officials connected with Government and state geological surveys.

A "BED" OF DRILL CORES AT RIO CLARO, BRAZIL

Daily Average Petroleum Production Increases During February

THE OUTSTANDING FACTS of the petroleum statistics for February, 1921, as compared with those for January, according to the U. S. Geological Survey, are that the daily average production of crude oil increased 33,000 bbl. and the daily average of imports decreased 19,000 bbl. The estimated daily average consumption also decreased 196,000 bbl., so that the stocks of crude oil showed the gratifying increase of 7½ million bbl.

Although the daily average rate of production was slightly greater in February than in January, it was 2,000 bbl. less than in December, but was more than 125,000 bbl. greater than in February a year ago. Kansas is credited with an increased daily average production of 12,000 bbl., Oklahoma with 10,000 bbl., and Wyoming with 6,000 bbl. Smaller gains are reported from Montana, Kentucky, West Virginia, Ohio, Pennsylvania, Indiana, and Colorado. A decrease of 3,500 bbl. in daily production is recorded from Louisiana, and slight decreases are noted for Texas, California, New York, and Tennessee.

The accompanying figures, compiled from company reports, show the quantity of petroleum removed from producing properties. Oil consumed on the leases is not included.

PETROLEUM PRODUCED IN THE UNITED STATES IN JANUARY, 1921, FEBRUARY, 1921, AND FEBRUARY, 1920
(Barrels of 2 U. S. Gallons)

State	January, 1921 (a)		February, 1921		February, 1920	
	Total	Daily Average	Total	Daily Average	Total	Daily Average
California	10,177,000	328,290	9,184,000	328,000	7,974,000	274,966
Central and Northern Texas	6,419,000	207,065	5,773,000	206,179	5,175,000	178,448
Coastal Texas	2,610,000	84,194	2,367,000	84,536	1,565,000	53,966
Oklahoma	8,383,000	270,419	7,855,000	280,536	7,933,000	273,552
Kansas	2,368,000	76,387	2,478,000	88,500	2,983,000	102,862
Northern Louisiana	2,531,000	81,645	2,173,000	77,607	2,560,000	88,275
Coastal Louisiana	156,000	5,032	156,000	5,571	146,000	5,035
Wyoming	1,462,000	47,161	1,497,000	53,464	1,167,000	40,241
Illinois	852,000	27,484	785,000	28,036	831,000	28,655
Kentucky	744,000	24,000	723,000	25,821	582,000	20,069
West Virginia	645,000	20,806	634,000	22,643	613,000	21,138
Central and Eastern Ohio	433,000	13,968	427,000	15,250	376,000	12,966
Northwestern Ohio	186,000	6,000	175,000	6,250	146,000	5,034
Pennsylvania	619,500	19,984	602,000	21,500	530,000	18,276
Montana	78,000	2,516	115,000	4,107	7,000	241
Indiana	95,000	3,065	92,000	3,286	68,000	2,345
New York	84,000	2,710	66,000	2,357	58,000	2,000
Colorado	9,000	290	9,000	321	8,000	276
Tennessee	1,500	48	1,000	36	1,000	34
Totals	37,853,000	1,221,064	35,112,000	1,254,000	32,723,000	1,128,379

(a) Revised [illegible] figures reported by Standard Oil Co. and Independent Oil Producers' Agency.

An International Petroleum Union

SPECIAL CORRESPONDENCE

During the last few months negotiations have been carried on between the leading German petroleum companies and the group of French stockholders in control of the larger petroleum enterprises in Poland and the Austrian succession states. These negotiations resulted in the formation at Zurich, on March 1, of the so-called International Petroleum Union, a trust company capitalized at 210,000,000 Swiss francs, in which the Swiss bank takes a leading interest.

The new company has acquired more than 75 per cent of the capital stock of the German Crude Oil Co. of Berlin, which latter company only recently raised its capital to 100,000,000 marks, as well as 75 per cent of the capital of the French Société des Pétroles de Dabrowa, of Paris. The capital of this company is soon to be raised to 150,000,000 French francs. The Société des Pétroles controls the majority stock in the Galician Karpathian Petroleum Co., formerly Bergheim & McGarvey, and in the "Schodnica" Company for Petroleum Industries, which possesses a number of refineries and similar enterprises in West, Central, and East Galicia. The new Swiss trust company is making considerable investments for the purpose of extending its sphere of influence, especially in transatlantic countries. These steps will be taken chiefly with the object in view to securing a larger percentage of the world's petroleum production for the countries interested in the formation of the International Petroleum Union. Furthermore, the company intends to introduce mining methods to obtain crude oil which proved so successful in the Alsacian and Hanoverian oil districts before and during the war. The production of mineral oil from bituminous slate as well as from bituminous coal, as now practiced in certain parts of the Central German lignite district, will also be taken up by the company. It is said that, chiefly for political reasons, neutral Switzerland was selected as headquarters of the company.

Federal Reserve Board Comments on Petroleum Situation

In analyzing the March reports of its member banks, the Federal Reserve Board has issued the following statement in regard to the petroleum situation:

"Production of petroleum in general has shown a decrease, following the recent decreases in prices in the industry. February daily average production of crude petroleum in California was 327,864 bbl., as compared with 331,181 bbl. in January, and in District 11 (Dallas) the daily average production was 403,243 bbl., as compared with 411,171 bbl. in January. In contrast with this situation, however, there has been a practically continuous increase in the weekly output in the Kansas-Oklahoma fields since the beginning of the year. The daily average output for the week ended March 11 was 366,500 bbl. in that field, as compared with 334,000 bbl. for the week ending Jan. 7. This occurred despite the noticeable falling off in the completion of new wells and in new production in District 10 (Kansas City), following the break in prices which occurred in the month of February. Many operators in that district are pursuing a policy of confining their development operations to 'offsets,' in view of the present situation in the industry.

"The decreased output shown in District 11 (Dallas) reflects the decrease in drilling operations. Though the falling off in such operations had already begun in January, February completions, amounting to 420 wells, were 147 less than in January, and new production was only half as large. In District 12 (San Francisco) 60 new wells were completed in February, as compared with 64 in January, though the initial new daily production was cut nearly in half. After the drastic price reduction in January and early February, prices subsequently remained unchanged, the prevailing price in central-west and north Texas being $1.75 per bbl.

"During the first half of March prices held steady at the same figure in the mid-continent field. It is reported, however, that the second week of March brought marked improvement in that field, and every purchasing company in every field in Oklahoma and Kansas, with one exception, was buying crude oil on a 100 per cent basis. It is reported that fuel oil in the district 'is showing an appreciable increase in demand, and refined petroleum is beginning to move in slightly larger quantities and gasoline is fairly steady, though the demand has not come up to seasonal expectation.'"

Oil Land Boom in Utah

SPECIAL CORRESPONDENCE

The acreage of land in Utah which offers possibilities of producing oil is extensive, there being, according to Government reports, about 2,000,000 acres classified under oil-land withdrawals. The larger part of this land in southeastern Utah is unsurveyed and not yet accessible by railroads. Since the opening of the land to exploitation through the recently enacted leasing law a larger number of oil companies are constantly becoming interested, and more oil-drilling rigs are being sent in. A number of Eastern companies are active in the field, and companies organized by Utah men are also starting work. Recently the Salt Lake City land office has done a business recalling early boom days. At least seven test wells are being driven, and five of these are on land leased from the Federal and state governments. The Ohio Co. has been one of the first in the field, and is driving three wells, in each case using a standard rig capable of drilling to a depth of 500 ft.—one in the Circle Cliff field, in Garfield County, one in the Cainesville structure, in Wayne County, and one about three miles northwest of Huntington, in Emery County.

The San Rafael section, in Emery and Grand counties, is of interest, and a number of companies are planning or starting work here. It is understood that the Carter Oil Co. intends to operate in this field. Two local companies, made up of Salt Lake men, the Old Emery and the San Rafael Oil Corporation, are reported to have sent down rigs. Mohrland, Price, and Green River are the nearest towns to the San Rafael field, and bridges and roads are being built to make the various parts of the district accessible by automobile and truck.

In the southwestern part of the state is the Virgin oil field, from which a small quantity of oil has been taken from shallow holes. Interest is also being taken in the possibility of finding oil at the northern end of Great Salt Lake near Promontory and Rosel.

Oil Pipe-Line Bill Pending in Canada

SPECIAL CORRESPONDENCE

As a preliminary step toward the construction of a pipe line to the Fort Norman oil fields a bill to incorporate the Imperial Pipe Line Co. was introduced in the Alberta Legislature. Charles Taylor, manager of the Imperial Oil Co., was one of the incorporators, and the nominal capital was placed at $10,000. The bill came up in committee on March 13, the company being represented by William McAdam, who stated that the Imperial Oil Co. estimate of the total cost of the work was $40,000,000. It would require two years' work to construct a 12-in pipe line, or two 6-in. lines to provide for a production of about 30,000 bbl. per day.

Several members of the committee held the view that a provision should be inserted making the line a common carrier, as were the Kansas and Texas pipe lines. Mr. McAdam strongly opposed this proposal, asserting that the Kansas field had been ruined by this measure. It would, he stated, promote indiscriminate drilling and prematurely exhaust the field, and if the company were compelled to provide for the transportation of other companies' products it would render the cost prohibitive. The company would be glad to buy or transport other oil after it had taken care of its own output. The committee agreed to report the bill as it stood and leave the details to be decided at a later stage.

Imperial Oil Co. To Use Airplanes

SPECIAL CORRESPONDENCE

The Imperial Oil Co.'s all-metal monoplanes have made an initial flight from Peace River to Great Slave Lake and return. The two planes are preparing for their first flight to Fort Norman as soon as weather conditions are favorable, carrying drills and equipment. The company has four California standard drilling rigs on the way, which will be set up adjacent to its present well. A group of Canadian and British syndicates represented by James D. Tait will have three or four drills in operation during the season. The Fort Norman Oil Co., headed by Joseph M. Aitken, brother of Lord Beaverbrook, announces that development will begin on its Fort Norman and Great Slave Lake properties during the summer.

Book Reviews

Electrolytic Deposition and Hydrometallurgy of Zinc. By Oliver C. Ralston. Cloth; 6 x 9; pp. 201. McGraw-Hill Book Co., New York. Price, $3.

Investigators in the hydrometallurgy and electrolytic deposition of zinc have been particularly fortunate in the liberal attitude of their employers and of their fellow workers in releasing information. Many articles on the subject have appeared, and, with the exception of the Brunner, Mond & Co. plant, in Winnington, Chestershire, England, experimental and commercial works have, we believe, been freely opened to properly accredited visitors. The present book by Mr. Ralston is another step in the progress of the art.

The author has succeeded well in his attempt to cover the subject completely and simply. It is always difficult to write a first book on a given topic, for there is not the usual opportunity to see what some one else has said and try to say it better. The principles are well stated, and their development in experimental plants is described.

Mr. Ralston has evidently capitalized his electrolytic experience at Niagara Falls. Particular attention is rightly given to the matter of solution impurities which have proved such a stumbling block. A chapter is devoted to the economics of zinc hydrometallurgy, and this subject is one to which even more space could well have been devoted. Will it pay to install an electrolytic zinc plant? This is a question destined to be of importance, and although the present state of the art does not allow any very definite or conclusive data to be given, the subject should have more and more attention in later editions. It is regrettable that no word of the work being done with the Tainton-Pring process at Martinez, Cal., is included, as the experiments there being made with high-current densities show much promise.

Prompt publication, of course, is essential in a work of this kind, and in hurrying a book to press some errors can be pardoned. However, we think the author and (though we say it as shouldn't) the publisher should have been a little more careful in correcting some of the obvious typographical and other mistakes which appear. Cobalt, we are ingenuously told, causes "re-solution of the cathodes, leaving them looking like they had been shot full of holes"! E. H. R.

Gold. By B[illegible] White. Cloth; 5 x [illegible] in.; pp. [illegible]. Isaac Pitman & Sons Co., New York. Price, $1.

A companion volume to "Silver," by the same author, describing the history and romance of gold and "its place in the economy of mankind," Mr. White has attempted to popularize a subject that lends itself to voluminous and technical description both as to the production of gold and its function as a monetary medium, and technical shortcomings or omissions are excusable. Production of gold from earliest to present times is considered, and the evolution of coinage given in much detail. The importance of the gold standard, gold movements, stocks, the industrial use of gold, and the part the metal played in the Great War are emphasized. To anyone wishing a short but nevertheless "meaty" treatise on the metal the book is excellently adapted, and no doubt many engineers whose efforts are devoted to mining the precious metal will find much information in the book to enlighten them regarding their own part in the economy of the production and use of this fascinating metal. F. E. W.

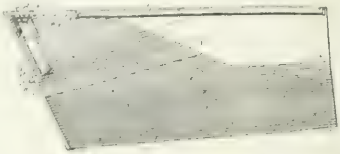
Quin's Metal Handbook and Statistics, 1921. By L. H. Quin. Cloth; 6½ x 4½; pp. 309 inc. advts. Published by The Metal Information Bureau, Ltd., 7 East India Avenue, London, E. C. 3, England. Price, 5s.

The 1921 issue of this handy volume of statistical information has just been published. Production, consumption, prices, imports, exports, grades, and other information respecting all of the more important ferrous and non-ferrous metals are given. Data for other countries as well as Great Britain are included.

Recent Patents

Drum Filter—No. 1,368,618. Henry B. Faber, New York, N. Y. A drum filter in an air-tight container, making use of pressure on the outside of the drum, rather than suction within, to dewater the filter cake. Provision for washing the cake is made, and the wash-water may be divided after passing through the filter, if desired, so that the final wash-water may be kept separate from the other. A counterpressure of air from the inside is used to loosen the cake previous to its discharge.

Vibrating Sluice Box—Fred Cushman, Seattle, Wash., assignor of one-half to C. J. Stephanus, Seattle, Wash. Design of a concentrator, embodying a vibrating sluice box suspended over another vibrating receptacle. No. 1,368,901.



Concentrating Table—J. F. McNeil, Clifton, Ariz. A table with a new system of riffling, as shown in the illustration. No. 1,368,815.

Technical Papers

Phosphate Rock—"Phosphate Rock in 1919" a separate of *Mineral Resources* containing fifteen pages, has been issued by the U. S. Geological Survey, Washington, D. C., and is obtainable on request. The value of the Florida production was $7,797,929; that of Tennessee, $3,414,516; South Carolina, $308,968; and Idaho, Utah, and Wyoming, $69,855. Further statistics of domestic production are given, and several pages are devoted to a description of phosphate deposits in Spain, Algeria, Tunis, Morocco, and Nauru and Makatea islands, in the Pacific.

Seward Peninsula, Alaska—Mining conditions on the Seward Peninsula in 1919 are discussed in Bulletin 714-F of the U. S. Geological Survey (nine pages, free on request). Underground and open-cut mining have decreased greatly in the last three years, and dredging is the principal activity. Some of the details of the practice and the names of the dredges operating are given. Two dredges were engaged in the recovery of tin.

Military Mining—The Engineer School of the U. S. Army, Washington, D. C., has published a thirty-eight-page illustrated bulletin (No. 62) on this subject. The author, A. H. Brooks, was chief geologist of the A. E. F. He emphasizes the principles of mine warfare as developed in the recent conflict rather than the technique of mining. The paper as a whole avoids strictly technical nomenclature, making it all the more valuable to the general reader. Beginning with a historical sketch of military mining, the general features of the art are briefly given. Such matters as terrain, geology, mining tactics, and tools receive extended treatment, copiously illustrated with diagrams. The paper is interesting and valuable to those who wish to be informed regarding mining in other than its peaceful phases.

Kansas Oil Fields—The U. S. Geological Survey has published a map of the oil and gas fields of Kansas. This map, which is on a scale of 12 miles to the inch, shows not only economic data of special interest to the oil man, but the township net, county boundaries, railroads, drainage lines and principal towns and cities. The oil fields are outlined in green and the gas fields in red, and scattered occurrences of oil or of gas that are not of sufficient importance to be classified as fields are plainly indicated. The pipe lines are shown in a distinctive color, the locations of refineries are indicated, and the names of the principal fields are given. The map is sold for 50c. a copy, and may be obtained from the Director of the U. S. Geological Survey, Washington, D. C.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Three Power-Test Codes Ready for A. S. M. E. Chicago Meeting

Nineteen power-test codes, constituting what their framers style "a national common law" in the field of power-plant testing, are being framed by 125 leading engineers, scientists, and educators under the auspices of the American Society of Mechanical Engineers. The codes, when completed, will affect a wide range of industrial enterprises, large and small. They will provide courses of procedure by which all forms of devices from an electrical superstation to a boiler feed pump shall be tested to see if they comply with the terms of purchase or if they are operating at the desired efficiency.

In this work, centering at the headquarters of the society in New York, and radiating to practically every important industrial center of the country, nineteen committees are engaged. These committees are supervised by a main committee of twenty-eight, of which Fred R. Low, of New York City, editor of *Power*, is chairman, and Prof. Clifford B. Le Page, of Stevens Institute of Technology, Hoboken, N. J., is secretary. The committeemen represent engineering societies, manufacturers, public service corporations, national, technical and scientific associations, railroads and Government agencies, including the U. S. Bureau of Standards and the U. S. Naval Academy.

The codes, when all are completed, will constitute a revision and enlargement of the power-test codes of the American Society of Mechanical Engineers, issued in 1915. This plan of revision was set in motion in 1918 when the power-test committee of the American Society of Mechanical Engineers was reorganized as a body to draft nineteen new codes for the different classes of apparatus comprised in power-plant equipment.

Three codes will be presented to the American Society of Mechanical Engineers meeting at Chicago, May 23-26, for consideration and adoption. The code which is probably of most general interest is officially known as "Test Code for Reciprocating Steam Engines."

Another forms a preliminary set of rules, and is entitled "General Instructions." This code was prepared by a committee under the chairmanship of William H. Kavanaugh, professor of experimental engineering in the University of Pennsylvania.

The third of the nineteen codes to be formulated is described by the committee as intended primarily for the testing of apparatus heated by steam, such as vacuum pans, or single and multiple effect evaporators.

The individual committee in charge of a test code first submits a preliminary draft to the secretary of the main committee. This draft is edited and returned to members of the individual committee by the secretary, to whom ; edited revision is returned approved. The draft is then put in type, and proofs are distributed to a selected list of from one hundred to two hundred engineers for criticism, after which the individual committee submits the revised code to the main committee. The main committee then returns the code to the individual committee for further revision, and then submits the revised draft of the code to the council, the governing body of the society, and asks permission to print and present it to the society. When the council, consisting of thirty members representing cities East and West, gives leave to print, the code appears in *Mechanical Engineering*, the official journal of the society.

The next step is the submission of the code to the society at a regular meeting where it is either approved and adopted or is returned for further revision. "The purpose of the power-test codes," says an official statement by the society, "is to provide standard directions for conducting and reporting performance tests of power-plant and heat apparatus, such as are most commonly undertaken in commercial work. They are sufficiently comprehensive to apply to tests which determine all the details of the performance, but selected parts of the code may be used for tests of limited scope. They apply, further, to tests which concern the fulfillment of performance guarantees and to acceptance tests.

"The codes are not intended to supply directions for general research or the development of equipment or of processes. It is assumed that the engineer who is concerned with research will proceed as nearly as is practicable in harmony with their requirements, and that in the publication of results he will employ forms of presentation which will be comparable with those of the codes."

Oil in Utah Discussed

The Utah Society of Engineers recently considered "The Livest Subject in Utah." Three leading papers were presented. Job Winwood, consulting engineer, began the symposium with a discussion, "Federal Requirements for Oil Locations," which was followed by a paper on "Sinking Oil Wells," by B. C. Morrison. "Oil Refining" was discussed by John C. Howard, president of Utah Oil Refining company, and Prof. H. J. Pack, of the University of Utah, spoke on "Oil Geology."

Carnegie Institute Offers Fellowships in Mining at Pittsburgh

The Co-operative Department of Mining Engineering of the Carnegie Institute of Technology offers two fellowships in Mining Research, and two in teaching and research, in co-operation with the U. S. Bureau of Mines. Fellowships are open to the graduates of universities and technical schools who are properly qualified to undertake research investigations. The value of each fellowship is $750 per year of ten months. Fellowship holders are required to register as graduate students and become candidates for the degree of master of science unless an equivalent degree has previously been earned. The purpose of these fellowships is to undertake the solution of problems in mining and utilization of fuels which are of special importance to the bituminous coal industry. The following subjects have been suggested for investigation: Acid Mine Waters; Shotfiring; Shooting Coal; Storage of Bituminous Coal; Geology of Coal-Producing Districts in Pennsylvania; Utilization of Fuels; Preparation of Bituminous Coal.

All applicants for appointment to research or teaching fellowships should understand the following conditions governing the appointments: (a) Appointment to the position of research fellow is for a period of ten months beginning July 1, 1921. All of the time of the research fellow is to be devoted to assigned duties in the experiment station of the Bureau of Mines.

(b) Appointment to the position of teaching fellow is for a period of ten months beginning Aug. 1, 1921. Ten hours each week will be devoted to teaching work in mining, and the balance to assigned duties in the experiment station of the Bureau of Mines.

(c) No vacations will be observed.

(d) Any manuscript presenting the result of research shall be published under the joint authorship of that member of the staff of the Bureau of Mines who initiated the investigation and gave it general supervision, as the principal author, and the research or teaching fellow who conducted the investigation as the sub-author.

(e) Fellows are not permitted to accept any kind of employment for pay during their appointment.

Applicants should [illegible] of their collegiate [illegible] trar's office of [illegible] have been [illegible] Applications [illegible] 1, 1921, a[illegible] Supervisor, [illegible] of Mining Engineering, Carnegie Institute of Technology, Pittsburgh, Pa.

MEN YOU SHOULD KNOW ABOUT

McMosier Henry, geologist, of the Phelps Dodge Corporation, is in Morenci, Ariz.

Colonel Azéma has been elected president of la Société française de Minéralogie.

Douglas Lay has succeeded Paul S. Couldrey as manager of Le Roi No. 2, at Rossland, B. C.

Horace V. Winchell, of Minneapolis, was in Tonopah, Nev., on professional business late in March.

Albert Burch, mining engineer of San Francisco, was in Tonopah, Nev., recently on professional business.

H. A. Wheeler, consulting mining engineer of St. Louis, Mo., was in New York City for a few days last week.

W. A. Rose, chief mining engineer for Pickands, Mather & Co., is in Washington, D. C., on business for his company.

William J. Loring, of San Francisco, was at Tule Canyon, Nev., recently inspecting the Silver Hills mine in which he is interested.

C. M. Weld, consulting mining engineer, has returned to New York City after a professional trip to West Virginia and Kentucky.

George M. Bevier, geologist for the Atlantic Oil Producing Co., has moved his headquarters to the company's office at Houston, Texas.

E. A. Hayes, president of the Hayes Mining Co., Ironwood, Mich., has been appointed a member of the War Finance Corporation, Washington, D. C.

O. B. Hopkins has resigned as petroleum geologist with the U. S. Geological Survey. He will continue his private work for interests in Canada.

Rufus Mather Bagg, geologist, formerly with the Maryland and New York state geological surveys, is now with the department of geology of Lawrence College, Appleton, Wis.

J. M. Price, assistant superintendent of the Montreal Mining Co., Montreal, Wis., and **V. D. Johnson**, of Ironwood, Mich., recently visited the Mesabi Range on business matters.

Carl T. Sparks, mining engineer, attached to the Fairbanks, Alaska, experiment station of the U. S. Bureau of Mines, is returning to Butte, Mont., on urgent private business.

G. A. Joslin, managing engineer of the Ramshorn Mines Co., Salt Lake City, Utah, is going to the company's property at Bayshore, Idaho, where he will spend most of the summer.

A. W. Newberry, mining engineer, has returned to the United States from Nicaragua, after an absence of four months. He went to Toronto before returning to New York City on April 8.

Phillipe Zurcher, a geologist who has devoted much attention to the deposits and resources of Provence, France, has been elected president of la Société Géologique de France. He succeeds **P. Termier** in that office.

Sidney J. Kidder, general manager for the Mogollon Mines Co., has been appointed by Governor Meacham of New Mexico as one of three commissioners for the new county of Catron, just established from the west end of Socorro County, N. M.

E. H. Weitzel, manager of the fuel department of the Colorado Fuel & Iron Co. for the last thirteen years, has been appointed general manager for the company at Pueblo, Col., succeeding the late **J. B. McKennan**. Mr. Weitzel began his coal-mining experience in the Pittsburgh, Pa., district. In 1903 he was general superintendent of the Empire Coal Co., Bellaire, Ohio, but soon moved to Dawson, N. M., for reasons of health. In 1906 he moved to Trinidad, Col., where he opened an engineering office, and in 1907 entered the employ of the Colorado Fuel & Iron Co. as chief engineer. **D. A. Stout** succeeds Mr. Weitzel as manager of the fuel department.

E. H. WEITZEL

E. W. Shaw, petroleum geologist, who has been connected with the U. S. Geological Survey for a number of years, resigned recently to take up private consulting work. Mr. Shaw returned from a South American trip last January, and recently executed a commission in South Carolina for the Survey.

N. H. Darton, of the U. S. Geological Survey, has gone to Arizona to take charge of the geologic mapping work which is to be done in that state during the next field season. He recently made a geological study of the structure of the northern Appalachian coal fields in Pennsylvania.

Frederick B. Hyder, mining and metallurgical engineer of San Francisco, Cal., has resigned his position with the income-tax unit of the office of the Commissioner of Internal Revenue, and resumed private practice in San Francisco. Mr. Hyder is specializing in valuations of natural resources for Federal tax purposes, and in studies of mineral industries.

Mining engineers and metallurgists recently visiting New York City included: **Elwin F. Brown**, general manager, Pewabic Iron Co., Iron Mountain, Mich.; **F. N. Flynn**, of Mexico City, D. F., Mexico., and **Samuel S. Wyer**, consulting engineer of Columbus, Ohio.

SOCIETY MEETINGS

Illinois Mining Institute will hold its spring outing the latter part of May on the Mississippi and Illinois rivers, the boat leaving St. Louis for Peoria on May 26 and returning on May 28. Secretary, Martin Bolt, Springfield, Ill.

The **Tulsa, Okla., Section** of the **American Institute of Mining and Metallurgical Engineers** announces that it meets regularly on the last Friday of each month throughout 1921. M. M. Valerius is chairman, and Jon A. Udden secretary-treasurer of the section.

The Iron and Steel Institute holds its annual meeting on May 5 and 6 at the Institution of Civil Engineers, Great George St., London, S. W. 1. The annual dinner will be held on the evening of May 5, at the Connaught Rooms, Great Queen St., London, W. C. G. C. Lloyd, secretary, may be addressed at 28 Victoria St., London, S. W. 1.

OBITUARY

A. E. Reynolds, mining man, rancher, and a trustee of the University of Denver, Col., died of apoplexy at Nashville, Tenn., on March 21. Mr. Reynolds was born Feb. 13, 1840, near Lockport, N. Y., and in the '60s went to Ft. Leavenworth, Kan., where he was an Indian post trader for some years. In 1874 he staked a mining claim near Lake City, Col., but did not settle permanently at Denver until ten years later. From that time on his mining interests expanded. Among his prominent Colorado activities were the Aspen Mining Co. at Creed, the Revenue Mine Co. at Ouray, the Emma mine at Denton, and the May Day, near Durango, Col. The University of Denver elected him to its board of trustees in 1900 and to the executive committee in 1911.

THE MINING NEWS

LEADING EVENTS

WEEKLY RÉSUMÉ

The Guggenheims elected their board at the A. S. & R. Co.'s annual meeting on April 6. In Manitoba the Flin Flon option has been dropped by the Thompson interests.

Following close upon the news of suspension of operations by many copper producers last week comes the announcement that the Phelps Dodge Corporation will shut down its Copper Queen mine, at Bisbee, and the smelter at Douglas. The Mammoth copper mine at Kennett, Cal., has also suspended. In the Michigan copper country the Copper Range, Mohawk, Wolverine and Quincy companies have announced further wage cuts, as has also the Granby Consolidated, in British Columbia. In Washington the Day interests have closed their Northport smelter, and at Grand Forks, B. C., the Consolidated has shut down its Rock Candy fluorspar mine. The Arizona Copper Co. has deferred its annual meeting until (probably) the end of May. Rumors are afloat of a possible change in control of the Canada Copper Corporation. In Mexico the Torreon smelter has again shut down after exhausting its fuel supply. Judge Johnson, in Salt Lake City, following the Swain report on smelter smoke, has ordered that the Murray plant continue as it has during the last year and that the Midvale plant make certain changes in methods of operation. At Tonopah rumors of possible apex litigation between the Extension and the Cash Boy companies are heard.

In Washington it is said that there is some doubt that H. Foster Bain will be renominated as Director of the U. S. Bureau of Mines.

Eilers Defeated; Guggenheims Win A. S. & R. Election

682,223 Shares Voted Supporting Management; Opposition Musters Only 202,479

Karl Eilers' efforts to oust the Guggenheims from the control of the American Smelting & Refining Co. were defeated, and the Guggenheim board of directors was elected, at the annual meeting of the company in Jersey City on April 6. A total of 682,223 votes was cast, Mr. Eilers not voting the shares or proxies that he controlled. As the vote cast at the meeting a year ago was 636,284, it was evident that the management of the company had a generous margin. The new board, as elected, is as follows:

Daniel Guggenheim, Simon Guggenheim, G. P. Bartholomew, F. H. Brownell, H. M. Brush, Lyman Candee, member of the New York Board of Underwriters; Merrel P. Callaway, vice-president of the Guaranty Trust Co.; Charles Earl, J. C. Emison, H. A. Guess, Frank W. Hills, E. C. Jameson, president of the Globe & Rutgers Fire Insurance Co.; Benjamin Joy, vice-president of the Bankers Trust Co.; F. J. Leary, vice-president of the Central Union Trust Co.; William Loeb, Jr., W. S. McCornick, president of the McCornick National Bank, Salt Lake City; Willard S. Morse, formerly manager of the company's business in Mexico, now retired; E. L. Newhouse, W. T. Page, H. A. Prosser, F. R. Raiff, C. A. H. de Saulles, E. B. Schley, of Moore & Schley; Wilfred Shore, of the Irving National Bank, representing Amsterdam interests; Roger W. Straus, Frederick T. Walker, of the Royal Bank of Canada; John N. Steele and C. W. Whitley.

It became evident in the course of the meeting that the Guggenheims would be able to elect their ticket, which had been published in the morning papers. President Simon Guggenheim being absent when the hour arrived for calling the meeting to order, F. H. Brownell, a vice-president of the company, took the chair and presided throughout the day. After the presence of a quorum had been determined and the minutes of the preceding meeting read, a motion was made by a Mr. Leary, apparently representing Mr. Eilers, that the meeting be adjourned until the first Wednesday in October and also proposing that the management furnish the Evans committee with all information that it might desire in the course of its proposed investigation. The motion also reiterated, in effect, the charges previously made against the management by Mr. Eilers. This motion was opposed by the chair on the ground that only a motion to adjourn was in order and that the motion as made was much broader than this. The chair was sustained on this point by a ballot which at once demonstrated that the Guggenheims and their associates would carry the day, Karl Eilers voting only 202,479 shares and receiving negligible support from those present. A new motion to adjourn was promptly defeated.

The polls were opened at 12.35 p. m. to remain open until 4 o'clock. In the meantime, other business being temporarily adjourned, the stockholders repaired to St. Peter's Hall, near by, which was larger and better adapted for discussion than the small board room. The principal feature of the afternoon was a long defence of the Guggenheim management, read by S. R. Guggenheim. The results of the election were later announced at the board room. The entire meeting was uninteresting, as the outcome was apparent at the start.

Flin Flon Option Dropped by Thompson Interests

Mining Corporation of Canada Said To Be Negotiating Independently To Take Over Property

On account of conditions in the money and metal markets, the William Boyce Thompson interests have dropped the option on the Flin Flon prospect in northern Manitoba, which they purchased early in March, 1920 (see *Engineering and Mining Journal*, March 13, 1920, p. 670). An option held by Hayden, Stone & Co. had previously been dropped in January, 1920, before the Thompson interests acquired theirs.

Colonel Thompson and his associates, including the Mining Corporation of Canada, have expended over $200,000 on the property, in accordance with the terms of the option which expired with the end of March. It is said that the Mining Corporation is now negotiating independently for an option on the property, on which to date a total of over $500,000 has been spent.

The Flin Flon deposit has been described in the *Engineering and Mining Journal* of Oct. 25, 1919. It contains 20,000,000 tons of primary sulphides running 1.7 per cent copper, 1.5 oz. silver, and $1.40 gold. The ore is said also to contain zinc, and the metallurgical problem is reported to be difficult.

Salt Lake Valley Smelters Get Court Decree

Murray Plant Must Operate as During Past Year—Changes Necessary at Midvale

Judge Tillman A. Johnson, of the United States district court of Utah, following the suit of farmers claiming damage to vegetation from smelters operating in the Salt Lake Valley, and after examination of a report by Dr. Robert Swain, who investigated the matter, has issued a decree permitting the smelters to operate on compliance with certain recommendations outlined by Dr. Swain. The Murray plant of the A. S. & R. Co. is enjoined to continue operation as it has in the past year, while the United States company, operating at Midvale, is required to increase the temperature of its stack gases or to make certain alterations.

Copper Queen Mine and Douglas Smelter To Shut Down

The Phelps Dodge Corporation has announced that it will shut down the Copper Queen mine at Bisbee and the smelter at Douglas, Ariz., on April [illegible]. The Sacramento Hill project and the construction of the new Copper Queen concentrator will be continued.

Hecla and Marsh Mines Settle Litigation Amicably

No Further Payment Made—Hecla Gets Release of All Claims—Marsh Lease Cancelled

The Hecla Mining Co., of Wallace, Idaho, has notified its stockholders under date of March 30, 1921, that the negotiations in progress between the Federal Mining & Smelting Co. and Marsh Mines Consolidated for the settlement of the latter's claim against the Hecla have been concluded. The Marsh company has delivered to the Hecla a release of all claims against it and a cancellation of the Marsh lease on the O'Neil, Mono Fraction, and Russell lode mining claims. It is stated that the litigation has been ended without further payment of any other sum than Hecla's obligation to the Federal company, which has been paid in full.

Tonopah Companies May Undertake Apex Litigation

It is rumored in Tonopah, Nev., that there is a possibility of litigation between the Tonopah Extension Mining Co. and the Cash Boy Mining Co. over the ownership of certain orebodies which the former has followed into Cash Boy ground. It is said that the Cash Boy company has demanded that the Tonopah Extension prove apex rights before extracting further ore. Albert Burch and H. V. Winchell have recently been in Tonopah, though the nature of their business is not known, other than that it is professional.

Lake Superior Mining Institute To Meet Next August

The Lake Superior Mining Institute will hold a meeting on the Marquette Range next August. It was to have been held in Houghton County, but a change has been made by the institute board because of the depression in the Michigan copper country. A. J. Yungbluth, secretary of the institute, states that this is to be one of the most interesting of the meetings of this body, according to plans now being formulated. No meeting of the institute has been held since the beginning of the late war, and a big attendance is looked for at the coming one. Several interesting side trips are being arranged.

Compensation Ordered Paid for Death of Miner

The Industrial Commission of Utah has ordered that compensation be paid the minor sisters of Walter Carr, who was killed by falling into a missed hole at the mine of the Judge Mining & Smelting Co., at Park City, the money to be paid to Mrs. W[illegible] mother, who shall file semi-annual affidavits that she has applied all of the compensation under the award to the support and education of the sisters. Payments amount to $16 a week for 202 weeks.

Conditions in Cœur d'Alenes Better Than Elsewhere

Less Than Half of Usual Number of Men Employed—Morning and Bunker Hill & Sullivan Will Continue —Hecla To Decide Soon

Since November about 1,300 men have been thrown out of employment in the Cœur d'Alene district, in Idaho, through the suspension of mineral production. The first to shut down was the Callahan Zinc-Lead Co., affecting about 350 men. About Jan. 1 the Gold Hunter followed, affecting about 160 men. Low prices of lead and zinc, high freight rates, and war prices for powder and other mining supplies were the causes of the shutdown in each case. Hope for relief from these onerous conditions did not materialize; in fact, the metal prices further declined, and there has been little relief from war prices for supplies. As a consequence on March 20 the Hercules and the Tamarack & Custer mines, both controlled by the Days, stopped production, resulting in throwing about 700 men out of employment. The only big producing mines now in operation are the Hecla, at Burke; the Morning, at Mullan (owned by the Federal Mining & Smelting Co.), and the Bunker Hill & Sullivan, at Kellogg.

It may be stated authoritatively that the Morning, which is closely affiliated with the American Smelting & Refining Co., and the Bunker Hill & Sullivan, which has its own smelter, will continue in operation, as the smelting companies with which they are connected have ample financial resources to carry an unlimited stock of lead until there is a market for it. What the Hecla will do will probably not be known until after the annual meeting of the company, which will be held in Spokane on April 12. These three companies, including the Bunker Hill smelter, employ in round figures 2,000 men. Small producers and leasing and development operations give employment to 500 men, according to a conservative estimate, making the total number of men employed by the mining industry in the Cœur d'Alene district 2,500, less than half the number employed in normal times. Still this is said to be a better showing than most of the Western mining districts can make.

Mond Nickel Co. Issues New Securities

The Mond Nickel Co., of Coniston, Ont., in the Sudbury district, has issued £1,300,000 in 8 per cent debentures at 98 in London to provide funds for the further development of its business.

Granby Cuts Wages Further

Granby Consolidated Mining, Smelting & Power Co. cut wages 25c. more on April 1, making a total cut of $1 per day since Dec. 31 last. The four furnaces continue to produce 2,000,000 to 3,000,000 lb. of copper monthly.

The End of the German Steel Trust

Pessimistic Report of Stahlwerksverband for Year July, 1919, to July, 1920, Sketches Conditions in Industry

From Our Berlin Correspondent

The Stahlwerksverband, which is the official title of the German Steel Trust, one of the mightiest and most influential institutions of pre-war Germany, has just delivered its death song in the form of the business report, covering the time between July, 1919, and June, 1920, at which time the business activity of the corporation came to an end.

The beginning of the dissolution of the trust dates far back into the early stages of the war, when this powerful structure began tottering on account of the steadily growing tendency of its members to free themselves from all restrictions with regard to production and distribution. The enormous demand for steel products during the war caused the steel trust to be more and more considered as something entirely superfluous, and as a severe handicap to individual progress. It would have fallen into pieces before the war came to an end if the government had not brought influence to bear upon the steel works for the sake of the continuation of the trust. Conditions, however, became critical after the separation of the Luxembourg and Lorraine works. Great difficulty was found to patch up matters from April, 1919, to the end of September, 1919. When, however, at the end of July the Sarre works also left the trust, all hope for a continuation of the trust was abandoned. The government conceived the idea of a new body, which was to take over the functions of the steel trust, under the control of the government, as far as control of prices and distribution was concerned.

This body, the Eisenwirtschaftsbund, or Iron Economy Society, came into life in April, 1920. Strong pressure has been used from the side of the government to keep the steel trust alive until operations of the new society came into swing, in such way that the corporation agreement was compulsorily renewed four times until the 3d of June, 1920, when the activities of the trust were terminated definitely.

The last business report of the trust makes sad reading, and is conspicuous for the absence of optimism. It deals very severely with the official institutions for the control of exports, the export licenses, and the slow red-tape business procedure for obtaining them, which were patiently borne by the foreign buyers only as long as the foreign markets stood in great need of German steel products. Many substantial orders at good prices have been lost on the one hand, while the export offices could not prevent large quantities of steel, specially rolled products, bought at inland prices obviously for inland consumption, from finding their way across the frontiers through the "Hole in the West," which is the common term used for the territories now occupied, where control of exports is handled indifferently and very leniently. In this way only 11 per cent of the total shipments of 1,278,310 tons could be sold abroad. Even the strong inland demand of that period is not looked upon as a hopeful sign, as it was discovered to be artificial and inflated by speculation.

After delivering a parting shot at the steel trust's successor, the Eisenwirtschaftsbund, which, it is said, in the opinion of the steel industry, is perfectly superfluous and out of place, the report gives vent to rather pessimistic views on the present situation and on the outlook, which is declared to be gloomy. The main danger to the German industry is seen in the growing competition of the foreign rivals, whose situation is steadily improving, while the German industry has not seen its worst time yet. The latter is existing solely on the grace of the low exchange, and is thus controlled by a factor which in itself is uncontrollable. A sudden rise of the exchange, like last year's, would land the German steel industry in a sore predicament.

The shipment of semi-finished products in the period covered by the report was 314,762 tons, as against 439,309 tons in the previous year, or 124,547 tons less. Of these shipments only 12,234 tons, or 3.89 per cent, has been sold on foreign order. The shipment of railroad material was 586,814 tons, which is 229,097 tons less than in the preceding year. On foreign order have been shipped 120,886 tons, or 20.46 per cent; of rolled shapes, 384,743 tons, or 50,077 tons less than the previous year, was shipped, of which only 12,183 tons, or 3.22 per cent, was sold on foreign order. The shipments of steel bars totaled 279,456 tons. The exports of steel bars could have been much higher, says the report, if the steel works had been free from the fetters of government control, this being the more regrettable, as it evidently has caused the loss of several important markets to foreign competitors. The accompanying table shows the year's shipments.

SHIPMENTS OF GERMAN STEEL PRODUCTS DURING THE INDIVIDUAL MONTHS OF THE BUSINESS YEAR (In Tons)

Month	Semi-Finished Material	Railroad Matrial	Rolled Products	Total	Decrease Over Previous Period
1919 July	42,712	55,491	37,598	135,801	63,181
August...	34,762	62,008	40,542	137,312	68,626
September.	58,254	61,147	42,233	161,634	21,960
October....	26,412	59,632	36,233	122,277	30,892
November.	19,084	43,122	34,988	97,194	9,106
December..	18,967	51,666	30,097	100,730	5,067
1920 January	12,543	33,412	27,164	73,119	52,242
February..	19,062	39,830	29,338	88,230	42,990
March	22,516	36,563	27,687	86,766	63,150
April.	21,858	42,581	27,872	92,311	30,088
May	17,200	45,164	26,060	88,484	28,204
June......	21,332	56,198	24,931	102,461	13,274
Total tons	314,762	586,814	384,743	1,286,319	410,721

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Bain's Renomination as Director in Doubt

Position May Go To Pay Political Debt—Fall Said To Be Making Inquiries as to Bain's Experience

Some apprehension is felt at this writing concerning the directorship of the U. S. Bureau of Mines. A report is in circulation to the effect that the position may be filled by a man to whom the administration owes a political debt. Since Dr. H. Foster Bain, the acting director, has been connected with American mining enterprises abroad during the greater part of recent years, and from the fact that he never has been at all active in politics, it is certain that he had no part in the recent Republican success.

There has been much talk about an honest-to-goodness dirt farmer in connection with the selection of the Secretary of Agriculture, and there are some advocating the application of the same principle in the selection of a director for the Bureau of Mines. The fact that the new Secretary of the Interior for many years was engaged in prospecting and has a large acquaintanceship among honest-to-goodness prospectors has given rise to the idea that such procedure would not be unusual.

At the office of Secretary Fall it is stated that there is no ground whatever for the rumor. On the other hand, it is known that the secretary is making some inquiry in regard to Dr. Bain's practical experience. There is reason to believe, however, that he will follow the precedent of former administrations in continuing in office the heads of technical bureaus, regardless of any political consideration.

Dr. Bain accepted with reluctance the acting directorship of the Bureau of Mines. It meant a considerable financial sacrifice on his part. He was induced to accept the place by the argument that he would be in a position to do great service to the mining industry. He has refused to allow any steps to be taken by his friends toward advancing him for continuation in office. On the other hand, it is known that there is some activity in behalf of aspirants for the place.

Three Years' Tungsten Supply in Stock Here, Says Hess

More than three years' supply of tungsten ore is being held in stock in this country, in the opinion of Frank L. Hess, tungsten specialist for the U. S. Geological Survey. For this reason, he points out, the production of tungsten concentrates in the United States in 1920 was practically negligible. The only operations conducted during the year were those of the Wolf Tongue Mining Co. and the Vasco Mining Co., of Boulder, Col. The two companies produced in 1920 a tonnage that was equivalent to 216 short tons of ferberite ore, carrying 60 per cent tungsten trioxide.

Poindexter To Remain Chairman of Senate Committee on Mines

Senator Gives Up Work on Certain Other Committees—Republican Members Named

Senator Poindexter, of Washington, is to continue to head the Committee on Mines and Mining of the Senate. Owing to the fact that the number of Senate committees has been greatly reduced and as there is an unusually large number of Republicans to be considered for committee assignments, objection had been raised to Senator Poindexter's service on a number of important committees. In addition to his chairmanship of the Committee on Mines and Mining he held during the last Congress membership on Interstate Commerce, Naval Affairs, Pensions, Postoffices and Postroads, Public Lands, as well as on minor committees. Final action has been taken on the matter, however, and he is to continue during the next Congress as chairman of the Committee on Mines and Mining, and, in addition, he will hold his membership on the committees of Interstate Commerce, Naval Affairs, and Public Lands.

Republican members of the Senate Committee on Mines and Mining, in addition to the chairman, have been chosen as follows: [illegible] Newberry, Michigan; [illegible], Colorado; Sutherland, West Virginia, and Norbeck, South Dakota. The minority members have not been designated.

War Mineral Awards

Awards totaling $25,696.77 were recommended during the week ended March 26 by the War Minerals Relief Commission. In the manganese claim of Thorkildsen & Miller an award of $17,526.18 was recommended. The claimants had asked for reimbursement to the extent of $24 248.35. In the case of the Manganese Products Co. an award of $7,331.19 was recommended. The company had asked for $98,865.48 to reimburse it for losses sustained in its manganese operations. Introduction of new evidence in the case of Hussey, Beam & McVay resulted in the recommendation of an award of $645.40. This was 86 per cent of the amount claimed. The claim previously had been disallowed. An additional $194 was recommended for G. Howard Garrison.

Flotation Work at Platteville Successful

Information has reached the Bureau of Mines to the effect that it seems certain that Bureau of Mines engineers have assisted importantly in solving the fundamentals of the Wisconsin problem in the treatment of mill sands and slimes. The work has been handled by Messrs. Coghill and Anderson, of the bureau's staff, who had under their charge the flotation experiment work at Platteville, Wis.

To formulate plans for the work of the Alaska mining experiment station George S. Rice, the chief mining engineer of the Bureau of Mines, and Dorsey A. Lyon, its supervisor of stations, are planning to visit Alaska this summer.

Missouri Appropriates $150,000 for Rolla Station

The Missouri Legislature has appropriated $100,000 for the building which the state will erect to accommodate the experiment station of the Bureau of Mines at Rolla. In addition $50,000 was appropriated for Missouri's share of the co-operative work to be done at the station.

Harding To Present Radium Gift to Mme. Curie

Plans have been completed for President Harding to present to Mme. Curie the gram of radium which is being given to her by the women of America. The presentation will be made at the White House on May 20. Mme. Curie will sail from France on April 20.

NEWS BY MINING DISTRICTS

Special London Letter

Modderfontein "B" Cuts Main Reef Leader in Southwest Shaft—Modderfontein East Seeking Funds for Milling and Development Scheme—Cam & Motor's February Run

By W. A. Doman

London, March 22.—Two Far Eastern Rand gold-mining companies come into the limelight this week—the Modderfontein "B" and the Modderfontein East. The former has intersected the main reef leader in the southwest shaft at a depth of 1,488 ft., and the average reef width of eight sections taken round the shaft is 13.9 in., and the average value 29.1 dwt. This gives 405 in.-dwt., not quite up to the average of the ore reserves; but certainly good. As the New Modderfontein, Modderfontein Deep, and the Government Gold Mining Areas are on the western and southern boundaries, and contain ore with high gold values, the prospect of the Modderfontein "B" proving equally successful in this portion of its property is regarded as bright. The South Eastern shaft was not so fortunate, for the reef where struck was of an unprofitable character. The mine, considered not so many years ago as almost a "dud," has proved one of the best in the district.

The Modderfontein East had in mind a more extensive development and milling scheme, for which additional funds are required. At present the ore is treated at the Apex mill. Some weeks ago, in connection with its extended program, the Jupiter reduction plant was acquired for about £110,000, a good bargain for both parties, seeing that on account of expenditure exceeding revenue the Jupiter had closed down and that the Modderfontein East could not elsewhere have secured a suitable plant at such a reasonable figure. The total expenditure of the latter company on its scheme will run into approximately £350,000. In any case, owing to high labor costs, the dismantling of the Jupiter plant and its re-erection at the Modderfontein East could not be accomplished in a hurry, and it now seems that the transfer will be delayed for some time, as insufficient funds are available for capital requirements. It was hoped that options over 373,000 shares at 22/6 per share would be exercised, but there is little prospect of this happening. Besides, the debenture issue of £500,000 falls due for repayment at the end of July. As the money market is in no mood to put up funds for Kaffirs, a scheme is being devised for meeting the situation. There can be no doubt that the debentures will be redeemed at due date, but the program of expansion cannot yet be executed. Pending satisfactory arrangements, operations will be continued on the present scale at the Apex plant. Recent developments have disclosed ore of a lower grade, but the reserves amount to 1,750,000 tons, of an average value of 7.75 dwt. over 55.3 in.

The strike of white miners in Rhodesia does not yet appear to be settled. According to some of the mining companies, the men had accepted the owners' terms unconditionally, but another message says that negotiations are still proceeding. At the Rhodesia Broken Hill mines, which, by the way, produced lead at a lower cost than anywhere else in the world, the men are totally unaffected. Possibly this may be explained by the fact that these properties are much further north, and that the men are well provided for in the way of housing and recreation.

Having remodeled its reduction plant, the Cam & Motor company, operating in Rhodesia, has announced the result of the February run. The ore milled, 8,200 tons, had a screen value of 44/-, and gold contents of £18,040, at presumably standard price. Concentrates obtained were 989 tons, or 12 per cent of the original, the value per ton being £10 9s. 6d., and the total value £10,360. The value per cent of the original is thus 57.5. It is stated in a later message that the residue of first tanks concentrates treated indicates 90 per cent extraction. Costs for the month exceed the value obtained.

AUSTRALIA

Queensland

Proposed Process for Treating Mount Elliott Low-Grade Ores Would Net £2,000,000

Brisbane, Feb. 21—The annual report of Mount Elliott, Ltd. (Cloncurry), as submitted to a meeting of shareholders in London in December last, reached Queensland in January. During the twelve months covered by the report the smelters of the company remained idle, development was cut down to the most narrow limits, and the loss on the year's operations was £8,940. The failure, already reported, to obtain fresh capital in America is referred to in the report. The very life of the company is described as being dependent upon a railway being constructed to Mount Oxide. This it can obtain only if fresh capital is subscribed, and the directors have under consideration a scheme for the reconstruction of the company with this purpose in view.

Three estimates are given of the ore reserves of Mount Oxide copper mine—those of Edwin S. Berry, of Messrs. Yeatman & Berry, who was sent to Cloncurry on behalf of capitalists in New York to report on the company's mines; the chief govern-

PLANT OF MOUNT ELLIOTT, LTD. (COPPER), CLONCURRY DISTRICT, QUEENSLAND, AUSTRALIA

ment geologist of Queensland, B. Dunstan, and W. H. Corbould, consulting engineer of the company. Mr. Berry's estimate is 100,300 tons of 14.3 per cent ore and 83,300 tons of 10.5 per cent; Mr. Dunstan's is 200,000 tons, having a general average of 12½ per cent down to the 300 level, with evidently an immense deposit in the southern workings containing an average of 4 per cent; and Mr. Corbould's is 300,000 tons of an average grade of 10 per cent. This mine is regarded as one of the richest of its kind for its size in the world.

Mr. Corbould has submitted to the directors a process of his own for the treatment of the low-grade ores of the company's mines, and states that with his proposed treatment plant the profit to be derived from all the ore disclosed to date in the company's group of mines would amount to not less than £2,000,000. Under this treatment he believes that copper can be produced and shipped at port for £50 per ton.

Tasmania

Mount Bischoff Tin's Profits Dropped in Second Half of 1920

Waratah—The average price received for tin by the Mount Bischoff Tin Mining Co., of Tasmania, during the latter half of 1920, was £253 3s. 6d. per ton, as compared with £342 13s. for the previous six months. It is not surprising, therefore, that the margin of profit on the term's work was small—£3,414. In addition, £416 in interest was received, and £74,236 brought forward from previous account, making the available total £78,066.

New South Wales

Will Sell Great Cobar Copper Property

Cobar—The Great Cobar copper mine, New South Wales, is to be offered for sale at an early date. Once an important mining center, the Great Cobar went into the hands of a receiver in 1916, but a reconstruction scheme was formulated to obviate the need for selling during the war. The sum required was £100,000, and to keep the enterprise from failing the New South Wales government underwrote £40,000 of the receiver's certificate. The works were reopened, and operations were so successful that the government received its capital back, with interest and a profit of over £25,000. Labor difficulties and the weak metal market have now, however, caused the present owners to decide that they will not resume operations, and the mines, machinery, rights, stores, rolling stock, and general equipment are to be offered for sale by tender.

Victoria

Bendigo Amalgamated Shareholders May Object To Erection of Rubber Works

Bendigo—The profit made by Bendigo Amalgamated Goldfields during the latter half of 1920 was £70,504, after providing £20,000 for depreciation and other contingencies. The gold recovered from 50,692 tons of ore milled totaled 32,507 oz., worth at the standard price £129,387, to which must be added £65,092 received in premiums from the Gold Producers' Association. The company has £150,000 in hand and purposes establishing rubber works at Bendigo. A. H. P. Moline, general manager, is visiting England and America in connection with the purchase of plant and machinery for the undertaking. There is likely to be some objection on the part of shareholders to the directors' proposals.

SOUTH AFRICA

Transvaal

Messina Company To Make Blister From Matte in Reverberatory

Messina—The Messina Development Co. is planning to start up a small reverberatory plant for refining copper. It is intended not only to refine blister copper by blowing in a reverberatory furnace in the usual way but also to bring high-grade matte to blister copper by blowing in another reverberatory. The customary converter has not been installed for this work because the tonnage to be handled is very small and the grade of matte made is from 60 to 65 per cent copper, owing to the fact that the ore is mostly bornite. The company had expected to begin work on its new plant in March but the start of operations has been postponed.

CANADA

British Columbia

Consolidated Closes Rock Candy Fluorspar Mine—Rumored Canada Copper May Change Hands

Nelson—Because of the impossibility of reducing wages in the mines of the Crow's Nest Pass district at the present time there is no likelihood of effecting a reduction in coal and coke prices, according to G. D. Robertson, Dominion Minister of Labor. Following a conference with the Western Coal Operators, Mr. Robertson informed F. A. Starkey, commissioner of the Associated Boards of Trade of eastern British Columbia, that there is very little profit made by Crow's Nest operators in coal production under existing conditions and that coke production is effected at a loss of about 60c. per ton.

Grand Forks—Consolidated Mining & Smelting Co.'s Rock Candy fluorspar mine, on the north fork of Kettle River, closed down April 1 because of lessened demand for output in steel operations at Gary, Ind. It is anticipated that the suspension will not last long.

Princeton—Rumors are persistent as to a possibility of change of ownership of the Canada Copper property at Copper Mountain, and of the concentrator at Allenby. If a change is made it will probably result in outright control by Consolidated Mining & Smelting Co., which has apparently had some understanding with the Canada Copper Corporation for some time. The West Kootenay Light & Power Co., a Consolidated subsidiary, has spent large sums in construction of a long distance transmission line to the district, and the Kettle Valley Ry., a Canadian Pacific subsidiary, incurred heavy expenses in building a spur line to the Canada Copper holdings, with a view to furnishing transportation. The control of the Consolidated is known to be vested in the Canadian Pacific.

Three Forks—The report of the Rambler-Cariboo Mines, Ltd., covering the past year, indicates but little development or production for 1920, owing to labor troubles and water shortage. Underground development consisted of 404 ft. of drifting and 85 ft. of raising. Tonnage mined was 4,000, producing 220 tons of lead concentrates and 250 tons of zinc.

Ontario

Plan of Reorganizing British America Nickel Indorsed

Sudbury—Bond and debenture holders at meetings held in Toronto March 31 indorsed the proposed plans for the financial reorganization of the British America Nickel Corporation by the issue of $24,500,000 in income bonds of three classes.

Porcupine—Plans for house construction for the accommodation of their employees have been adopted by the Hollinger Consolidated and the McIntyre. The former company will build upward of 100 houses in Timmins, and the McIntyre will put up thirty or more on the north side of Pearl Lake.

The Allied Porcupine Gold Mines, Ltd., has been incorporated, capitalized at $5.000,000, to operate the La Palm and Three Nations properties in Whitney township. It is understood that the Jermy Veteran claim will also be included in the merger, giving the company control of over one square mile of territory in the northeastern part of Whitney township.

The Premier Paymaster, southwest of the Dome, has been reopened. Diamond drilling is being done to prove the extension eastward of a large orebody met on the 200 level.

The directors of the Porcupine Keora propose to sell two of its claims to a new company. The proposition was submitted to the shareholders on April 4.

Kirkland Lake—The Lake Shore during February produced $24,068 from the treatment of 1,458 tons of ore, the average recovery being $16.44 per ton. The mill ran 83 per cent of possible running time.

West Shining Tree—George R. Rogers, president of the Wasapika Consolidated, announces that arrangements have been made for the erection of a mill, the first unit of which will be of 100 tons daily capacity.

Quebec

Black Lake—The shareholders of the Black Lake Asbestos & Chrome Co. have decided to move the head office from Toronto to Montreal in view of the recent change in the control.

MEXICO

Coahuila

Torreon Smelter Shuts Down Once More Owing to Lack of Fuel

Torreon—The smelting plant of the Cia. Minerales y Metales at Torreon closed down last week, having exhausted its fuel supply. The railroads are unable to bring in sufficient coal and coke, owing to the general strike of employees. Several thousand Mexican laborers are thrown out of employment.

At Dinamita, about twenty-five miles west of Torreon, is the only dynamite factory in Mexico which has been furnishing explosives to the mines of the republic. Since the establishment of this factory prior to the revolution it has been protected by a high tariff on imported dynamite. According to a new law published in the official paper on March 14 these duties have been suspended, and the factory at Dinamita is threatening to close down, its owners declaring they cannot compete with the foreign factories in price.

Sonora

Cananea — Development work continues at the property of the Calumet & Sonora. Ore has been cut on the 900 level of the Chivera shaft. The finishing touches are being put on the reconstructed mill. The power plant has not yet been put into operation, owing to difficulties met in getting the new turbine generator started.

The Cananea Consolidated Copper Co. has a few repair men at work in the mines and also a few men doing various painting jobs at the smelter.

Chihuahua

The Cia. Explotadora de Santa Marta was recently incorporated, with 5,000 shares and capital stock paid up. It will reopen and operate the Santa Marta property, in the Barranca del Cobre in southwestern Chihuahua, about 45 miles from Creel, on the Kansas City & Orient R.R. About 150 acres are included in the holdings. Some ore had been shipped to the El Paso smelter prior to 1914. Dr. C. S. Bungart, of Fort Smith, Ark., is president; Dr. I. J. Bush, of El Paso, vice-president; H. W. Foster, secretary-treasurer, and T. W. Foster, manager.

MICHIGAN

The Copper Country

Copper Range, Mowhawk and Wolverine and Quincy Cut Wages—C. & H. and Subsidiaries Shut Down

The Copper Range group of mines has announced a reduction in all wages and salaries effective April 1. Under the new schedule the wages of miners will be $3.50 per day and trammers and other labor $3 per day. Quincy also cut wages on April 2.

The management of the Calumet & Hecla and subsidiaries has announced that all their properties will cease production for an indefinite period beginning April 1. This means the shutting down of the Calumet & Hecla Mining Co., the Ahmeek Mining Co., and the Isle Royale Copper Co., these being the only mines of this group operating since last November. This action is necessitated by the condition of the copper market and is in line with the policy of other large copper producers throughout the country.

Theodore Dengler, general manager of the Mohawk Mining Co. and Wolverine Copper Mining Co., has announced a general reduction of wages and salaries of all employees, taking effect April 1. The new schedule will be as follows: Miners, $3 per day; trammers, $2.75 per day, and surface laborers, $2.25 per day.

In his notice to the employees the general manager said: "To all employees we would say that the question of whether the company shall continue to operate these mines or not during this low price of copper depends upon you to meet the conditions with all your effort."

Menominee Range

Chapin Mine Cuts Force

Iron Mountain—The Chapin mine has let out about ninety men, this being the first reduction of forces at any of the Oliver Iron Mining Co.'s properties on the Menominee Range. The stockpile ground at the Chapin is about filled to its capacity and shipments will have to be made to permit much more stocking.

Marquette Range

Republic Company Closes Hartford Mine

Ishpeming—The Republic Iron & Steel Co. has closed its Hartford mine that had been operating only one shift, thus letting out about eighty men. The company has closed several other properties in its Lake Superior list.

MINNESOTA

Mesabi Range

Duluth—Referring to an item printed on p. 443 of *Engineering and Mining Journal* of March 5, George H. Crosby writes: "The *Engineering and Mining Journal* was in error when it involved me in the suit versus the Inland Steel Co. for improper operation of certain mining leases. There is no misunderstanding of any kind between myself and the Inland Steel Co., either personal or as agent for some one else."

ALABAMA

Gulf States Steel May Put Surplus Ore From Shannon Slope on Market—Furnaces Seek Lower Freight on Raw Material

Birmingham—Having completed its development work and being prepared to produce 2,000 to 2,500 tons of self-fluxing ore daily the Gulf States Steel Co. may offer ore on the open market, the supply which will come from the deep-mining slope at Shannon, eight miles south of Birmingham, being greater than the company needs. The mine is down 2,772 ft. from the surface and the slope is completely concreted.

The Woodward Iron Co. has already sunk a shaft to deep ore on some of its property and is prepared to begin the mining on a large scale. When the pig iron market shall have improved so as to warrant the resumption of operations at the several furnaces of the Woodward Co. the new mine will be drawn upon, though the older mining properties will supply ore for many years to come. Developments are under way south of Shannon with prospect of other deep-mining projects being entered upon. Negotiations are under way with property owners in the lower part of Jefferson County looking to the development of the property. The belief is expressed that when the pig iron market returns to activity there will be much ore in demand. Two or three of the more active companies of this district have considerable ore stacked up already, while a fourth one has a good start on surplus ore and will be ready to increase the pig iron make on very short notice.

The Alabama company is preparing to test the Hammond ore field on Shinbone Ridge, opposite its furnace plant site in North Gadsden, Etowah County. It is said that there is little doubt that the vein worked for 40 years on adjoining property will be found to exist on the Hammond tract.

Independent ore companies, now shut down because of no demand, are taking the opportunity to install improvements. The pig iron make in this district is very low, three independent companies each having a furnace going; namely, the Woodward Iron Co., the Alabama Co. and the Sloss-Sheffield Steel & Iron Co. The Tennessee Coal, Iron & Railroad Co. has five furnaces on basic iron, one on ferro-manganese and one on foundry iron.

Furnace companies in the Birmingham district are appealing to the Public Utilities Commission of Alabama for a reduction in freight rates on raw material from the mines and quarries to the furnaces. A few years ago the railroads handled the material for practically nothing to assist the iron manufacturing companies, but now it is proposed to make a material charge.

ARIZONA

Arizona Copper Co. Defers Annual Meeting—Asbestos Deposits Open to Location April 15

Clifton—The Arizona Copper Co. has deferred its annual meeting owing to the difficulty experienced in adjusting questions in connection with taxation upon which the company's secretary is now engaged in Washington. The board hopes that the report can be issued and the meeting held about the end of May.

Douglas—At a recent meeting in this city of the stockholders of El Tigre Mining Co., Charles M. Bush, of Kansas City, was elected a director, being retained in a place to which he had been temporarily chosen last fall after the death of his predecessor, O. V. Dodge, of Kansas City. The other directors were re-elected and L. R. Budrow, of Douglas, remains as manager. The statement was made by a director that no shut down is contemplated, as producing costs have been reduced materially, though freight rates remain a serious burden.

Bisbee—The Boras Leasing Co. has started a raise on its 700 level to come up under the oxide orebody on the 600 level. Drifting continues on the 700 level to get under the sulphide stope on the 600 level.

The Night Hawk Leasing Co. has been shut down temporarily owing to an accident to the hoisting equipment.

Patagonia—Prospecting and development work has been resumed at the Flux mine.

Chloride — The Dardanelles Mining Co. shipped its eighth car of high-grade silver ore March 19. The north and south drifts are advancing steadily and both are opening up promising ore.

The White Hills property, twenty miles northwest of Chloride, has been taken over by Senator Keller and associates. The first work is being done by lessees, of which three groups are working.

Globe—Something of a rush is expected April 15 into the Apache reservation, east and north of Globe, that date having been set by the Indian Bureau for the opening for location of a number of known deposits of asbestos. The Indian agent has issued warning that any persons who try to evade the terms of the opening notice will be dealt with severely and will be considered as trespassers.

COLORADO

Sunnyside M. & M. Co. Cuts Promising Vein Below 200 Level

Eureka—In sinking the Washington shaft of the Sunnyside Mining & Milling Co. a promising vein of lead, zinc and copper ore has been opened below the 200 level. A crosscut indicates a width of over 40 ft. and assays run up to $100 a ton. Contracts have been let for 700 ft. of drifting on the vein and a 500-ft. tunnel into the Brennem claim which adjoins the Washington. The Washington shaft will be sunk another 100 ft. The new vein is in virgin ground and is considered very encouraging. The company is laying plans for resumption of active mining operations on a larger scale.

Denver — The Colorado Fuel & Iron Co. at its annual meeting of stockholders elected the following: J. F. Welborn, Denver, president; S. J. Murphy, New York, vice-president; Fred Farrar, Denver, general counsel and executive assistant to the president; Wendell Stephens, Denver, attorney; S. G. Pierson, Denver, vice-president and treasurer; A. H. Lichty, Denver, vice-president in charge of industrial relations; E. S. Cowdrick, Denver, assistant to vice-president; E. H. Weitzel, Pueblo, general manager.

NEVADA

Ore Shoot Recently Cut on 1,000 Level of Tonopah Divide Becomes Low Grade

Tonopah—The gross value of gold and silver bullion shipped from the mills of this district, and representing results of two weeks' operations, totaled about $300,000. The McCane shaft of the Tonopah Extension has reached a depth of 1,646 ft., good progress being made. On the 1,881 level from the Victor shaft, which is the deepest working in the Tonopah district, three faces are being pushed, all of which are in Extension breccia, which is the ore-bearing formation in this portion of the district. In the West End mine development has been started from the 960 level of the West End shaft and from the 1,100 level of the Ohio shaft. Both workings are in favorable formation.

Divide—In the Tonopah-Divide mine some encouraging but erratic values have been cut in the southeast drift on the 800 level. On the 1,000 level the oreshoot entered about three weeks ago has become low grade. Crosscutting and drifting is being done to prospect the vein thoroughly, experience on the upper levels having proved that parallel lenses of ore can occur where the vein is wide, and conditions are favorable on this level, as the vein is very wide. The ore on this level was sulphide in character but not so hard and siliceous as on the level above.

The Tonopah Dividend is crosscutting to the vein on the 200 level and drifting on the 400 level. This is the same vein that the Divide Extension is working on, and in which this company has proved one oreshoot to have a length of at least 150 ft. and to contain high-grade ore, assays up to $1,000 across a width of 4 ft. having been obtained.

Tule Canyon—The Silver Hills Mining Co. reports that the oreshoot recently cut in the drift on the 200 level is holding out well, the face of the drift now showing 5 ft. of $80 ore, with face samples at least as good for several days. The face is approaching the projected position of rich orebodies which were formerly worked on the upper levels.

Spanish Belt—The 50-ton plant of the Consolidated Spanish Belt Mining Co. is to be completed in the near future. This mine has been under development for several years by this company and there is a considerable tonnage of milling ore in sight, with some narrow veins of high-grade assaying up to $500 per ton, which have recently been discovered in virgin ground.

Pioneer—The Mayflower mill is operating successfully on limited tonnage which will soon be increased to about 30 tons per day. The grade of ore is about $15 per ton and the extraction about 70 per cent by amalgamation and concentration.

Pioche — Ore shipments from the Pioche district for the week ended March 24 totaled 1,220 tons. Shippers were: Virginia Louise, 805 tons; Bristol, 320, and Black Metals, 95.

Operations at the Prince Consolidated mine are proceeding satisfactorily and shaft sinking has been started. A Snow horizontal [illegible]tion pump, having [illegible] gallons per minute, [illegible] No. 2 pump [illegible] the lower [illegible] reached and the long [illegible] expectations of the [illegible] may be realized.

Silver Horn—The Silver Dale Mining Co., which is operating and mining high-grade silver ore, recently cut ore running over 400 oz. per ton. Material and supplies for the new Silver Dale camp are being freighted to Silver Horn as fast as teams and railroad can get them there.

The Silver Horn company has increased its working force by five men and is again building additional bunk houses. This company reports that it will soon put on more men and work a second shift. The company's mine development program entails some deeper development, and the present work will open up the vein at a depth of about 150 ft.

The townsite of Silver Horn has been established on patented ground joining the Silver Horn Mining Co.'s property, and recently a number of lots have changed hands. Arrangements have been made with the Silver Horn company whereby water will be supplied to the new town.

CALIFORNIA

Nevada Progressive Plans To Build 150-Ton Cyanide Mill—Central Eureka To Install Hoist and Steel Headframe

San Francisco—F. B. Farish, Edwin Higgins and Roy H. Elliott, of the Metals Exploration Co., recently visited Grass Valley to inspect operations at the Idaho Maryland, which has been reopened under the superintendence of John A. Fulton.

D. C. Jackling and others interested have recently visited the Bully Hill mines at Winthrop, Shasta County, where a metallurgical plant for treating zinc ores is being installed by the Shasta Zinc & Copper Co.

Sweetwater—The Nevada Progressive Gold Mining Co., owned by Chicago interests, is planning to construct a 150-ton cyanide mill at the Silverado and Kentucky mines. The Bodie power plant on Green Creek has been acquired and a twenty-five-mile power line is to be constructed to the Silverado mine.

Kennett—The Mammoth copper mine has closed down indefinitely.

Sutter Creek—Plans for installing a hoist and steel headframe are under consideration by the Central Eureka Mining Co. to replace the present equipment. The shaft will be straightened and repaired so that larger skips can be used. Good headway in diamond drilling is reported from the Old Eureka.

Jackson—Unwatering operations are still in progress at both the Argonaut and Kennedy mines.

Browns Valley—Seattle interests are said to have taken an option on the old Smethhurst mine in Yuba County and are planning to reopen it.

Placerville—The Grit Mining Co. has purchased a mill compressor and accessory equipment, and it is said that construction will begin at once. Lode properties in the Spanish Dry Diggings near Greenwood are being developed.

IDAHO

Cœur d'Alene District

Extension of Success Vein Found—Rich Ore Shoot Cut in Alhambra

Wallace—The western extension of Success vein has been found on adjoining ground by the Belle of the West Mining Co., of which George R. Trask, mining engineer, is president and manager. The vein is 20 ft. wide and along the hanging wall there is 5 ft. showing stringers and bunches of lead-silver ore with considerable chalcopyrite. There is a good showing of ore in the upper tunnel about 150 ft. east and commercial ore is looked for when the drift reaches a point under it. The company is being financed by certain New York interests.

A letter from Donald A. Callahan, president of the Chicago-Boston Mining Co., to the stockholders, explaining the necessity for the recent assessment of 2c. per share, says that when the Interstate-Callahan, now the Callahan Zinc-Lead Co., took over control of the Chicago-Boston the first-named company loaned the latter $100,000 for development purposes. This fund has now been exhausted and the Callahan company is not in position to make further advances. Therefore, Mr. Callahan says, it became necessary to levy an assessment to provide funds for further development. Of the sum loaned by the Callahan company $25,000 was paid for two additional claims, $3,336 was advanced to the Kill Buck Mining Co., and $68,935 expended in construction, equipment and development work. A report from C. W. Newton, mine manager, says that good bodies of lead-silver ore have been opened on the 100 and 200 shaft levels, and that on the 400, the next level, the vein is "from 10 to 15 ft. in width, well defined, showing seams of ore running high in silver, and in places widening to 2 ft. of high-grade milling ore."

Kellogg—An important strike is reported on the Alhambra, which is being developed by the Bunker Hill & Sullivan company. The property is situated at the head of Elk Creek and joins the Bunker Hill group on the east. It is stated that a crosscut has intersected an ore shoot 4 ft. wide, carrying lead-silver and gray copper and running high in silver. The ore shoot had been located by diamond drilling.

SOUTH DAKOTA

Eagle Bird Starts 1,500-Ft. Tunnel—Homestake Completes Installing Ellison Hoist

Deadwood—The Eagle Bird Mining Co. has let a contract for driving a 1,500-ft. tunnel and the work has been started. The power line has been extended from the Two Johns mine, 1½ miles away, and an Ingersoll-Rand compressor installed. The property is situated on Squaw Creek below the Trojan mill and the present work is the start of active development of this ground. The tunnel will be driven on creek level and will give a depth of 400 ft. from the outcrop of the ore at the surface.

Lead — Installation of the electric hoist at the Ellison shaft is about completed. Excavations for skip pockets and underground crushers are now being made and the new equipment will be in use some time this year. The crusher stations and loading pockets will be below the 800, 1,400 and 2,000 levels and the ore will be broken to about 4½-in. size before it is delivered to the skips. The arrangement for loading skips will be the same as that now in use at the B & M shaft. Seven-ton skips will be used and the new hoist will have a capacity of 4,000 tons in fifteen hours from a depth of 2,300 ft.

Chronology of Mining

March, 1921

March 1 — Consolidated Mayflower mill at Pioneer, Nev., resumed operations.—Davidson Consolidated mine, Porcupine, Ont., reopened.

March 2—Black Lake Asbestos & Chrome Co., Ltd., passed under control of J. A. Jacobs, Montreal.

March 3—All explosives licenses cancelled by Federal government and a new act superseded war-time regulations.

March 6—San Rafael mill at Pachuca, Hidalgo, Mexico, burned down.

March 15—A. S. & R. smelter at Murray, Utah, and U. S. Smelting, Refining & Mining Co.'s plant at Midvale reduced day wages 25c. for unskilled and 50c. for skilled labor.

March 20—Howe Sound Mining & Milling Co.'s plant at Britannia Beach, B. C., burned down.—Hercules and Tamarack & Custer mines in Idaho closed down.

March 21—Union Sulphur Co. filed suit against Texas Gulf Sulphur Co. for $6,678 000, alleging illegal extraction of sulphur from its holdings by defendant.

March 23—Thomas Park brought suit for $1,250,000 against Richard V. Dey, of San Francisco, in Supreme Court at New York, the purchase of Grand Reef Mines, in Graham County, Ariz., being involved.

March 26—William H. Taft consented to conduct investigation into affairs of American Smelting & Refining Co. upon invitation by company management, as result of charges made by Karl Eilers.

March 28—United Eastern Mining Co., of Oatman, Ariz., given decision in apex suit brought against it by Tom Reed Gold Mines Co.—North Butte Mining Co., Butte, Mont., suspended production.

March 29—Anaconda, Utah, Ray Consolidated, Chino and Nevada Consolidated announced immediate and complete shutdown for indefinite period. Old Dominion and Burro Mountain Branch of Phelps Dodge Corporation had previously taken similar action.

March 31—Magma Copper Co., Superior,' Ariz., closed down.

THE MARKET REPORT

Daily Prices of Metals

March	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
31	12.50	27.75	29.00	4.25@4.40	4.25	4.65
Apr. 1	12.50	27.75	29.00	4.25@4.35	4.25	4.65
2	12.50	27.75	29.00	4.25@4.35	4.25	4.65
4	12.50	27.50	28.75	4.25@4.35	4.25	4.65
5	12.50	27.50	28.75	4.25@4.35	4.25	4.65
6	12.50	28.00	29.50	4.25@4.35	4.25	4.65

*These prices correspond to the following quotations for copper, "delivered": 12.75c. for the week.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

March	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
31	70	69½	72½	158½	162	20	20⅜	24¼	25¾
Apr. 1	69	68⅝	72½	157¼	160¾	19¾	20⅛	24⅛	25¾
2	...	...	...	....	....	...	...	...	...
4	68	67½	72½	154	157	19⅝	19¾	24	25½
5	68⅜	68	71½	152½	156¼	19½	19⅞	24¼	25¾
6	68¾	68½	71½	154½	157¾	20	20⅜	24¾	24⅝

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Mar.	Sterling Exchange	Silver			Apr.	Sterling Exchange	Silver		
		New York, Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York, Foreign Origin	London
31	391½	99½	57¼	33⅜	4	390	99½	57	33⅜
Apr. 1	391	99½	56⅛	32½	5	390	99½	56⅞	33
2	390¾	99½	56⅜	32½	6	391	99½	57⅜	33¼

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, April 6, 1921

Conditions have been very dull indeed during the last week, and prices are substantially unchanged. The undertone is firm, despite meager sales. Curtailments continue, and it is understood that the Broken Hills works, in Australia, will close down entirely until more prosperous times.

Transatlantic freight rates have been raised considerably. The French line was largely responsible for the recent cut, and at one time rates as low as [illegible] per long ton were quoted from Baltimore. This line has now joined the Conference, however, and will hereafter abide by the rates set by that body. From New York to Germany the new rate is $8.80 per long ton; to French, Dutch, and Belgian ports, $8; and to English ports, $11, as before.

Copper

Producers did a fairly satisfactory business in the closing days of last week at 12.75c. delivered, for April shipment. Since Monday, however, the demand has died away, and only a few small domestic sales are reported. Several sellers are willing to accept 12.75c. for April or May, and even slightly under this figure has been rumored. The large producers as a rule cling to the 13c. price set some time ago. Copper for June could probably be obtained for 12.875c. and for July at 13c., but producers are not anxious to go so far into the future.

Monthly Average Prices for March

Copper:	
New York Electrolytic	11.976
London Standard	67.565
London Electrolytic	71.190
Lead:	
New York	4.084
St. Louis	4.000
London	18.911
Silver:	
New York, foreign	56.023
New York, domestic	99.500
London	32.479
Sterling Exchange	389.806
Zinc:	
St. Louis	4.737
London	25.077
Tin:	
99 per cent	27.296
Straits	28.806
London	156.024
Antimony	5.282
Quicksilver	46.796
Platinum	72.463

Demand from Europe, chiefly by Germany and France, continued fairly good throughout the week, practically all of the business being done through the Copper Export Association at the reported price of 12.75c., c.i.f.

Lead

On Thursday, March 31, the American Smelting & Refining Co. increased its price of lead, New York and St. Louis, from 4.10c. to 4.25c. This was more nearly in accord with the outside market.

The situation in lead has been rather peculiar. One producing interest has been willing to sell for April, and in some cases even for early May, at 4.25c. New York, whereas other producers and agencies have been quoting 4.375@4.50c., and even up to 4.625c. Some business was done as high as 4.35c., but those who were asking the higher figures sold practically nothing except small lots to those who were out of touch with conditions. A large tonnage for these times, however, was sold at 4.25c. An encouraging feature is that the demand was well distributed among the various classes of consumers. The premium on chemical lead is decreasing, not more than 15 points now being asked by any producer. Demand is slack. Lead for future delivery is scarce and would be difficult to obtain under 4.40@4.50c.

Zinc

The market remains unchanged at 4.65c., St. Louis. Producers generally report a lack of interest in the trade, and sales are confined to small lots, mainly for galvanizing purposes. Brass manufacturers are [illegible] out of the market, as [illegible] suitable for [illegible] purposes [illegible] to be offered. Brass Special was sold last week in small amounts, a few carload lots, at 4.75c., East St. Louis. High-grade zinc can be obtained for 7c., but this price has been shaded. Zinc producers are relying strongly upon the early passage of a higher tariff to help them out of their difficulties.

Tin

Tin has been as inactive as usual, though a little spurt took place yesterday afternoon. Electrolytic sales have been small, at about the same price as Straits.

Straits tin for future delivery: March 31st, 29@29.50c.; April 1st, 29@29.50c; 2d, 29@29.50c.; 4th, 29@29.25c.; 5th, 28.75@29c.; 6th, 29.25@29.75c.

Arrivals of tin, in long tons: March 28th, China, 5; 29th, Singapore, 25. Total for March, 1,613.

Silver

The silver market has continued dull, with lower tendency in London. There has been no China demand, and Indian orders are the only support of the market. Demand for domestic consumption continues limited. Foreign supplies, however, are small, owing to curtailment of production by closing down of mines in Mexico and Canada.

Mexican Dollars—March 31st, 43¾; April 1st, 43; 2d, 43; 4th, 43⅜; 5th, 43⅜; 6th, 44⅛.

Gold

Gold in London: March 31st, 104s. 9d.; April 1st, 104s. 10d.; 4th, 105s.; 5th, 105s. 5d.; 6th, 104s. 11d.

Gold is pouring into the United States from all over the world, and it is estimated that $150,000,000 has been received so far this year. The Federal Reserve Board states that approximately $53,000,000 has come from England; $44,000,000 from France; $22,000,000 from Asia; $10,000,000 from Canada; $8,000,000 from Sweden; $5,000,000 from The Netherlands; and $5,000,000 from South America. The only considerable export of gold has been $3,000,000 to Cuba.

Foreign Exchange

On Tuesday, April 5, francs were 7.025c.; lire, 4.17c.; and marks, 1.63c. New York funds in Montreal have declined considerably, and were quoted at 11½ per cent premium.

Other Metals

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 22@23c. per lb.; 22½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 5¼@5½c.; market dull. W.C.C. brand, 5¾@6c. per lb. Cookson's "C" grade, spot, 9⅝c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb. Demand light, with heavy supplies available.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.65 per lb., 500-lb. lots.

Cadmium—Nominal, $1@$1.10 per lb., in 1,000-lb. lots. Price reduced as a reflection of London drop. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $4 per lb.; black oxide, $3@$3.10 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $250@$300 per oz.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 38@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—$72@$74 per oz. Market a little softer.

Quicksilver—Nominally, $45@$47 per 75-lb. flask. San Francisco wires, $45.50.

[1]**Rhodium**—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 45@50c. per long ton unit, f.o.b. Atlantic ports.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $7.45; Mesabi bessemer, 55 per cent iron, $7.20; Old Range non-bessemer, 51½ per cent iron, $6.70; Mesabi non-bessemer, 51½ per cent iron, $6.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5.80; old bed concentrates, 63 per cent, $6.70; Harmony, cobbed, 63 per cent, $6.70; new bed low phosphorus, 65 per cent, $9.50.

Manganese Ore—30c. per unit, seaport; chemical ore (MnO_2) $60 per gross ton, lump; $70@$75 per net ton, powdered. Market dull.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¾@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., April 2—Zinc blende, per ton, high, $24.90; basis 60 per cent zinc, premium, $22.50; Prime Western, $22.50; fines and slimes, $21@$18. Average settling price, all grades of zinc, $23.83.

Lead, high, $44.10; basis 80 per cent lead, $42.50; average settling price, all grades of lead, $42.68 per ton.

Shipments for the week: Blende, 6,572; lead, 1,340 tons. Value, all ores the week, $189,990.

Though there is an unusually large reserve stock of zinc ores in bins throughout the district, buyers can secure but a limited tonnage of current offerings, the owners of reserve ore apparently being able to hold it indefinitely. The purchase this week was around 2,500 tons less than the output, yet most buyers were short on orders at the week-end. An advance of $2.50 per ton for lead was made this week to encourage an increased production.

Platteville, Wis., April 2—No market for zinc or lead. Shipments for the week: Blende, 7,450 tons. Shipments for the year: Blende, 10,315; lead, 5,550 tons. Shipped during the week to separator plants, 576 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $2,000@$3,000; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7 per long ton, f.o.b. Cartersville, Ga. Small lots as low as $5.

Chalk—English, extra light, 5@5½c. Domestic light, 4½@5c.; heavy, 4@4½c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$10; washed, $10@$12; powdered, $15@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $15@$20, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $15@$25, f.o.b. American ports; powdered, $35@$45, f.o.b. New York.

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar—Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20 per ton, f.o.b. Illinois mines, and $20, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, $60; lump, $17.50, f.o.b. Heathden, N. M. In Canada 85 per cent calcium fluoride sells for $20 per ton, f.o.b. Madoc; output limited. Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines.

Fuller's Earth—$16 per ton, carload lots, f.o.b. mines. California grades, Floridon, $43 per ton; Medina, $39. Local grades, $15@$25, f.o.b. mines. Large oil companies use Floridon grade.

Graphite—Ceylon lump, first quality, 8@9c. per lb.; chip, 7c.; dust, 5½c. No. 1 flake, 7c.; high-grade amorphous crude, 3c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$2 per net ton; 1½ in., $1.50@$2. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined—High-grade caustic calcined, lump form, $30@$35 per ton, carload lots, f.o.b. California points. In Chicago district, $57.70; Atlantic seaboard, $60.

Dead-Burned—$38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); all f.o.b. New York.

[1]**Monazite**—Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $7.35; 68 per cent, $6.85; 68@66 per cent, $6.60.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 16c., c.i.f. Atlantic seaport; furnace size, 16½c.; Spanish lump, 14@15c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$40, talcum powder grade. Southern talc, powdered, carload lots, $10@$14 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 8@9c. per lb. in carload lots.

Sodium Nitrate—$2.60@$2.75 per cwt. ex vessel, Atlantic ports. Market quiet.

Sodium Sulphate—For 95 per cent material, $20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; $32@$33 per ton, New York.

Potassium Sulphate—Domestic, $215@$220 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 15c. per lb. of chromium contained; 4 to 6 per cent carbon, 16@17c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $90@$95, f.o.b. furnace; resale, $90, delivered; English, $90@$95, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $32, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $50@$55; 50 per cent, $85@$90; 75 per cent, $145@$150.

Ferrotungsten—Domestic, 70 to 80 per cent W, 54@58c. per lb. of contained tungsten. f.o.b. works. Foreign, 50c. duty paid f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—Basis 30 to 40 per cent, $5 per lb. of V contained, plus 75c.@$2 differentials and according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York list price, 20@20½c. per lb.; wire, 15c.

Lead Sheets—Full lead sheets, 7½c.; cut lead sheets, 7¾c. in quantity, mill lots.

Nickel Silver—33½c. per lb. for 18 per cent nickel.

Yellow Metal—Dimension sheets 18¾c.; sheathing, 17¾c.; rods, ⅜ to 3 in., 15¾c.

Zinc Sheets—$11 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $80 per net ton, shipping point; arches, keys, wedges, $85; splits, soaps, $100.

Fire Brick—First quality, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $45@$50.

Magnesite Brick—9-in. straights, $90@$100 per net ton; 9-in. arches, wedges and keys, $105; soaps and splits, $120.

Silica Brick—9-in., per 1,000: $45@$55 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, April 5, 1921

Demand for steel products is more widespread, but the tonnages called for are small, most of the business being in single carload lots.

Production by the Steel Corporation has been holding up lately better than was expected, after the sharp decline from the middle of January to the forepart of March. The Corporation's ingot production last week was 45 per cent of capacity. Independent production is still estimated at about 20 per cent, but there are many changes at individual plants.

Bars, shapes, and plates have been unchanged in the independent market for several weeks, at 2c. for bars and 2.10c. for shapes and plates, for the usual run of orders. Sheets are lower this week, at 3.75c. for black and 4.80c. for galvanized, in carloads with desirable specifications, or $2 a ton decline in black and $3 or $4 in galvanized in a week or ten days.

The Steel Corporation maintains its prices, and trade is so dull that there is only mild interest in the question when and by how much the [illegible] will reduce its quotations, [illegible] still those of the Industrial Board schedule of March 21, 1919.

Pig Iron—The market remains inactive, and is quotable at $25 for bessemer, malleable, and foundry, and $23 for basic, at Valley furnaces. W. P. Snyder & Co.'s [illegible] March are $26.[illegible] [illegible] 50 for basic, at Valley [illegible]. The average [illegible] $25.89, Valley.

Coke

Connellsville—[illegible] $4.[illegible]@$5.25; foundry, [illegible]

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[1] Foote Mineral Co., Philadelphia, Pa.

COMPANY REPORTS

Eagle & Blue Bell Mining Co. Increases Net Gain

Lead; Utah

The annual report of operation of the Eagle & Blue Bell Mining Co. for 1920 states that mining operations show a net gain of $254,872.23, and, with interest of $10,236.69 received, make a total net gain of $265,108.92, an increase of $162,583.97 over the previous year. Production amounted to 3,178.5 oz. gold; 528,306 oz. silver; 5,408,375 lb. lead, and 1,095 lb. copper, from 26,641.1 dry tons of ore. Smelter returns totaled $544,568.59. Operating statement follows:

Gross earnings		$544,568.59
Revenue from rents, etc.		1,097.25
Total		$545,665.84
Operating expenses		
Mining	$168,748.53	
Management	35,042.08	
Insurance, taxes	36,194.66	
Mine development	50,808.34	290,488.91
Net operating gain		$254,872.23

Profit and Loss Account

Debits		Credits	
Depreciation	$ 8,171.57	Net operating gain	$254,872.23
Depletion	82,401.98	Interest	10,236.69
Balance to surplus	174,535.37		
	$265,108.92		$265,108.92

Earned surplus balance, Dec. 31, 1919	$ 31,193.49
Balance to surplus	174,535.37
	$205,728.86
Less dividends paid in 1920	178,629.20
Earned surplus balance, Dec. 31, 1920	$ 27,099.66

Three dividends were paid during the year, two of 10c. each per share, paid from net earnings, and one of 15c., paid from reserve for depletion—a total of $312,601.10.

Barnes-King Development Co. Retrenching

Gold; Montana

A report covering the operations of the Barnes-King Development Co. for 1920 states that the Piegan-Gloster and North Moccasin mines were closed down during the year in June and September, respectively. The Shannon mine was worked continuously throughout the year, giving a profit of $52,337.33. The company's net profit for the year was, however, considerably reduced by reason of the losses incurred at the North Moccasin and Piegan-Gloster properties, and also because of general unsatisfactory operating conditions due to continued high prices of labor and supplies. The company paid three dividends, at the rate of 5c. per share each, totaling $60,000, and making total dividend disbursements of $440,000 to date. A general profit-and-loss account follows:

Property Operation			
Profit on operation of Shannon property		$52,337.33	
Profit on operation of Kendall property		2,009.69	
Total property net earnings			$54,347.02
Loss on operation of North Moccasin property		$32,693.11	
[illegible]	$4,236.23		
[illegible] of supplies	270.08	4,506.31	$28,186.80
Loss on operation of Piegan-Gloster property	$10,840.22		
[illegible]	6.17	10,834.05	
[illegible]			39,020.85
[illegible]			$15,326.17
[illegible]			3,175.59
[illegible]			$18,501.76
[illegible]			
[illegible]	[illegible]		
[illegible]	[illegible]	$4,561.76	
[illegible]		5,035.41	
Taxes paid		4,781.60	
[illegible]		1,383.60	
[illegible]			15,762.37
[illegible] 1920			$2,739.39

Lake Shore Mines, Ltd., Reports Profit

Gold, Silver; Ontario

A report of operations of the Lake Shore Mines, Ltd., for the year ended Nov. 30, 1920, states that bullion valued at $483,701.93 was produced from 18,889 tons of ore milled. Profit and loss account for the year follows:

Income		
Bullion production		$483,701.93
Exchange on bullion sales		41,576.45
Interest on victory bonds		2,750.00
Total		$528,028.38
Expenses		
Operating expense	$236,792.62	
Administration expense	16,438.73	
Depreciation of buildings and equipment	29,779.44	
Exchange on dividend cheques	10,025.00	293,035.79
Profit before providing for exhaustion or Dominion taxes		$234,992.59
Provision for exhaustion	$120,000.00	
Provision for Dominion war taxes	10,000.00	130,000.00
Net profit		$104,992.59

Dividends amounting to $80,000 were paid during the year. Debit balance on Dec. 1, 1919, was $47,010.13; on Nov. 30, 1920, $22,017.54.

Ahmeek Sells Copper at Profit

Copper; Michigan

The annual report of operations of the Ahmeek Mining Co. for 1920 states that 20,489,438 lb. of copper was produced, at a cost of 16.08c. per lb.; 9,929,782 lb. was on hand January, 1920, valued at 17.32c.; 12,856,495 lb., valued at 17.04c., was delivered during 1920 at 18.60c., and 17,562,725 lb. was on hand Dec. 31, 1920, valued at 13c. Earnings statement follows:

Received for copper, delivered (18.60c.)	$2,391,358.40
Cost of copper, delivered (17.60c.)	2,262,191.54
Gain on copper delivered	$129,166.86
Loss by reduction of copper on hand to market value	540,667.38
Balance	$411,500.52
Miscellaneous receipts	30,463.48
Net loss	$381,037.04
Dividends paid, $300,000; additional taxes, $60,822.31	360,882.31
Total	$741,919.35
Increase in reserves (amortization)	911,434.80
Increase in balance of current assets	$169,515.45
Balance of current assets, 1919, adjusted	3,065,773.38
Balance of current assets, Dec. 31, 1920	$3,235,288.83

Victoria Copper Mining Co.'s Production Unsold

Copper; Michigan

A report of operations of the Victoria Copper Mining Co. for the calendar year 1920 states that the production of refined copper for the year is estimated at 1,600,829 lb., valued at $137,907.77. The copper carried over from the previous year was 1,097,566 lb., a total of 2,158,395 lb., of which 977,440 lb. was sold at an average price of 18.163c., leaving a balance on hand of 1,180,955 lb. as a stock still to be marketed.

The total cost of the year's production is estimated at $263,877.06, and returns amounted to $147,123.24, leaving a loss of $116,753.82. Total expenditures were $305,540.68 and balance of expenditures over receipts was $158,417.44. Surplus from previous year was $262,384.66, leaving a balance of $103,967.22.

The tenor of ore on the lower levels has increased.

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York 1920	New York 192	London 1920	London 1921	Sterling Exchange 1920	Sterling Exchange 1921
January	132 827	65.950	79.846	39 985	367 082	372 650
February	131 295	59.233	85.005	34.745	337 466	385 932
March	125 551	56 023	74 194	32 479	370 870	38[illegible] 806
April	119 779	...	68 848		392 438	.....
May	102 585	.	60 010		383 360	.. ...
June	90 957	...	51.096		393 663	......
July	91.971	..	53.736		385.538	......
August	96.168	...	59.875		360 404	......
September	93.675	.....	59.476	..	350.370	......
October	83 480	...	54.197		346.460	......
November	77.734	....	50 952		342.333	......
December	64.774	..	41.845		348 101	......
Year	100.900	.	61 590		364 840	.. ..

New York quotations cents per ounce troy, 999 fine London, pence per ounce, sterling silver, 925 fine.

Copper

	New York Electrolytic 1920	New York Electrolytic 1921	London Standard 920	London Standard 1921	London Electrolytic 1920	London Electrolytic 1921
January	18 918	12.597	118.095	70 964	123 238	79 119
February	18.569	12 556	120 188	70 925	126 [illegible]	75 925
March	18 331	11 976	109.533	67 565	118 348	71 190
April	18.660		103.025		111 500	
May	18.484		96.750		109 200	
June	18.065		87.864		101 909	
July	18.576		90 148		106 455	
August	18.346		93.935		111 143	
September	18.144		96 381		111 905	
October	15.934		93 327		104 905	
November	14 257		84 807		94 614	
December	13.188		75 702		85 905	
Year	17 456		97 480		108 839	

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York 1920	New York 1921	St. Louis 1920	St. Louis 1921	London 1920	London 1921
January	8 561	4 821	8 300	4 747	47 095	23 387
February	8 814	4 373	8 601	4 228	50 256	20 650
March	9 145	4 084	8 894	4 [illegible]	46 [illegible]	18 911
April	8 902	.	8 618	.	39 225	
May	8 576	.	8 352	......	38 488	
June	8.323	......	8.169	......	34 330	
July	8 338	..	8 283		34 960	
August	8 687		8.725	......	36.304	
September	8 177	.	8.160	......	35 452	
October	7 070	.	7.018	......	35 238	
November	6 159		6 127		32 489	
December	4.727	......	4.717	......	24 089	
Year	7.957	......	7 830		37 832	

New York and St Louis quotations, cents per lb London, pounds sterling per long ton.

Tin

	New York 99% 1920	New York 99% 1921	New York Straits 1920	New York Straits 1921	London 1920	London 1921
January	61 596	36 000	......	36 000	376 512	190 464
February	58 466	28 534	59 932	32 142	395 750	166 250
March	61 037	27.296	61 926	28 [illegible]	369 489	156 024
April	61.120	......	62.115		345 450	
May	53 230	......	55.100		294 813	
June	46 125		48 327		250 614	
July	45 798		49 154		261 886	
August	43 856	..	47 620		274 048	
September	41 940		44 465		270 120	
October	39 310		40 555		258 190	
November	35 667		36 854		241 080	
December	31 135	......	34 058		212 440	
Year	48 273	.... .	49 101	...	295 866	

New York quotations, cents per lb London, pounds sterling per long ton.

Zinc

	St. Louis 1920	St. Louis 1921	London 1920	London 1921
January	9 133	5 413	58 643	25 262
February	8 [illegible]	4 928	61 338	24 850
March	8 [illegible]	4 737	53 467	25 077
April	8 [illegible]		47 388	
May	7 [illegible]		45 088	
June	7 [illegible]		41 193	
July	7 [illegible]		41 886	
August	7 [illegible]		41 220	
September	7 661		39 690	
October	7 150		39 756	
November	6 247		35 028	
December	5 824		27 762	
Year	7 671		44 372	

New York and St Louis quotations, cents per pound London, pounds sterling per long ton

Antimony, Quicksilver and Platinum

	Antimony (a) New York 1920	Antimony (a) New York 1921	Quicksilver (b) New York 1920	Quicksilver (b) New York 1921	Platinum (c) New York 1920	Platinum (c) New York 1921
January	10.577	5 258	90 192	48.440	154.23	73 400
February	11.588	5 250	84 432	49.545	151.59	70.227
March	11.056	5 282	92 611	46 796	138.5[illegible]	72 463
April	10.500	......	102.192	......	127 04	.....
May	9.655	......	89 560	......	97.50	.. ..
June	8 289	......	90.154	......	85 19	. .
July	7.500	......	90 333	......	83 94	. ..
August	7.177	......	83 806	......	111 44	.. ..
September	7.113	......	75 000	......	115 20	.. ..
October	6 723	......	67 200	......	101 70	.. ..
November	6 109	......	58 417	.. ...	84 75	.. .
December	5.534	......	49 577	......	79 62	. .
Year	8 485	......	81 123	......	110 90	. .

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer 1920	Bessemer 1921	Basic 1920	Basic 1921	No. 2 Foundry 1920	No. 2 Foundry 1921
January	$40 47	33 96	$39 88	31 96	$39.86	33 88
February	42 95	28 96	42 61	26 96	43 40	30 25
March	43 40	28 16	42 90	26 46	43 40	27 85
April	43 72		44 22		43 90	...
May	44 00		44 88		45 36	.
June	44 89	.	45 41	.	46 40	...
July	47 21		47 42		46.56	. . .
August	48 90		49 88	.	49 35	. .
September	50 46		50 46		51 96	.
October	49 21		44 38		48 58	. .
November	41.26		39 20	.	42 61	. .
December	36.96		34 90		37 73	. .
Year	44 45		43 85		44 93	.

In dollars per long ton

Monthly Crude Copper Production

	1920 November	1920 December	1921 January	1921 February
Alaska shipments	12,802,696	6,631,700	5,241,634	5,482,962
Arizona Copper	2,800,000	2,650,000	2,300,000	2,000 000
Calumet & Arizona	3,486,000	3,300,000	2,438,000	3,330,000
Con. Ariz. Smelting	750,000	476,000	....	
Inspiration	5,350,000	5,000,000	5,000,000	4,500,000
Magma	671,752	600,000	600,000	600,000
Miami	4,505,232	4,373,123	4,439,000	4,200,101
New Cornelia	2,670,000	2,688,456	2,170,000	1,975,918
Old Dominion	2,563,000	2,655,000	2,822,000	1,882,000
Phelps Dodge	5,492,000	5,850,000	6,339,000	5,712 000
Shattuck Arizona	6,063			
Ray	3,975,000	2,975,000	2,983,000	2,976 000
United Verde	4,030,000	3,260 000	3,500,000	3,450,000
United Verde Extension	2,642,812	3,204,258	3,219,912	3,349,94[illegible]
Calumet & Hecla	7,326,763	7,507,712	7,234,300	7,395,084
Other Lake Superior	6,000,000	6,000,000	6,000,000	5,000 000
Anaconda	11,100,000	10,500,000	9,700,000	9,000 000
East Butte	1,658,860	1,538,760	1,600,000	1,500,000
Nevada Cons	3,950,000	3,000,000	3,000,000	3,000,000
Chino	4,000,000	2,999,000	2,999,751	2,978,934
Utah Copper	9,120,000	7,500,000	7,500,000	7,500,000
Eastern Smelters	1,600,000	1,600,000	1,500,000	1,500,000
Others, estimated	10,200,000	11,400,000	10,000,000	9,300,000
Total United States	106 700 178	95,709,009	90,586,597	86 632,941
Imports: Ore and concentrates, etc	7 143 610	6,331,559	8 749 861	9 837 49[illegible]
Imports in blister, etc	31,148,088	34,619,919	23.340.358	20.168,019
Grand total	145,291,876	136,660,487	122,776,816	116,638,459
British Columbia				
Granby Cons.	2,465,585	2,665,018	2.530 038	.. ..
Mexico				
Boleo	771,680	1,014,160	969 920	813 650
Cananea	3 500 000	3,700,000	2 530 038	
Phelps Dodge Mexican properties	2,666,000	2,468,000	2,362,000	1,870,000
Other foreign				
Cerro de Pasco	3,612,000	4,258,000	4,086,000	4.174,000
Chile	8,8[illegible]9,984			
Katanga	3 174 824	2 07[illegible] 133	2 91[illegible]	
Backus & Johnston	1,548,000	1 604 000	1 7[illegible] 000	1 306,000

Comparative Annual Copper Production

	1919	1920	1921
January	135 733 511	121,903 744	90 586 597
February	111,649 512	117 450 000	86 632 941
March	102,040 460	120 302,31[illegible]	
April	98,808 998	116 278,87[illegible]	
May	92,652 975	114 964 2[illegible]	
June	95,856,570	116,1[illegible]	
July	100,369 247	109,[illegible]	
August	107 204,04[illegible]	116,4[illegible]	
September	108,70[illegible]	(a) 104,[illegible]	
October	115,14[illegible]	10[illegible],231 [illegible]	
November	117,2[illegible]	106 700 178	
December	102 [illegible]	95,709,0[illegible]	

(a) Revised

MINING STOCKS

Week Ended April 2, 1921

COPPER

Stock	Exch.	High	Low	Last	Last Div.	
Adventure	Boston	*60	*50	*50		
Ahmeek	Boston	46	44	44	Sept. '20, Q	$0 50
Alaska-Br. Col.	N. Y. Curb	9/16	7/16	7/16		
Allouez	Boston	19	18¼	18¼	Mar. '19	1 00
Anaconda	New York	38½	35⅝	35¼	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2½	2¼	2½		
Ariz. Com'l	Boston	7¼	7¼	7½	Oct. '18,	.50
Big Ledge	N. Y. Curb	5/16	¼	5/16		
Bingham Mines	Boston	8	8	8	Sept. '19, Q	25
Calumet & Arizona	Boston	45	42¼	43	Mar. '21, Q	.50
Calumet & Hecla	Boston	220	212	213	June '20, Q	5 00
Canada Copper	N. Y. Curb	....	....	*13		
Centennial	Boston	8½	8	8½	Dec. '18, SA	1.00
Cerro de Pasco	New York	25⅞	25	25	Mar '21, Q	.50
Chile Copper	New York	10¼	9¾	9⅞		
Chino	New York	20⅜	19¾	19½	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*24½	*22½	*22½		
Con. Arizona	N. Y. Curb	....	....	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	..	.	1⅞		
Copper Range	Boston	32¼	29¾	30	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*34	*26	*32		
Davis-Daly	Boston	5½	5¼	5¼	Mar. '20, Q	.25
East Butte	Boston	8	7¾	7¾	Dec. '19, A	.50
First National	Boston Curb	*79	*70	*79	Feb. '19, SA	.15
Franklin	Boston	1¾	1¼	1¾		
Gadsden Copper	N. Y. Curb	..	.	*25		
Granby Consol	New York	18⅝	18	18	May '19, Q	1.25
Greene-Cananea	New York	20¾	20½	20½	Nov. '20, Q	.50
Hancock	Boston	2¼	2	2¼		
Howe Sound	N. Y. Curb	2½	2¼	2½	Jan. '21, Q	.05
Inspiration Consol	New York	32	30¼	30½	Oct. '20, Q	1 00
Iron Cap	Boston Curb	..	.	6½	Sept. '20, K	.25
Isle Royale	Boston	17	17	17	Sept. '19, SA	.50
Kennecott	New York	17⅞	17½	17½	Dec. '20, Q	.50
Keweenaw	Boston	1¼	1⅛	1⅛		
Lake Copper	Boston	2	2½	2½		
La Salle	Boston	2	1½	1½		
Magma Chief	N. Y. Curb	.	...	*21		
Magma Copper	N. Y. Curb	18¼	17	18¼	Jan. '19, Q	.50
Majestic	Boston Curb	*10	*10	*10		
Mason Valley	Boston	..	....	1¼		
Mass Consolidated	Boston	*95	*75	*90	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	3	3½	3½		
Miami Copper	New York	17¼	17½	17½	Feb. '21, Q	.50
Michigan	Boston	....	....	3		
Mohawk	Boston	46	44	44¾	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5	4½	4⅞		
Nevada Consol	New York	9¼	9	9¼	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	14	12½	13¼	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....	....	*5		
North Butte	Boston	8¼	8½	8⅝	Oct. '18, Q	.25
North Lake	Boston	....	....	*25		
Ohio Copper	N. Y. Curb	....	....	3/16		
Old Dominion	Boston	17¼	17	17¼	Dec. '18, Q	1.00
Osceola	Boston	24	23	23	June '20, Q	.50
Phelps Dodge	Open Mar.	†160	†125	....	Apr. '21, Q	1.00
Quincy	Boston	37	36	37¼	Mar. '20, Q	1.00
Ray Consolidated	New York	12⅛	11¾	11⅝	Dec. '20, Q	.25
Ray Hercules	Boston Curb	*37	*37	*37		
St. Mary's Min. Ld.	Boston	31	30	30½	June '20, K	2.00
Seneca Copper	Boston	..	..	15⅜		
Shannon	Boston			1	Nov. '17, Q	.25
Shattuck Arizona	New York	6	5¼	6	Jan. '20, Q	.25
South Lake	Boston	....	....	1½		
Superior Copper	Boston	3¼	3	3	Apr. '17,	1.00
Superior & Boston	Boston	1¾	1½	1¾		
Tenn. C. & C. cfs	New York	8	7¼	7½	May '18, I	1.00
Toulumne	Boston	*48	*41	*43	May '13,	.10
United Verde Ex.	Boston Curb	24	22	23¼	Feb. '21, Q	.50
Utah Consol	Boston			3½	Sept. '18,	.25
Utah Copper	New York	47½	45¾	46⅜	Mar. '21, Q	1.00
Utah M. & T.	Boston	1½	1½	1½	Dec. '17,	.30
Victoria	Boston	1¼	1⅜	1⅛		
Winona	Boston	*40	*40	*40		
Wolverine	Boston	11½	11½	11½		

NICKEL-COPPER

Stock	Exch.	High	Low	Last	Last Div.	
Internat. Nickel	New York	14⅞	14¼	14¼	Mar. '19,	50
Internat. Nickel, pf.	New York			80	Feb '21, Q	1.50

LEAD

Stock	Exch.	High	Low	Last	Last Div.	
National Lead	New York	72½	71½	71	Mar '21, Q	1 50
National Lead, pfd.	New York	.		102½	Mar. '21, Q	1 75
St. Joseph Lead	New York	12½	12	12½	Mar. '21, Q	25
Stewart Mining	Boston Curb	.	..	*6	Dec. '15,	.05

ZINC

Stock	Exch.	High	Low	Last	Last Div.	
Am. Z. L. & S.	New York	[illegible]	8	8½	May '20,	1 00
Am. Z. L. & S. pfd	New York	[illegible]	27¼	27¼	Nov. '20, Q	1 50
Butte C. & Z.	New York	[illegible]	4½	4½	June '18,	50
Butte & Superior	New York	11	11¾	11¾	Sept. '20,	1 25
Callahan Zn-Ld	New York	5	4½	5	Dec. '20, Q	.50
New Jersey Zn	N. Y. Curb	139	135	137	Feb. '21, Q	2 00
Success	N. Y. Curb	*3	*2	*3	July '16,	03
Yellow Pine	Los Angeles			*30	Sept. '20, Q	03

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

GOLD

Stock	Exch.	High	Low	Last	Last Div.	
Alaska Gold	New York	1⅛	1	1		
Alaska Juneau	New York	1	1	1½		
Carson Hill	N. Y. Curb.		..	22¾		
Cresson Consol. G.	N. Y. Curb	1⅞	1 13/16	1⅞	June '20, Q	$0.10
Dome Extension	Toronto	*60	*60	*60		
Dome Mines	New York	16	16¼	16⅝	Jan. '21, Q	.25
Golden Cycle	Colo. Sprgs.	*65	*64	*65	Dec. '20, Q	.02
Goldfield Consol.	N. Y. Curb	*8	*6	*6½	Dec. '19,	.05
Hollinger Consol.	Toronto	7 00	6 89	6 99	Feb. '21, M	.05
Homestake Mining	New York	60	59	60	Sept. '19,	.50
Kirkland Lake	Toronto	*49¼	*49¼	*49¼		
Lake Shore	Toronto	1 15	1 15	1 15	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	1 98	1 95	1.96	Jan. '21, K	.05
Porcupine Crown	Toronto	*20¾	*20¾	*20¾	July '17,	.03
Portland	Colo. Sprgs.	*45	*45	*45	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*5	*3	*4	May '19,	.05
Silver Pick	N. Y. Curb	....	....	*5½		
Teck Hughes	Toronto			*10		
Tom Reed	Los Angeles	1.24	1.07	1 08	Dec. '19,	.02
United Eastern	N. Y. Curb	3	2⅝	2¾	Jan. '21, Q	.15
Vindicator Consol.	Colo. Sprgs.	‡*20	*17½	*19	Jan. '20 Q	.01
West Dome Consol.	Toronto	*6½	*6½	*6½		
White Caps Mining	N. Y. Curb	*8	*6½	*7½		
Yukon Gold	N. Y. Curb	⅞	⅞	⅞	June '18,	.02½

SILVER

Stock	Exch.	High	Low	Last	Last Div.	
Arizona Silver	Boston Curb	*23	*14	*21	Apr. '20, M	.03
Batopilas Mining	New York	....	....	¾	Dec. '07, I	.12½
Beaver Consol.	Toronto	*36	*36	*36	May '20, K	.03
Coniagas	Toronto	....	....	2.00	Nov. '20, Q	.12½
Crown Reserve	Toronto	....	....	*16	Jan. '17,	.05
Kerr Lake	Boston	2¾	2½	2¾	Jan. '21, Q	.12½
La Rose	Toronto			*22	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*20	*20	*20	Oct. '20, Q	.03
Mining Corp. Can.	Toronto			1.00	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	8	7⅛	7¼	Jan. '21, QX	.50
Ontario Silver	New York	....	....	4⅛	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	1 9/16	1⅜	1½	Jan. '12,	.10
Peterson Lake	Toronto	....	....	*7	Jan. '17,	.01¼
Temiskaming	Toronto	*25	*25	*25	Jan. '20, K	.04
Trethewey	Toronto	*14½	*14	*14	Jan. '19,	.05

GOLD AND SILVER

Stock	Exch.	High	Low	Last	Last Div.	
Atlanta	N. Y. Curb	*2	*1½	*1½		
Barnes-King	Butte	‡	....	1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*70	*61	*63		
Cashboy	N. Y. Curb	*8	*6	*7		
El Salvador	N. Y. Curb	⅜	¼	¼		
Jim Butler	N. Y. Curb	*14	*12	*13	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*9	*7	*8	June '16,	.05
Louisiana Con.	N. Y. Curb	.	.	¼		
MacNamara M.& M.	N. Y. Curb	*16	*13	*14	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	10½	†9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1⅝	1¼	1⅜	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1 3/16	1 3/16	1 1/16		
Tonopah-Extension	N. Y. Curb	1½	1 5/16	1 5/16	Apr. '21, Q	.05
Tonopah Mining	N. Y. Curb	1½	1 5/16	1 7/16	Oct. '20, SA	.05
West End Consol.	N. Y. Curb	1 3/32	1	1 1/16	Dec. '19, SA	.05

SILVER-LEAD

Stock	Exch.	High	Low	Last	Last Div.	
Caledonia	N.Y. Curb	*12	*10	*11	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	1.10	1.10	1.10	Dec. '20,	.15
Chief Consolidated	Boston Curb			2½	Feb. '21, Q	.05
Consol. M. & S.	Montreal	18	16	16	Oct. '20, Q	.62½
Daly Mining	Salt Lake	....	....	2.50	July '20, Q	.10
Daly-West	Boston	....	....	3	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	....	....	2½	Dec. '20, K	.25
Electric Point	Spokane	*7	*7	*7	May '20, SA	.03
Federal M. & S.	New York	6¼	6¼	6¼	Jan. '09,	1.50
Federal M. & S., pfd.	New York	24	23	23	Mar '21, Q	1.00
Florence Silver	Spokane	*17	*16	*16	Apr. '19,	.01¼
Grand Central	Salt Lake	....	....	*37½	June '20, K	.03
Hecla Mining	N. Y. Curb	4	3¾	3¾	Mar. '21, Q	.15
Iron Blossom	N. Y. Curb	....	....	*18	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	....	....	3 00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*8	*6½	*6½		
Prince Consol.	N. Y. Curb	5/16	½	¼	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*6	*6	*6	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*8	*7	*8		
South Hecla	Salt Lake	1 15	*99	1.00	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	3/16	3/16	3/16	Oct. '17,	.05
Tamarack-Custer	Spokane	1.90	1.85	1 85	Jan. '21, K	.04
Tintic Standard	Salt Lake	3.00	2.45	2.45	June '20, Q	.10
Utah Apex	Boston	2¼	2	2¼	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*4	*3	*4	Nov. '17,	.01

QUICKSILVER

Stock	Exch.	High	Low	Last	Last Div.	
New Idria	Boston	....	....	*95	Jan. '19,	.25

VANADIUM

Stock	Exch.	High	Low	Last	Last Div.	
Vanadium Corp.	New York	31⅝	28½	28½	Jan. '21, Q	1 00

ASBESTOS

Stock	Exch.	High	Low	Last	Last Div.	
Asbestos Corp.	Montreal	76	73	73	Jan. '21, QX	3.50
Asbestos Corp., pfd.	Montreal	90	89¼	89¼	Jan. '21, QX	3.75

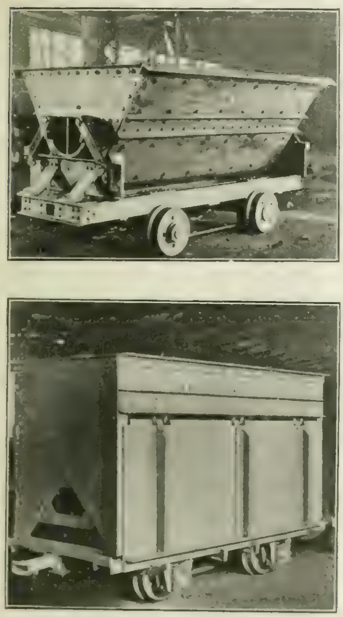
MINING, SMELTING AND REFINING

Stock	Exch.	High	Low	Last	Last Div.	
Amer. Sm. & Ref.	New York	37¼	34¾	36	Mar '21, Q	1.00
Amer. Sm. & Ref. pf.	New York	73	68¼	68¼	Mar. '21, Q	1.75
Am. Sm. pf. A	New Yor	64	64	64	Apr. '21, Q	1.50
U. S. Sm. R. & M.	New York	29¼	26	26	Jan. '21, Q	.50
U.S.Sm.R.& M. pf.	Boston	42¼	41½	42	Jan '21, Q	.87

INDUSTRIAL NOTES

Recent Types of Ore Cars

Two types of ore cars recently built by the Lake Shore Engine Works, Marquette, Mich., are meeting with some success in the Northwest. The upper figure reproduces one of a number of steel rocker-dump cars shipped to the Richmond Iron Co. They are of 80 cu.ft. capacity, steel lined, with wood filling, and are arranged to take M.C.B. automatic car couplers. The wheels are of chilled Lake Superior charcoal iron, 16 in. in diameter and adjusted to 36 in. gage track.


ROCKER DUMP (ABOVE) AND MOTOR-DRIVEN LARRY (BELOW) ORE CARS OF LAKE SHORE ENGINE WORKS

The larry car shown in the lower cut is one of three 90 cu.ft. capacity, motor-driven, remote-control ore cars furnished to a firm in Nashwauk, Minn. These cars are driven by 20 hp. motors (alternating current), acting on a worm drive inclosed in an oil-tight housing. Besides the automatic drive, there is an automatic trip device for the door.

How a Capillary Oiler Works

The action of the capillary oiler with hangers and pillow blocks is one of the simplest processes for perfect and reliable lubrication ever known, but the average millwright or mechanic is often at a loss to clearly explain just how it occurs. The Dodge Manufacturing Co., Mishawaka, Ind., was the first manufacturer and original patentee of the capillary oiler, and for the last thirty years has sold hundreds of thousands of these oilers. This organization has worked out a clear explanation of how it has employed a primal law of nature to work out a lubrication problem.

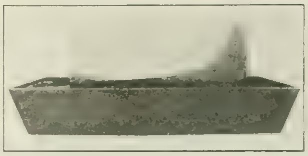


FIG. 1. OIL RISING BETWEEN CONVERGING SURFACES

The following simple test can be carried out by any one interested with simple apparatus: A tray is filled with lubricating oil in which are placed two upright glass plates, standing parallel, but not touching. The oil will be seen to rise between the plates to a height above the surface of the oil in the tray, depending on the interval between the plates. If the plates are made to touch at their right hand edges only, as in Fig. 1, note that the oil rises to the top of the plates at the line of contact. These plates are then exactly in the same relative positions as the surfaces of the Dodge capillary bearing.

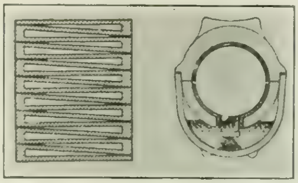


FIG. 2. SET OF CONVERGING PLANES IN DODGE OILER, AT LEFT

In Fig. 1, a strip of glass has been laid across the top of the two plates, representing the relative position of the shaft in a bearing lubricated by a capillary oiler. It will be noted that the increased rise of oil partly covers the top plate. Oil evidences the same tendency to cling to the shaft in a bearing.

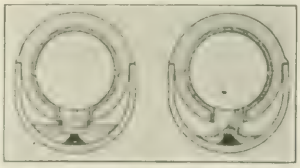


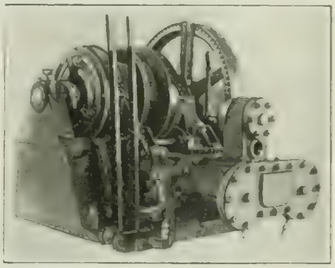
FIG. 3. DODGE CAPILLARY OILER IN USE

Figs. 2 and 3 are self-explanatory and show how the Dodge capillary oiler acts on the same principles involved in the first four illustrations.

All in all, the capillary oiler has the following advantages: It provides a definite and positive form of dependable lubrication that is bound to work just as long as the law of capillary attraction works. It is a non-agitating oiler, and as the oil always remains quiet in the reservoir, all sediment settles. Thus a constant flow of clean and pure oil reaches the bearing surface of the shaft. It has the further advantage of not requiring attention oftener than once every six months. At the end of this period, all oil should be drained off, the shaft cleaned, and new oil placed in the reservoir.

A New Air-Operated Scraper Hoist

A new air-operated scraper hoist has been designed by the Lake Shore Engine Works of Marquette, Mich. This machine is compact and powerful and embodies all of the essentials of an underground hoist for use in the modern scraper system. The following is a general description: 6 in. x 9 in. double cylinders with reversing throttle; two drums, 14 in. diameter and 5½ in. face, with flanges 22 in. in diameter; multiple disk friction clutches; rope spool on crank shaft; capacity of drums, 300 ft. of ½ in. rope; rope speed, 200 ft. per minute; capacity, 3,500 ft. rope pull at 80 ft. air pressure. Over-all dimensions are as follows: Length, 5 ft. 3 in.; width, 3 ft. 6 in.; height, 3 ft. 6 in. The weight is 3,500 lb.


AIR-OPERATED SCRAPER HOIST DESIGNED BY LAKE SHORE ENGINE WORKS

New Explosive Cannot Freeze

The Atlas Powder Co., Philadelphia, Pa., has produced a non-freezing explosive, the qualities of which will be appreciated by all blasting operators and especially by those who do cold-weather blasting.

The qualifications of this Atlas non-freezing explosive may be stated as follows: Five grades, one for every blasting requirement; cannot freeze at any temperature; withstands the heat of summer; its stability avoids premature explosions (nothing weaker than a No. 6 blasting cap should be used to detonate it); will not cause headaches to those who use and handle it, and is made in all standard sizes of cartridges.

The Lufkin Rule Co. is [illegible] a new 6-ft. "[illegible] Extension Rule," designed for taking [illegible] measurements [illegible]

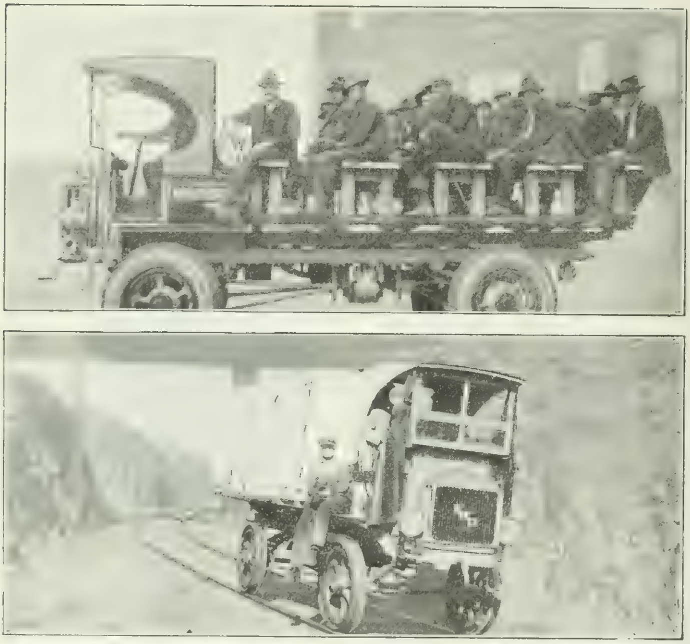
Highways Transport Bound Up in Motor Traffic

Lee L. Robinson, closing his story "Highways Transport" in *Sinclair's Magazine* for November, makes the following citations concerning the future of the motor truck in the United States:

Charles Chapin, first chairman of the reorganized Highways Transport Committee, Committee of National Defense, said: "The war pointed out that our highways could greatly supplement all other forms of transportation. . . . Today it is our duty to develop broadly this mighty new form of transportation, properly co-ordinate it with others, safely guide it through these early stages of growth, and make it responsible for opening up every nook and corner of our land."

John J. Esch, of Wisconsin, chairman of the House Committee on Interstate and Foreign Commerce, suggested that "Motor truck routes might be treated, when established and when the population and volume of traffic warrant, just as feeders or short-line railroads are treated, giving the motor-truck line a division of the through rate, also applying the through bill of lading to traffic originating on the motor-truck route to be transported by trunk line to destination or applying it in reverse order on traffic originating on trunk lines to be delivered to destination on the motor truck line."

John S. Cravens, who succeeded Mr. Chapin as chairman of the reorganized Highways Transport Committee, Committee of National Defense, said in part: "At some stage substantially all rail-transported product is moved over the highways, and there are millions of tons of highway-transported product that never reach the rails. . . . I firmly believe that the development of road construction and the use of the motor truck is the next great industrial development to take place in this country, and if intelligently considered and wisely applied, will open up sources of immeasurable national wealth and contribute to the welfare and comfort of our people to a degree that has rarely if ever been equalled by any one method."



FWD TRUCK HAULS CRESSON CONSOLIDATED MEN TO AND FROM WORK

Track-Running Motor Truck Serves Cresson Consolidated

The adaptability of the motor truck to operate on railroad tracks has made the four-mile ride of thirty-five men employed by the Cresson Consolidated Mining Co. to and from the mines as comfortable as riding in a Pullman. The motor truck, a three-ton FWD, made by the Four Wheel Drive Auto Co., Clintonville, Wis., which formerly was run over rough roads, has been equipped with flanged wheels and is now carrying its passengers in real comfort over the smooth steel rails that lead to the mines. Note that the crossways seats permit the passengers to face the driver, and that heavy curtains screen against sun and wind. Even the driver has protection from the elements in an all-weather cab.

TRADE CATALOGS

Hoists—The Wright Manufacturing Co., Lisbon, Ohio, manufacturer of high-speed hoists, screw and differential blocks, and steel trolleys, have issued an attractive new catalog descriptive of their line. It contains much data of use to those interested in hoists, and a portion of the catalog is devoted to a discussion of the various types of hoists and the field of usefulness of each.

Elevators and Conveyors—The Dodge Sales and Engineering Co., Mishawaka, Ind., announces the publication of a 6 x 9-in. catalog of 160 pages on Dodge standardized elevators and conveyers. The catalog is one of the most comprehensive the company has ever issued. It covers thoroughly the uses of the equipment with which it is concerned and may be said almost to constitute a textbook on the subjects treated. The tables of data included in the catalog represents much work on the part of the company.

Air Conveying—The Dust Recovering & Conveying Co., Cleveland, Ohio, recently distributed its bulletin No. 501, which discusses pneumatic conveying as accomplished by the company's devices. The flexibility of installation and of combination make them suited for a considerable range of purposes, such as sorting blast sand, cleaning grain, collecting atomized metallic lead, cement, carbon dust, and the like.

Diesel Engines—Nordberg Manufacturing Co., Milwaukee, Wis., discusses and illustrates in its bulletin No. 31, the advantages of the Diesel engine for most localities needing engine power, and the peculiar features of the company's engines.

Rock Drills—In an earlier issue reference was made to a catalog, prepared by the Denver Rock Drill Manufacturing Co., "Waugh 90 Drills." Through an oversight only one type, the "90" was mentioned, whereas three types are described in the pamphlet. The "90" is designed for and specially adapted to coal and iron mining, and, generally, drilling in the softer formations where a powerful, positive rotation is required. The "90" can also be successfully applied to block-holing, hitch-cutting, trimming, or drilling in any character of rock, but is not so well adapted, generally, to constant hard-rock drilling as some other types of Waugh drills specially designed for that purpose. The "93" is designed for drilling in rock, and will give a good account of itself in any formation. It can be operated either "wet" or "dry" and is consequently adapted to any sort of situation, above or below ground. The "95" is identical with the "93," except that it is designed for "dry" drilling only, and is, therefore, especially adapted to work above ground.

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The World Petroleum Problem

THE PROBLEM of the world's petroleum, especially as between the two chiefly interested parties, the United States and Great Britain, is approaching that stage most dear to the American heart, a show-down. It has happily progressed out of the realms of secret diplomacy and open propaganda. The plain note of Secretary Colby has brought back one equally plain from Lord Curzon, British Secretary for Foreign Affairs. Lord Curzon's reply is distinctly polemic. The "partition of petroleum" in Mesopotamia, between England and France at San Remo, he construes as really based on private property rights, in the concessions granted to British interests before the war, and, therefore, inferentially not to be claimed by the United States as a matter for national discussion. Secretary Hughes, however, will not find it difficult to point out that if it had not been pre-eminently a matter for national discussion, in which so-called "private interests" were submerged, it would not have been the subject for debate and barter between the British and French governments at San Remo, and that, therefore, the United States might properly request to join in the conference. Nor will he forget that the "British interests" spoken of were obtained and frankly controlled by the British government.

More to the point appear to be the countercharges of Lord Curzon in respect to certain territories controlled by the United States. He states that the Philippine Legislature in 1920 reserved the development of public mineral lands there to citizens of the United States and the Philippines. Though it is easy to perceive the Japanese (not the British) problem in this Philippine situation, the rejoinder is a fair come-back for American criticism of a similar attitude against aliens in Trinidad, Burmah, the Dutch East Indies, and many other colonies where petroleum is controlled by Great Britain. Also to the point is the charge that the United States has taken means to prevent the exploitation of mineral resources by British interests in Hayti and Costa Rica.

The argument which Lord Curzon makes, however, that America leads the world in petroleum production, is not a sound one, as her petroleum experts can tell him. America's production is greatest because it is being most actively exploited, by Americans, British, Dutch, and others, and, therefore, will be soonest exhausted. The real petroleum problem, as he ought to know, is the securing of petroleum reserves in hitherto undeveloped lands: the problem is not one of last year, or the year before, but of ten years, thirty years from now. By that time, as American and British petroleum experts (and their respective governments) know, the American reserves will have been practically exhausted.

A nation is a continuing organization, and runs its business with an eye to the future, not of the past. Lord Curzon should know, what the rest of us know, that the British petroleum policy is a deliberately worked out plan for world dominion of petroleum, quite in keeping with the British tradition of constantly extending the empire's boundaries: a plan which, it is true, started before the war, and which was constantly pursued during the war and in treaties and agreements since the war.

The American Government, on the other hand, has had no petroleum policy until the plain trend and import of that of England and France made it clear that it was a matter of national necessity to nationally investigate and participate in these far-reaching problems, which were being disposed of in the same cavalier fashion as that in which the German island of Yap was grabbed by Japan. "Every one for himself, and the devil take the hindmost" has been the motto displayed by Europe and Asia to America, ever since those soul-stirring days when we fought shoulder to shoulder for civilization.

We believe the new Administration will bring about a new era of better understanding and fairness. There is no national or international question more important than the question of the world's petroleum. The action of the British and French governments shows that the allocation of the reserves of this most important of all natural resources is a proper subject for national agreement. The action of our Government in asking for a place in the international petroleum council is modest and absolutely necessary.

Foreign diplomats (who are probably hardly fair representatives of their peoples) must forget at once and finally their attitude that the United States is to be disregarded in post-war settlements. The note of Secretary Hughes to Japan, Great Britain, France, and Italy makes this unassailably clear and definite. The equitable settlement between governments of this problem of the world's petroleum will go as far toward banding the nations together and insuring peace as any one thing can do. Let the plain talk go on, because it is plain talk that leads to a clearing of the atmosphere and to satisfactory conclusions.

Improving Drill Steels

"A CHAIN is no stronger than its weakest link," and such a condition may be regarded as quite applicable to drill steel. Comparative figures have brought out the fact that the number of breakages in drill steel is large, but it would appear that a certain percentage of failure is to be taken as a matter of course. Considering the different processes of manufacture and preparation of drill steel, there does not seem to be any one stage which consistently produces failure. In some instances the latter may be attributed to the composition of the steel itself, to the heat treatment during and after the forging process, or to the development of stresses in service, or perhaps to a combination of these three factors. It is generally agreed that proper heat treatment is essential, however, and is the most important of these. Steels of various combinations and of different shapes are submitted to different heat treatments, but to be of the greatest service—in other words, to produce the least percentage of failures—each step in the preparation of the steel for the work it is to do in the mine must be performed with exactitude and with a consideration of its specific function.

In this issue we present a paper by Frank H. Kingdon which was read at one of the drill steel sessions of the February meeting of the A. I. M. E. Dealing ostensibly with the essentials of an ideal drill steel, the paper serves as an excellent guide as to what may be expected of the steel maker and the user. Forming, as it does, an important part of mine operation, it is certain that the subject of drill steel will receive close attention from mine managers and be given consideration from many angles. The movement to instigate such research work and make a thorough correlation of the results will ultimately lead to conclusions that will be of lasting benefit to the industry, and we take this opportunity of commending those who have been instrumental in initiating such a study and adding it to the effective program which forms such an essential part of the Institute's activities.

Advice to the Ambitious

WHAT makes this country great is the average greater enlightenment of its citizens as compared with those of other countries; and the average greater freedom from the burden of accepted and dogmatic views, inherited or prescribed. That leaves us at liberty to reason; and the abundant opportunities of the public schools and the multitudinous colleges and special higher institutions bring out the reasoning power. Our daily and weekly press, more widely read in this country than in any other in the world, raises constantly the keenness and the general knowledge of the average mind, and tends to put it above childish passions, prejudices, and errors. Such a preparation and such tangible results in the average breadth of comprehension kept us freer from Bolshevism and the attempted murder of civilization than any other country, pending the practical demonstration in Russia of its childishness.

There is no limit to what you can learn, or the part you can play. There are at least two new Senators in Washington that we know of, and there is one Cabinet member, who have pounded a drill and handled the muckstick in their time. One, we believe, had studied law before the event, and one after the event; and one, we are glad to say, never studied law at all. The whole schooling of that one was limited; but he studied mines and men, and we [illegible] he will be a good judge of laws.

Therefore, ambitious and forward-looking miner or mining man, actually or hopefully, the sky is the limit; it's up to you. The first thing is to learn all you can about your own business. You will learn most of that from the mines themselves if you move around, observe, and ponder: but it is good to have a background of principles and learn what has been done in the past. If you can figure it out, and have not already done so, go to a mining school and take the course. What mining school? The best you can find out about. You should have had, if possible, some practical experience in mining before you go. Pitch in when you get there, and get the meat out of your studies and the experience out of your teachers. There are men who attend college who should be kicked out, because they skim along and waste their time. A lot of them *are* kicked out, but in some colleges at least there are some who are sly or supple enough to loaf along and get their degree and still be small credit to themselves or the mining industry.

When you have got all the mining school offers, get back into the harness, work, experience, and study mines, mills, and the background of the mining industry. Then narrow and concentrate your efforts: as you have hitherto worked broadly, now dig deep. Work for experience, not salary. Above all, be honorable, kind, and human. If you follow out the above we can guarantee your success. What is success? To have a mind at peace, and to love mankind, and to sense the Universal Laws.

Everybody cannot follow out this course of college training. You may find it impossible to travel far and study at what you think the best mining school. If that is so, take the best you can, and, if need be, the handiest, which may well be good. If you cannot study six years, or five, or four, take two or three, or even one year. Possibly—rarely—you cannot take any. You may have a family on your hands, which is a great and fine thing, or otherwise have dependents to support, and find it impossible to lay off and study.

No need to feel discouraged in these days and in this country. Take a correspondence school course, or a university extension course (such as are being given by many schools), or even a summer course. There are men who have hacked their way up without even that. Buy books and study; and at the same time study men and mines, and cultivate the greatest gift of all—horse sense. Books are simply the record of common sense; science and mining are nothing else. It is easy to find men with one or many degrees who are of no use: long memorizing has failed as a substitute for balance of thought, observation, and judgment. The man who knows nothing of books and the man who knows nothing but books are alike ignorant, and bound to be the underlings in the world's struggle onward and upward.

Be modest—you have every reason to be. If you are a college graduate, do not swell up on that account. We remember one college graduate who was shocked because he could not hold a job. "Why," he said, "they don't seem to realize what a Ph.D. from Harvard means." "It means," was the reply, "that you've got to make good, or get fired."

On the other hand, if you have been denied the advantages of school and college, do not try to compensate for it by self-conceit. Do not tell yourself and the world that you are in the same class with Abraham Lincoln, Thomas A. Edison, and the rest. The chances are ten million to one that you are not—that you are an ordinary dub like the rest of us, and need all the help you can get to raise you out of the ordinary, or possibly from the infraordinary up into the ordinary.

That most wonderful of natural forces, the Human Will, is the sword with which you can cut through all obstacles, overcome all handicaps. It will enable you to overcome the handicap of too soft an early life, and the fatal tendencies of the loafer and the cad; it will smash through the handicap of too rude a beginning, and the danger of becoming a sulker and an ignorant braggart. It is a force which each of us possesses: it grows with use, and can raise any of us so that we can look level into the eyes of any man on earth. And it makes us all good miners. We do not all want to be engineers. In our army we must not dream of having all colonels, as in the standing army of Nicaragua. We need some lieutenants, supply sergeants, and a lot of red-headed, two-fisted, intelligent doughboys. And above the mining engineer comes the general, who directs the lot.

In this country we used to be liberal with our titles. We remember groups where every man was a doctor, judge, colonel, and the rest; and all of them complimentary, and indicative of the desire of friends to please. At the present time it is good form to call anybody that has distinguished himself in science, industry, or education "Doctor." It is largely a kindly, almost quizzical form of address, and indicative of the equality of Americanism. If you cannot honestly earn a doctor's degree in a college, some friendly university may give you one for nothing: but if that fails, you can always depend on your friends.

But as to engineers—mining engineers—that is a little more serious. We should be more careful how we apply the term. "Your husband is a mining engineer?" was the remark once made to a lady we know. "I only met a mining engineer once: he got twenty-five dollars out of me for mining stock. I've had enough." A case of wrong classification, of course; the man she had met should be called a "human engineer." And remember that many a foreman is more fit to handle a mine than many an engineer.

Clay Industry in California

THE CALIFORNIA State Mining Bureau recently issued a preliminary bulletin upon the status of the clay industry in California. From it we gather that since 1887 there has been a gradual growth in the industry, the peak being reached in 1909, with a total production of crude pottery clay of 299,424 tons, valued at $465,647. In 1918, the latest figures available, production was 112,423 tons, valued at $166,788. The value of pottery clay products in 1918 amounted to $1,687,902, and the brick and tile production for the same year totaled $2,363,481.

As nearly as can be ascertained, the producing companies at this time number fifty-two; twenty-three making common brick, five terra cotta, three porcelain and china, five pressed brick, four firebrick and refractory, nine pottery and sewer pipe, two tile, one art pottery, and nine clay. A surprising variety of products is put up on the market—paving brick, common brick, paving fiber, partition tile, hollow building blocks, vitrified sewer pipe, drain tile, flue lining, terra-cotta products, miscellaneous pottery, glazed art pottery, sanitary porcelain ware, chemical stoneware, building tile, [illegible] floating brick and porcelain and china products, firebrick, and refractories.

As might be supposed, there are many deposits of clay in California, some developed and being used and others only partly developed. Probably many undiscovered deposits exist. The industry, although not as large as that in the Eastern states, is, however, substantial, and may be expected to develop steadily with the growth of population on the Pacific Coast. The clay industry is intimately related to the growth of cities, as many of its products are used in building construction and for decorative purposes. At present there is a decided increase in building operations upon the Pacific Coast, and the result will be to stimulate considerably this industry, which has suffered from the effects of the war period more than most others have.

Government Scribbling Paper

TO CRITICISE the Government is the favorite prerogative of the governed. It is easier than to work for a better government, and it brings the criticizer more into the limelight, particularly if his style is sufficiently satirical. A favorite opening is afforded by the practice of the United States Government bureaus in sending printed and mimeographed bulletins to those to whom they think the information therein contained will be valuable. In many instances, however, such matter is merely thrown in the consignee's favorite file—the waste basket—unless, perchance, one side of the paper is left blank, when a partially developed sense of economy suggests its use for scribbling purposes. We have devised a better scheme.

Until recently, we received regularly in this office, among other useless things (to us), reports of legal decisions made by the Interstate Commerce Commission, and certain publications of the U. S. Weather Bureau. For the sake of economy, we were willing to invest two 2-cent stamps to carry a message to each of these departments suggesting that our name be deleted from their mailing lists. In reply we received two courteous letters thanking us for bringing the matter to their attention and expressing regret that the publications had been sent where they were not needed.

Those who publish information know that if they wait for some one to clamor for their product, in nine cases out of ten they will wait in vain. Government bureaus, in particular, are expected to give general distribution to their bulletins without waiting for individual requests. The recipients usually find the information thereby obtained more or less valuable. Appreciations are few, but howls are loud if a service is discontinued. We believe that if anyone receives Government publications which are of no use to him, he is open to severe censure for connivance in the misappropriation of Federal funds!

Gold Mining on the Mend

A GRADUAL TREND of the gold industry away from the depression of the last few years is being noted with the fall in prices of supplies and the greater efficiency and supply of labor. Producers of this metal, of course, are elated rather than depressed over the collapse of prices and general industrial depression, for they have much to gain and nothing to lose. South African statistics just to hand show an improvement there, too. The production of the Witwatersrand area declined every month from last August up to January of this year, when a turn upward came, the January production being 31,000 oz. greater than that in December. Foreign producers, of course, where free export of gold is permitted, obtain a premium over the fixed price obtainable in this country by reason of the premium on dollar exchange.

WHAT OTHERS THINK

A Gram of Radium for Mme. Curie

In your issue of March 19 you have an editorial under the subject "A Gram of Radium for Mme. Curie." So little does the public know about radium other than through hearsay that it is perhaps not surprising some of the general information in your editorial is in error. Quite a few articles have appeared of late in newspapers and magazines which leave the same impressions, but the information furnished in *Engineering and Mining Journal* being for technical men, you no doubt wish it to be above the average in accuracy.

There is no real scarcity of radium; the companies producing it have met the demand as fast as it has grown. It may not be unreasonable to think that Providence may have intended that mankind should have to work hard to get anything so wonderful as radium; worth while things are difficult of attainment.

Radium is distributed quite generally over the world, being found in Europe, Australia, Africa, and America, and it doubtless exists in many other countries waiting for discovery. In America, so far it has been found in Colorado, Utah, Wyoming, New Mexico, Pennsylvania, Canada, and it no doubt exists in many other localities. The visible supply of the ores that yield radium is not small in relation to the radium which has been produced and the needs of mankind as so far indicated. The Colorado deposits are now rather thoroughly investigated in particular, and there is no probability of exhaustion of these deposits alone for ten times the half dozen years mentioned in the editorial, and the production of radium is likely to keep step with the progress of mankind in learning to use it. If radium were as plentiful as the more ordinary elements, who knows but mankind might be destroyed before learning how to control and use it?

Radium exists in ores only in such slight traces as not to be considered in percentage, but it must be identified, measured, and controlled by means of electroscope measurements of its radio-activity. The mining, extracting, and recovering of this element is costly far beyond anything ever attempted in a mining and metallurgical way, and is perhaps the most complex metallurgical undertaking ever attempted. It requires approximately six months to extract and finish radium ready for use, after the ore is mined.

From the above it may be inferred that radium is more costly than anything else known to mankind, not because it does not exist in reasonable amounts (considering that it is radium, not table salt, nor pig iron), but because it costs so much to recover it from the condition in which Providence has furnished it, and perhaps as a fitting reward for a hard fight.

The amount of radium used for luminous paints is practically negligible, contrary to so much that has been published of late by those who are not informed, and is a very small percentage of the radium produced. These paints are luminous zinc sulphide with the faintest trace of radium present to keep the zinc sulphide luminous when radium is used, as the price must evidence, but a large part of such paints are being produced by using mesothorium instead of radium. It can, I believe, be stated with assurance that such radium as has been used in luminous paint never kept doctors from obtaining needed radium, but there was a time during the war that the use of radium in luminous paints for the Government saved many lives and materially aided in keeping radium companies in operation.

The production of radium has kept abreast of medical requirements, and the various radium companies of America alone have a combined capacity of at least three grams of radium element per month. There is no danger of exhaustion of radium ore deposits for many years to come, and all demands for radium have been promptly met by the companies producing it.

L. F. VOGT,
Standard Chemical Co.
Canonsburg, Pa.

Principles of Copper Leaching and Precipitation

A number of statements are made by Frank E. Lathe, in the paper on the principles of copper leaching and precipitation practice, presented at the recent meeting of the Canadian Institute of Mining and Metallurgy, as reported in the March 12 issue of the *Engineering and Mining Journal*, as to which opinions will differ. It is stated that crushing must be sufficiently fine to set free the copper mineral, and thus make a good extraction. As I understand the term "setting free a mineral," this is usually understood, in describing milling practice, to mean that, in an ore so crushed, the individual particles of mineral are practically free from gangue. I do not know of any crushing being done for leaching so fine as this, and the main object of crushing in this instance is to permit access of solution to the mineral and its removal by washing in a reasonable time, an entirely different matter, which has little to do with "setting free the mineral" in the ordinary acceptation of that term.

In the paragraph following we read that "copper sulphides are almost insoluble in ordinary leaching solutions, whereas those of iron are often fairly soluble." I would be inclined to doubt any appreciable solubility of iron sulphides in "ordinary leaching solutions."

Regarding the advantages and disadvantages of sulphuric acid as a solvent, although it is true, as Mr. Lathe states, that some oxides of iron and aluminum are dissolved by it, the main objection to this comes from an increased acid consumption and not from "fouling the solutions." Foul solutions, in practice, have proved to be much less of a bugbear than they are in the literature of copper leaching, and it is a fact that copper electrolysis, as carried on at Ajo, could not be done with pure solutions of copper sulphate.

The statement is made regarding ammonium compounds that they cannot be regenerated by electrolysis. Although this has not been done practically, I am not at all sure that it cannot be accomplished, and some work has been done on this problem. In my opinion it is a proper field for experiment, which may result in a method at least as cheap and practicable as the present process of recovery.

Mr. Lathe states that reduced ferric salts are hard to oxidize, and that precipitation by electrolysis is impossible. The latter is, of course, true if ferric salts are present in large amounts in an electrolyte, but I do not believe that it will be found impossible to work out an electrolytic method making use of the solvent action of ferric salts. Such a method, although it would probably have a restricted use for special operations only, would nevertheless have the great advantage of being able to dissolve sulphides of copper without roasting.

As to what is said regarding upward and downward percolation, so far as I am able to judge from what is told me by competent metallurgists familiar with both the Ajo and Chuquicamata plants, there are no obvious advantages from the choice of either method. I would hesitate to say that upward percolation necessarily results in more rapid extraction or in ten times as much water-soluble copper in the tailings, as stated by Mr. Lathe.

In comparing consumption of acid at different plants on different ores, the number of pounds consumed per ton of ore signifies little, and it would be more informing to state the consumption in pounds of acid per ton of copper extracted.

The author does not give the whole story in the statements that he makes with respect to graphite anodes. It is true, as he says, that liberated oxygen and ferric salts attack graphite, and that is true for lead, which is not so stated by him, but this attack on either lead or graphite is only true for solutions of pure copper sulphate or those which do not carry sufficient depolarizing agents. Without the presence in solution of depolarizing agents, neither graphite nor lead could be used as anodes, as the first would be disintegrated and the second peroxidized by the oxygen evolved; but the evolution of free oxygen is prevented by the presence in solution of sufficient depolarizing agents (SO_2, ferrous sulphate or both), and either graphite or lead anodes are entirely durable under these conditions. This fact was the most important practical discovery made during the course of large-scale leaching experiments for the Phelps Dodge Corporation, under my direction, and this method of preventing the disintegration of anodes, which was not known previously, is covered by patent. I am informed that graphite is in use at a plant in Australia with perfectly satisfactory results, and the lead anodes at Ajo are certainly durable, and the durability of both are due to the facts above stated.

The statement made by Mr. Lathe that the amount of copper deposited per kilowatt hour should be 0.7 to 0.9 lb. is conservative. As a matter of fact, it should be much more than this, and tests have shown that much higher yields are entirely practicable. Of course, local conditions will not always make the use of such practice possible, but there is nothing very complicated or difficult in getting a yield of 2.5 to 3 lb. of copper per kilowatt hour.

In the discussion of Mr. Lathe's paper, Mr. Mathewson mentioned the use of large current densities, and although under such conditions the size of the precipitating plant would of course be reduced, it must be borne in mind that neither graphite nor lead anodes can be used with high enough current densities to give evolution of oxygen, as such, at the anodes, as they would rapidly disintegrate under these conditions.

Los Angeles, Cal. G. D. VAN ARSDALE.

The Roads to Knowledge

I have made it a point never to force my opinion on anyone and have cultivated the habit of respecting the opinions of others, in some cases more than I do my own, especially when their positions entitle them to this respect.

I believe the editor in the March 5 issue of *Engineering and Mining Journal*, under the heading, "Only a Correspondence School Engineer," missed one point, and a very important one at that. I submit it, and hope it will be received as intended, kindly.

No one would care, I'm sure, to take issue with the editor when he claims superiority for the university over the correspondence school, else why should students spends thousands of dollars at a university when the same thing could be obtained for a few hundred through a correspondence school? Let us, however, take the case of a young man, John Smith (just any young man), who has a family and an earnest desire for betterment. University training is absolutely out of the question. So he and his life partner plan and save for a correspondence course in mining. He studies faithfully, and by the help of the officials gains experience first in one branch and then in another, as his studies progress, until he becomes quite proficient, and at last obtains a position of enough importance to be considered a credit to the profession, and in a small way a success.

OR—Smith after commencing his studies subscribes for the *Engineering and Mining Journal*, and finds the knowledge to be gained therefrom invaluable. But one evening he reads of a certain man termed "Only a Correspondence School Engineer." Upon reflection and realizing the editor is a man of note and experience, and that his opinion must represent that of his fellow engineers, Smith thinks that if his efforts are considered in this light he might as well say with the rooster "What's the use, anyway? Yesterday an egg and tomorrow a feather duster."

As there are men who have reached the highest rung on the ladder of success without university training, a proper consideration not only for those struggling young correspondence school men but for the mining industry in general should have caused the editor to leave out "Only a Correspondence School Engineer."

No correspondence school man expects an equal chance with a college-trained man, but the correspondence study is not to his discredit; so why speak or write of anyone as "Only a Correspondence School Engineer"?

Sixes, Ore. G. E. MCGINITIE.

Copper Producers Helpless in Matter of Price

We have read with a great deal of interest the editorial in *Engineering and Mining Journal* of Jan. 8, entitled "Why Is Copper a Luxury?" It seems to us that the copper producers are rather helpless in such a situation as you mention, namely that of the copper screens. In the last few years competitive conditions have been set at nought. No doubt manufacturers who did not get as much profit as possible on the market from the luxury screening were called foolish.

Is it not your opinion that in this, as in a [illegible] other items, the only help for the copper producers will come with renewed keen competition between different manufacturers? SECOND WARD SECURITIES CO.

Milwaukee, Wis. F. M. KEAYS

Some Aspects of the Zinc Situation

A Study of Production, Consumption, and Prices During the Last Two Decades Indicates That Present Conditions Can Only Be Temporary and That a Tariff Increase May Not at This Time Be Desirable

By W. F. Boericke
Written for *Engineering and Mining Journal*

"As a RESULT of the war, the United States has become the leading source for the world's zinc. Belgium and Germany used to supply most of the international demand, but these countries are not now able to produce zinc to compete with the American product."—From an article entitled "Zinc Trade of the World," in the *Commerce Monthly*, published by the National Bank of Commerce of New York, November, 1920.

"The United States production henceforth must be limited to the extent of her own domestic requirements, as her producing cost will not permit of competition with European zinc."—From the November letter of the European correspondent of the American Zinc Institute.

Here are two conflicting statements, emanating from two authorities, each worthy of serious attention, that affect vitally the prosperity of the American zinc industry, which today is looking into the future with no certain discernment. If it be a fact that production costs in Europe will be so high that American zinc can find a profitable market there, the zinc mines and smelters of the United States can look forward to a long era of prosperity and expanding business, during which the phenomenal production of 1916 and 1917 may be equaled or even exceeded. If, on the other hand, production is to be limited strictly to the needs of this country, it is likely that there will be a necessity for curtailing production for some time to come, and business will be on an extremely competitive basis, with prices approximating the cost of production at the best-equipped and most economical plants, until all surplus producers have been forced to the wall or taken over by their more powerful rivals.

To gain a clear conception of the situation, it is necessary to make a careful study of the statistics of the zinc industry of the United States during the last two decades. The following table gives the production, consumption, and surplus of production over consumption (or vice versa) of primary zinc in the United States for each year from 1903 to 1920:

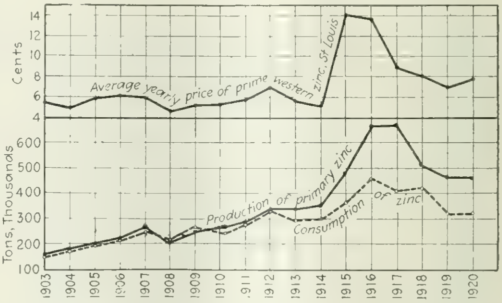
ZINC PRODUCTION AND CONSUMPTION IN THE UNITED STATES
In Short Tons

Year	Production	Consumption	Surplus	Per Cent of Production
1903 (a)	159,219	154,381	4,838	3.0
1904 (a)	186,702	180,901	5,801	3.1
1905 (a)	203,849	200,398	3,451	1.2
1906 (a)	224,770	220,781	3,989	1.8
1907 (a)	249,860	226,969	22,892	9.1
1908	210,424	214,167	— 3,743	1.8 (b)
1909	255,760	270,730	— 14,970	5.8 (b)
1910	269,184	245,884	23,300	8.6
1911	286,526	280,059	6,467	2.2
1912	338,806	340,341	— 1,535	0.4 (b)
1913	346,676	295,125	51,551	14.8
1914	353,049	299,125	53,924	15.5
1915	489,519	364,855	124,664	25.4
1916	668,343	459,317	209,026	31.2
1917	669,573	413,643	255,930	38.2
1918	517,927	423,792	94,135	18.1
1919	465,743	323,964	141,779	32.5
1920	463,000	324,000	139,000	30.0

(a) Includes production of secondary zinc. (b) Deficit.

The chart gives the same figures in graphic form. The lower solid line depicts the production of zinc, the broken line the consumption, and the top solid line shows the average price of zinc for each year at St. Louis.

The table naturally divides itself into three parts. The first takes in the years 1903-1914 inclusive, a period of normal development of a great industry, marked in general only by the disturbance due to the 1907 panic. The second part, properly starting with the outbreak of the World War in 1914, extends through 1918, with the signing of the armistice, and embraces the immense development of the industry in response to war demands, with the hectic and sensational price advances in the metal. The third, the readjustment era, brings us to the present year, and this chapter is far from being closed.



A COMPARISON OF THE PRODUCTION, CONSUMPTION, AND PRICE OF ZINC IN THE UNITED STATES FROM 1903 TO 1920

Considering the first period, 1903 to 1914, it is evident from the table that, until 1913, at no time was there any appreciable surplus of zinc for which a large foreign market had to be found. Until 1907 production and consumption nearly balanced. In 1907, a surplus of 22,892 tons, about 9 per cent of the production, accumulated, but this was easily absorbed in the following years, during which consumption exceeded production. In 1910 there was another surplus of 23,300 tons, which was likewise taken up in 1911 and 1912.

In 1913 there was a considerable excess of production over consumption, due not so much to large zinc production as to a considerable drop in consumption. Importations of foreign zinc were made as a result of tariff changes, and stocks accumulated rapidly. The industry was in a depressed condition, more on account of a slowing up of general business than from importations. Then came the war, and with it an entire change in the situation.

Demand Not Lessened by High Prices

During the pre-war period, production increased from 159,219 tons in 1903 to 353,049 in 1914, an increase of 193,830, or 121 per cent. Consumption increased from 154,381 to 299,125 tons, an increase of 144,744 tons, or

94 per cent. The average rate of increase of consumption per year was 13,158 tons, and this figure might be taken as the normal rate of increase in domestic consumption for the industry, representing a healthy, natural growth under normal price conditions. The average price received for zinc during this period was 5.58c., St. Louis.

A study of the chart shows that in general the production curve was more sensitive to price variations than the consumption curve. In other words, there is little evidence that a lower price for zinc stimulated the demand and increased consumption. On the contrary, the largest consumption for the period occurred in 1912, when the price reached its highest figure, 6.93c., and a drop to 5.61c. and 5.11c. in 1913 and 1914, instead of increasing the demand, showed a falling off in consumption. These were years of unsettled business conditions in the United States, due to the change in the administration and to uncertainties in the tariff and financial issues. Demand for zinc decreased, along with general business.

The conditions affecting the industry during the war period are too well known and recent to require more than the briefest résumé. The seizure of the Belgian smelters by the Germans cut off at a single stroke the main source of zinc for the Allied countries. A glance at the following table will show how dependent those countries were on imported zinc, which came in large part from Belgium and Germany.

FOREIGN PRODUCTION AND CONSUMPTION OF ZINC IN 1913

Country	Production, Tons	Consumption, Tons	Excess of Consumption Over Production
Great Britain	73,020	214,508	141,488
France	74,835	89,286	14,451
Italy	......	12,015	12,015
Total	147,855	315,809	167,954

At the outset of the war, therefore, these countries were confronted with the necessity of finding over 100 per cent more zinc than they produced in order to supply their normal peace-time requirements, in addition to the urgent needs of war material. They turned, of course, to the United States as the most available source of supply. Under the stimulus of competitive bidding, the price of zinc went almost perpendicularly from 5c. to 23c. per lb. Production rose from 346,676 tons in 1913 to 669,573 in 1917, an increase of over 90 per cent. Exports rose from 7,783 in 1913 to 220,064 in 1917.

During the war period consumption increased from 299,125 in 1914 to 423,792 in 1918. The peak was reached in 1916, with a consumption of 459,317 tons. This, for the four-year period, was at the rate of 31,167 tons per year average increase, compared to 13,158 tons per year, the average yearly increase in the eleven-year period before the war. The conclusion is of course unavoidable that this increase in consumption was abnormal and due solely to war demands, and the consumption figures for the third period bear out this conclusion.

LAST TWO YEARS NOT A RELIABLE INDEX

In 1919 and 1920 consumption was practically the same, at the rate of 324,000 tons per year. Neither year gives a satisfactory index of the peace time requirements of the United States. Nineteen nineteen, with the wholesale changes attendant to the signing of the armistice, and the sweeping adjustments made necessary in passing from war to peace, gives little guide, and 1920, with its manifold labor difficulties, transportation troubles, price inflation, and final business depression, is quite as unreliable. The consumption for the first six months of 1920 was 175,268 tons, making an indicated consumption of 350,000 tons for the year had this rate been maintained. The difference was, of course, due to the slackened business conditions during the latter part of the year.

Is this consumption, 325,000 to 350,000, a *normal* consumption for the United States? Considering the pre-war consumption figures, a maximum of 340,341 tons in 1912 and 295,125 in 1913 is noted, and 1913 was, as has been recorded, a year of business depression. The normal annual increase in consumption for the pre-war period was about 13,000 tons per year. Were this rate maintained, a normal consumption of approximately 400,000 tons would be indicated as the domestic requirements in 1920. It should be emphasized that this whole amount would be consumed in the regular requirements of industry, considering the normal business requirements and the increase in population, and has nothing whatever to do with the extraordinary demands of war or special exigency. It seems to me that this figure is not far out of reason as a basis on which to work.

Unfortunately, however, in the distorted and extravagant trade tendencies of the war period, there is little means of knowing whether this increase in consumption was actually maintained in the industries dependent on the zinc business. Despite an ardent and persistent advertising campaign for increased use of zinc in industry by a certain large interest, there was undoubtedly some substitution of other metals and materials in certain lines which formerly consumed zinc. This was due in part to war necessity, which made it incumbent upon manufacturers to substitute a cheaper or more available material for that which might be theoretically the best. The greatly decreased use of brass in automobiles, for instance, and a production of some so-called galvanized products which have not lasted as well as the pre-war article, are cases in point. The competition of various forms of roofing has made inroads into the promising field expected, as a result of the century-old success in Europe of zinc roofing. These fields are still open, with immense possibilities, but there is need for the skilled salesman as well as for the miner. On the other hand, numerous new and growing uses have been found for the metal, and particularly for the byproducts.

PRODUCTION WILL NOT BE EXCESSIVE

Assuming, however, that 400,000 tons per year may reasonably be expected to be consumed in 1921 in the domestic market, what relation will this bear to production?

As has been previously pointed out from the chart, until 1912 production and consumption in the United States practically balanced. In 1913 and 1914 there was a considerable surplus, and the importation of European zinc into this market, due to the elimination of the tariff, would undoubtedly have put a damper on the opening of new sources of supply. It is highly probable that had conditions remained normal there would have been no such expansion of the industry as resulted in the ensuing years.

Between 1914 and 1917 the production of the United States increased over 160 per cent of the entire increase for the preceding eleven-year period. A considerable part of this production was made in quickly constructed, high-cost plants, the output of which was made possible only by the high price of zinc, and it was a foregone conclusion that the production of these plants would rapidly drop off and ultimately disappear with the return of the price to a saner basis. In considering the *potential* production of the country, therefore, it is absolutely necessary to limit the figure to the possible production under normal price limits, and this figure will be much less with 6 or 7c. zinc than with extravagant figures.

The production in 1919 and 1920 was practically the same, but the *rate* of production decreased rapidly toward the end of 1920. For the first six months the production was 258,108 tons, at the rate of 516,000 per year; for the last half only 206,000, at the rate of 412,000, a decrease of 20 per cent. It was estimated that on Jan. 1 only 52,500 retorts out of a total of 157,000 were in operation, and even this number is said to be decreasing. This would be at the rate of possibly 200,000 to 250,000 tons per year, much below the prewar figure as far back as 1909.

RICH ORE DEPOSITS OF OKLAHOMA PROVED UNEXPECTED STIMULATION

With the price of zinc at the end of the year below the average for the 1903 to 1913 period, and smelting costs much higher than in 1913, it is evident that a halt in production was bound to occur. It would have come earlier but for the extraordinary production of zinc in the Oklahoma field. Because of the intensive prospecting in this field during the boom years of 1915, 1916, 1917, stimulated by high ore prices, orebodies were drilled and developed in months which it ordinarily would have taken many years to block out.

It is estimated that an amount of drilling equivalent to ten years' prospecting was done in a third of that time. This fact, added to the amazing richness of some of the orebodies, plus the insecurity that many operators had in the tenure of their leases, and their reluctance to let go even in the face of an overproduction of zinc ore and falling ore prices, caused this district to increase its output 20 per cent over its 1919 production, reaching the record figure of 560,000 tons for the year. Much of this ore was sold for prices below pre-war figures, with costs at least 50 per cent higher than prevailed then. It is even questionable if many of the operators got back a new dollar for an old one, considering operating costs alone, and making no allowance for overhead, amortization, or depletion of orebody. The fact remains, however, by virtue of this vast production of high-grade blende, that the smelters dependent on this ore received an adequate supply, at prices, during part of the year at least, below the cost of production.

PRICE AFFECTS PRODUCERS MORE THAN CONSUMERS

It has already been noted that apparently the zinc consumption curve is not directly affected by the price. In other words, consumption depends more on general business conditions, especially building activity, than on a high or low price for zinc. This point can be appreciated by considering the comparatively small amount that even a large fluctuation in zinc would figure, in relation to labor and other cost, in a large building, for example. Yet its general use would be considerably influenced by the amount of building activity.

Production, however, is affected vitally by the price, and its curve follows price fluctuations much more constantly. Allowance must be made for necessary lag for production to respond to a higher price, and for the momentum that will carry along production at a high figure even after the price has fallen. Taking this fact into consideration, it is illuminating to note the production of the last two years in relation to the price. The figure is about the same for the two years, about 463,000 tons. The average price was 7c. in 1919 and 7.8c. in 1920, but, as noted, the price fell sharply toward the last of the year to a low of 5.5c. Of 157,000 retorts in the country, 107,500 were in operation on Jan. 1, 1920, and 95,000 on June 30, about two-thirds the capacity. Presumably the rest would be unable to show a profit under existing costs with 7.5c. zinc.

With a drop to 5.5c. at the end of the year, the number of retorts was reduced to 50,000, approximately. The possible production from these would be about 200,000 tons per year. This figure is about two-thirds of the country's pre-war requirements, or about one-half the requirements as calculated in a preceding paragraph. If 400,000 tons per year as the normal requirements of the country is approximately correct, it is evident that this rate of production will fall far short of satisfying the domestic demand. Is it reasonable to believe that this balance of 200,000 tons can be supplied from abroad, at anything like present prices?

To answer this, a consideration of the world statistics of the metal is essential. The pre-war production and consumption of zinc for 1913, which incidentally are the last reliable figures available for the different countries, are:

WORLD PRODUCTION AND CONSUMPTION OF ZINC IN 1913
(In Tons)

Country	Produced	Country	Consumed
United States	346,676	United States	295,370
Germany	312,075	Germany	255,734
Belgium	225,112	Great Britain	214,508
France	74,835	France	89,286
Great Britain	73,020	Belgium	84,216
Netherlands	26,811	Austria	44,533
Austria	21,504	Russia	36,707
Russia	11,574	Italy	12,015
Others	25,810	Netherlands	4,409
		Others	29,541
	1,117,417		1,066,319

In 1913 the United States evidently produced about 30 per cent of the world's zinc, and consumed nearly the same amount. The situation today, owing to the manifold changes politically and economically as a result of the war, is wholly different. Outside of the United States there is not a single country in a condition to approach, much less exceed, pre-war production. Germany and Belgium were, and still are, the mainstays of European production. For 1920 the Belgian production is estimated at 90,000 tons, and that of Germany around 100,000. The world's production, outside of the United States, is estimated at only 280,000 tons. This compares with 770,000 tons in 1913, a decline of over 60 per cent.

EUROPEAN CONDITIONS REMAIN DEPLORABLE

Large as the decline has been, it is debatable if it is not warranted by the lessened demand for the metal abroad, resulting from the chaotic industrial conditions in Central Europe. It must be kept in mind that a large and expanding demand for zinc can arise only from countries with well-developed industries. There are in addition the enormous difficulties of doing business with countries where all trading is practically on a barter system, with a wildly inflated paper currency and fluctuating exchange rates that tend to make every transaction a gamble. Under one or the other head can be classified many of the most important pre-war consumers of the metal. Russia and Austria, in particular, which formerly took large amounts of zinc, are now eliminated. On the other hand, consider the growing needs of Japan and Canada, which, by virtue of the development of their industrial system, are rapidly becoming large consumers of zinc.

That a *need* for zinc and zinc products now exists in Europe, especially in the devastated area, where rebuilding must be done on an unprecedented scale, is undoubtedly true. But a sharp distinction must be made between this and *effective demand*, which not only means the mere desire for the commodity, but in addition the power of purchasing. Too often this last eminently practical point is overlooked by enthusiasts who can see only the need for the product. If Russia, Hungary, Poland, Jugo-Slavia, and central Europe generally were able to make an effective demand for zinc, the apparent overproduction of the metal would vanish overnight.

REHABILITATION OF THE INDUSTRY LIKELY TO PROCEED WITH SPEED

To believe that this effective demand will be long in awakening is, however, contrary to all precedents of history and economics. The history of all virile nations is full of examples of conditions under which a country decimated in population, burdened with indemnities, and apparently with no hope of regaining trade or prestige has arisen Phoenix-like to a commanding position in an unbelievably short space of time. There is good reason for believing such will be the experience of many of the war-ridden countries of today, especially where the fixed factors of production, land, permanent improvements, and machinery have been unscathed by war.

The present situation in zinc, from an international standpoint, is entirely artificial, as is apparent to those who have studied it, miner and economist alike. It is an unfortunate combination of post-war adjustments, poor trade conditions, and the lowly state of Continental exchange. With the signing of the armistice, the Allied governments found themselves with considerable stocks of zinc on hand, in addition to a vast amount of scrap material reclaimed from the battlefields. The presence of these stocks, like our own sales of surplus war material, acted as a brake on any continued price advance, and will continue to do so until absorbed in industry. Inability of central Europe to buy led to a further slowing up. Finally, there is the curious anomaly of German zinc being sold in London at a price which makes profitable shipment of the metal to the United States and resale here, duty paid, at less than the American cost of production.

HOW FOREIGN EXCHANGE AFFECTS ZINC PRICES AND MARKETS

The reason, of course, lies in the devious workings of foreign exchange, and is wholly independent of costs of production which would normally govern. With a government-controlled price of coal in Germany, equivalent to about $1.60 per ton, and ore and labor paid for in marks, there is a profit in zinc when sold on the London market for sterling, when the enormous depreciation of the mark is taken into consideration. Even if there were no profit on the transaction, it still might pay the smelters by yielding funds for English purchases, which might be imported into Germany and sold for more than the zinc costs.

Obviously such a trade is only temporary. In the first place, with a production of only 100,000 tons per year, Germany is short 150,000 tons of supplying her own pre-war requirements, which, with any resumption of trade, may be expected to take her entire production for some time. In the second place, this trade is dependent upon the continued depreciation of the German mark, and the willingness of the German workmen to accept a cost of living, or a lowering of his standards, out of all proportion to what he enjoyed before the war. Neither condition is likely to persist.

Obviously, a small rise in the value of the mark today would play havoc with the present trade relationship. Suppose sterling, with marks at 1.50c., is exchangable 260 for 1. Should marks advance even 0.50c., the exchange rate would be cut to 190, and much of the advantage of the German exportation would be lost. Likewise, any relaxing of the price of coal by the government would immediately raise the price more nearly to the level paid by the Belgian and English smelters, and increase proportionately the cost of smelting. Such a demand by rival industries in need of fuel is certainly to be expected with any increase of industrial activity.

It is reasonable to believe, therefore, with the absorption of government stocks and improvement in European exchange, that the London price will rise to the present cost of production of the Belgian smelters, which is reported to be £40 per ton. It is entirely probable that the world-wide drop in commodity and labor costs now in process will further shade the figure, but not to a great extent.

It should be further noted by the American producer that he is afforded an automatic protection through the same medium that has caused his present distress—the operation of foreign exchange. With every 10c. rise in sterling, the price of zinc advances over 0.1c. per lb., the London market remaining unchanged at £25. The following table has been constructed for several prices of zinc and varying exchange rates:

VARIATION OF EQUIVALENT ZINC PRICE WITH STERLING EXCHANGE

London Price of Zinc, per Long Ton	Sterling Exchange	Equivalent Price per Pound, Cents
£25	3.50	3.90
	4.00	4.46
	4.50	5.02
	4.86	5.42
£30	3.50	4.68
	4.00	5.35
	4.50	6.02
	4.86	6.51
£40	3.50	6.25
	4.00	7.14
	4.50	8.03
	4.86	8.68

To this there is to be added, of course, freight, commissions, and the present 15 per cent ad valorem duty.

From a negligible amount of zinc exports in 1910, the United States in 1917 exported over 220,000 tons, 25,000 tons more than Belgium in 1913. In 1920, exports were 114,500 tons, the greater proportion of which were made in the first six months of the year. In view of what has been said in preceding paragraphs, no argument is required to show that this country under normal price conditions will be a large exporter of the metal, to the extent of 100,000 tons. There is a little danger that Europe's production of zinc will exceed its own needs for a considerable time, or until natural trade channels are again reopened and more normal conditions prevail. With an increase in the world's consuming capacity to a point approaching the pre-war figure of 1,000,000 tons per year, the United States will be called upon to make good the deficiency in production.

It may also be noted that under the terms of the reparation payments to be made by Germany, an amount equivalent to 12½ per cent of the value of exports may be levied on that country. This of course will add to the cost of production and amounts to an additional protection to the price of zinc, to the benefit of the American exporter.

PRESENT CONDITIONS TEMPORARY AND UPWARD REVISION OF TARIFF UNDESIRABLE

The foregoing, though optimistic for the future, provides only cold reading for the American producer, who sees foreign zinc today in active competition with his own product at the seaboard, at prices below his cost of production. Some contend that the country has now become not an exporter but an importer of zinc. This, except for the moment, is at utter variance with the facts. Now is a time, if ever, to keep a firm grasp of fundamentals, and endeavor to look not at conditions today, but at what they will be a year, and five years, hence.

It cannot be too often emphasized that the present situation is entirely artificial and not due to natural conditions of demand and supply in the industry. A tariff, now being urged by certain interests, would offer temporary relief, but the stopping of imports would simply add to the foreign stocks, weakening the London market still further, and would delay by just so long the resumption of the foreign demand which is relied upon to take up our own surplus. A slump in domestic demand, amounting to an almost complete stagnation momentarily, is the primary cause of the disastrous price drop, not the foreign importations. If the tariff suggested were purchased at the expense of retaliatory tariffs by other countries against American products, such as are now threatened, it might prove to be a boomerang.

The one thing that would probably help the situation as much as anything else would be the resumption of industrial activity in central Europe, and particularly in Germany. Assured of that, there would be little need to worry over a surplus German production for some time. The final settlement of the indemnity, and an early formal peace, both of which are reasonably assured in the near future, will be constructive features of the highest order. With an abundant ore supply, improved labor conditions, and lowered costs, the American producer can look to the future with confidence.

Fixing of Prices by Nitrate Association Of Chile

At a special session of the directorate of the Nitrate Association, held on Jan. 26, 1921, the prices of nitrate for May and June were set at 17s., the figure now ruling for April. The directorate also announced that it would guarantee that the prices for the first ten months of the coming nitrate year—from July 1, 1921, to March 31, 1922—would not be less than 14s. per Spanish quintal (1 quintal = 101.4 lb.). Definite prices will be fixed in May or June of this year.

The maintenance of the present high prices during the last two months of the nitrate year will virtually make impossible any sales by the association for delivery within that period, according to Consul Dana G. Munro, in *Commerce Reports*. The association apparently intends to make no serious effort to effect further sales for the current year. A large part of this year's exports is still unconsumed, and will be left on the hands of the dealers in Europe and the United States. The maintenance of the April price through May and June, and the announcement that the price for the ten months after July 1 would not be less than 14s., was intended to protect the interests of these dealers who have purchased their stocks at the high prices fixed by the association for this year, and also to give the banks financing the purchases definite assurances which would enable them to continue their assistance to the trade.

The decision of the association is on the whole regarded as wise, in view of the close connection between the interests of the producers and those of the large distributors. The disorganization of the market by the sale of nitrate at low prices when there were in existence large stocks purchased at much higher prices would react unfavorably upon the entire industry. On the other hand, the fear has been expressed that the maintenance of comparatively high prices might stimulate the competition of other fertilizers and curtail the consumption of Chilean nitrate. The current price is at least 2s. 6d. below the figure of 14s. announced by the association, but there are no very large quantities on the market.

The probable effect of the association's announcement will be a postponement of the hopes for an improvement in the nitrate market until a considerable part of the large stocks now existing have been moved. It seems improbable that there will be any further sales until the beginning of the coming nitrate year on July 1, and the improvement may be delayed even longer unless business conditions in the United States and Europe improve considerably before that time.

The Problem of Mining Canadian Iron Ores

A federal bounty, to be paid by the Dominion government on iron ores mined in Canada, has been advocated as the best means of developing the large bodies of low-grade ores which exist in that country. The subject came up for discussion at the March meeting of the Canadian Institute. At present, 95 per cent of all the iron ore smelted in Canada is imported from the United States or Newfoundland. G. S. Cowie thought that a bounty of, say, $1 per ton would be the best way of encouraging domestic production. The chief opposition to the plan, he said, came from the West, where it was thought that such a bounty would raise costs of iron products, a false assumption, as the speaker pointed out. This seemed to be the only means of assisting the industry. The Moose Mountain operations have already closed down and the Helen and Magpie mines may follow unless something is done.

Another speaker suggested that, instead of a bounty, a certain sum of money, say $300,000, be set aside for investigational work, which might later be returned. Or some inducement might be given for smelters to use Canadian ore. At present the native ore is unpopular, because most of it is low-grade magnetite, high in silica and sulphur, and in some cases high in phosphorus as well. There is also some siderite, as at the Magpie and Helen, and in Nova Scotia, where the siderite and magnetite are mixed.

Further, it was pointed out that Canadian furnaces had adopted American smelting practice, and it was therefore natural that American ores should be the most desirable. More research work was necessary for the purpose of developing a furnace and formulating a practice which would be suitable for Canadian ores.

Rand Results in 1920

Operators Depending on the Gold Currency Premium—Total Profits Slightly More Than Premium, but Dividends Rather Less—Working Costs 50 per Cent Higher Than Pre-War Figures—Ore Exhaustion and Economic Elimination

By A. Cooper Key
Written for *Engineering and Mining Journal*

IN PAST YEARS the association of America with the Rand has been largely a matter of personalities: of engineers and commercial firms. But latterly the connection has been financial. The Rand may be said to be living on the currency premium on gold, the deterioration of the British Treasury note compared with the dollar. What in years past would have been an economic heresy, that gold could command more than 85-per fine ounce, has proved an actual fact. It may be argued by some theorists that there is no such thing as a premium on gold, but, as one of the leaders of the industry said to me over a year ago, "It is all very well to talk like that, but the fact remains we are banking so much extra for our gold." In 1919, the Rand mines did not show this additional revenue in their monthly statements, nor did the Chamber of Mines take credit for it in the monthly output declaration. But the actual arrangement for a free market in gold was brought into being by Messrs. Rothschild & Sons in London in July of that year, and upward of four millions was actually received by way of premium in the final five months of the year.

Fears that the premium would not last doubtless led the companies not to bring it into account each month, and this policy created the anomaly of certain low and medium-grade mines showing losses or modest profits, whereas the addition of the premium revealed handsome profits. Even at a sovereign an ounce, about the average in 1919, but since exceeded, it will be realized that the extra revenue is an enormous benefit to properties like Crown Mines, with an output of 53,000 oz. monthly; Randfontein, with its 30,000 oz.; New Modder with 42,500, and a string of mines with from 15,000 to 30,000 oz. Since January, 1920, gold has been taken at realization price.

PREMIUM EIGHT AND ONE-HALF TO TEN MILLIONS STERLING

The currency price of gold is found by taking the figure $20.67183, the price which the United States Mint pays for fine gold, and dividing by the London-New York exchange. Allowance has to be made for brokerage, insurance, and incidental factors. It is now the practice of the Rand mining groups to take a conservative figure for the month's gold, which may be realized some weeks later, and to adjust the revenue up to the end of the previous quarter in the quarterly statements. But not until the yearly accounts are available, a few months hence, will it be possible to get anything more than an approximate estimate of the aggregate premium for last year. We can, however, frame two estimates of the magnitude of the premium. The Mines Department of the Union government adheres with the wonted and rooted conservatism of the bureaucrat to the fine gold standard. The Transvaal Chamber of Mines assesses the value on the estimated realization price. The Mines Department gives a figure monthly, showing what extra would be realized on the gold output applying the price assumed by the Chamber of Mines. The table herewith shows the increases in monthly value over that at the standard of £4.24773 per ounce, and the prices assumed for each month:

	Excess Over Standard	Estimated Realizable Value per Ounce
January	£759,650	£5.375
February	784,163	5.500
March	708,828	5.250
April	600,019	5.125
May	702,086	5.250
June	625,321	5.125
July	738,900	5.250
August	970,198	5.625
September	1,032,280	5.750
October	1,079,234	5.875
November	1,035,014	5.875
December	940,150	5.75
Total and average	£9,975,843	£5.475

The Chamber of Mines states the value of the gold production last year at £43,133,123, of course inclusive of gold premium; the Union Mines Department at £34,654,922, taking gold at the standard price, an indicated premium, by differences, of £8,478,201. Thus the premium on gold may be taken at eight and one-half or ten millions, the latter estimate containing the benefit of favorable exchange between London and Johannesburg, but when final accounts are available it may be found to be eleven millions or more.

PROFITS AND PREMIUM CONTRASTED

The vital importance of this premium is at once demonstrated by reference to the working profits of the companies. The total is £11,700,000, or not much more than the aggregate premium. But the government takes toll of the profits, and the actual sum distributed in dividends was £8,450,000. Thus, had there been no premium, there would have been no dividends, taking the average position; in point of fact many mines would have been closed down by economic elimination, and only the richer Far Eastern Rand group and possibly a mine or two mines near Johannesburg would have been able to survive and pay dividends.

It is not a question of deterioration in grade, but of an advance of 50 per cent in working costs since 1914 that has brought the Rand industry into such hectic dependence on the gold premium. In 1914 the average recovery for the Rand companies was 6½ dwt.; last year it was 6.758 dwt. This rise is due to the growth of the Far Eastern Rand group of mines, to weighting the average, to the adoption of selective mining simultaneously with the advance in working costs, and to the closing of certain low-grade mines owing to the same circumstance, namely, that working costs have shot up from 17/7 to the alarming figure of 25/8 per ton, which corresponds with 6 dwt. at the standard price of gold.

What is "food" for the Rand is "poison" for the rest of the world. Great Britain would like the sovereign back to $4.85; the Rand (at any rate so far as gold is concerned, and apart from other countervailing considerations) would like it $3.65. The fluctuation in the price of gold is of enormous significance to the Rand. In

October and November the price was 117/6 per fine ounce. At first it was proposed to assess the January output at 107/6, but owing to the decline in the second part of the month the figure has been modified to 105/- With an output of 8,000,000 oz. a year, it is easy arithmetic to see that every half-a-crown drop involves a shrinkage of a million in currency value of output and a million a year in profit. In a month or in two months no less than £5,000,000 a year has been lopped off the Rand's profit. From a million and a quarter in November, the total will have dropped to something like £850,000 for January.

There has been a constant rise in operating charges since 1914; the full effect of the war on the cost of supplies was not felt for a year or two years, but in 1917 there was a rise of 1/- per ton, in 1918 of no less than 2/5, then of 1/4. The jump of 2/9 last year is the highest on record.

LABOR'S REMUNERATION INCREASED

Up to the end of 1919 the mining companies had met the extra cost of living with which employees were faced by a war bonus on the 30 per cent scale, so allocated that lower-paid employees received the full amount, and diminishing as the rate of pay advanced. Single men without dependents received no allowance. But in December of that year it was agreed to give all employees a flat £3 15s. 6d. per month, and an extra £1 3s. per month for each total dependent. For an average family, man, wife and three children, the allowance worked out at £8 7s. 6d. per month. The cost of these allowances was in the neighborhood of four and three-quarters millions (sterling) a year. But in February, 1920, the Chamber of Mines, on representations of the Federation of Trades and the unions, in view of the gold premium being obtained, agreed to consolidate wages and cost of living allowances on the basis of 40 per cent rise in cost of living. Eventually this was agreed upon at £10 8s. per month, being on the basis of twenty-six shifts at the pre-war standard of a sovereign a day. Mine officials earning up to £75 per month received 20 per cent. These allowances were made retroactive to November, causing the February expenditure to advance to £2,689,000, as against £2,505,000 in January. Though the average cost for the year was 25/8, the figure for December was 26/10, representing 6.3 dwt. at standard price. In this connection it should be noted that 40 per cent of the Rand's ore reserve averages less than 6½ dwt. Allowing for metallurgical losses, it is probable that 7 dwt. *in situ* is the minimum required to balance existing working costs. Increased assessments under the Miners' Phthisis Acts are also a material factor in enhanced costs, and the price of stores continues high. Natives received an increase in February.

The unions have lately asked for a further 6d. per hour. The Chamber of Mines has pointed out that, if this were granted, the native workers, of whom these are 160,000, compared with about 21,000 whites, would not be content with existing rates of pay. Last year each ounce of gold cost £3 17s. 6d. At nine low-grade mines it cost 100/-; at four high-grade mines less than 50/-. But if an increase of 20 per cent in white wages and 20 per cent in native wages were conceded, there would be a dozen mines (including the important Randfontein and the East Rand Propietary, each capable of crushing 150,000 tons a month) whose cost per ounce would exceed the current price of 105/-. These demands again are being insisted upon, despite a decrease in the cost of living index figure.

The tonnage milled was twenty-four and one-half million tons, practically the same as in 1919, though the expenditure was £3,300,000 additional. Only thirty-nine companies are now working. Five of these cannot pay with gold at 105/- per ounce, and at least another four would be left with the narrowest of margins even if the premium be maintained at 20/- per ounce. Five properties are approaching exhaustion.

Six companies dropped out last year, two in the low-grade Germiston district. The Jupiter and the Simmer Deep surrendered in the fight against ever-increasing working costs that were for a time combated by selective mining. Moreover, they were faced with the necessity of providing fresh capital for shaft sinking and development. A third, the Knights Deep, was closed down owing to its mill being destroyed by fire. This was financially better than running the mine and the shares appreciated from 4/6 to 10/6 (par value £1) chiefly in consequence of the funds to be provided on the insurance policies. Three historic mines, the New Heriot, the City & Suburban, and the Village Main Reef, some of the oldest Rand concerns, having been registered in 1887, were closed owing to ore exhaustion, accelerated in the case of the latter by a severe earth tremor causing the collapse of stopes. One new mine, the Modder East, began milling with a hired reduction plant. It has since acquired that of the Simmer Deep-Jupiter mines, just mentioned.

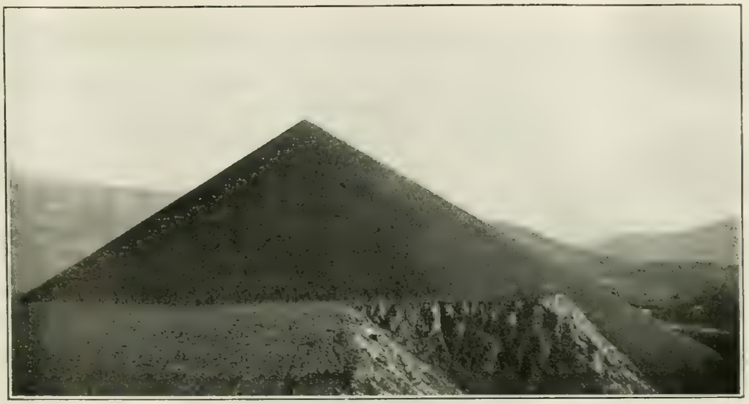
DIVIDENDS, EIGHT AND ONE-HALF MILLIONS—ONE MINE CONTRIBUTED ONE AND ONE-HALF MILLIONS

As earlier noted, Transvaal gold mines earned profits of £11,700,000, as against £10,436,500 in the previous year, when, however, the gold premium applied to five months only. Dividends figured at £8,450,000. The outstanding performance was the distribution of £1,435,000 by the New Modderfontein, unparalleled in Rand annals; though, immediately after the amalgamation, Crown Mines declared over a million for four consecutive years. The advance by the New Modder for the year is no less than £455,000. Among other great mines, Van Ryn Deep paid £777,980, and Modder Deep £725,000. The Crown Mines, a Central Rand concern, revived by the gold premium, distributed £728,582, and Government Areas (in which the Union Government is today a senior partner, receiving by way of royalty two-thirds of the gold premium), £700,000. The mines of the Eastern Rand district were responsible for £5,185,350, representing about 62½ per cent of the whole.

A POLICY FOR 1921

What does 1921 hold for us? The answer must be in the form of another question—What will the currency premium average? That is the economic girder from which the fortunes of the Rand depend. If the premium recedes, we may obtain certain advantages in the price of supplies. Already zinc is much cheaper, though cyanide is higher. But it is at least problematical whether labor, unless its temper changes materially, will surrender a large proportion of its higher wages unless compelled by the *force majeure* of shutting mines. The policy of the Chamber of Mines in agreeing to deduct union subscriptions from wage checks is insistently criticised as assisting the men in fighting the mines. What was justified in 1915 in the midst of war is mere foolishness today. Controlling houses endeavor to reduce working costs, as far as may be, *pari passu* with a falling gold premium. A premium of a sovereign an ounce translates into 6/8 per ton, which means that we have to get back to the 1917 figure of 19/– per ton milled.

It is a hoary saying that in gold mining every sovereign produced has cost 25/–. The Rand cannot go on producing an ounce of gold at a cost of £3 17s. 7d. per ounce, and relying upon a fluctuating currency premium, which may be ephemeral, for its profit. Mining engineer friends in London, when I was over on vacation last year, told me that in reporting on mines they based calculations on standard value only, which is the only sound policy. I am doubtful whether costs can be reduced by 3/– a ton, unless conditions change materially.



A PERFECT CONE
The angle of rest of the granulated slag is thirty-one degrees.

The Disposal of the Granby Slag

For Ten Years This Waste Product Has Been Granulated and Stacked on the River Bank With Conveyor Belts

By C. M. Campbell

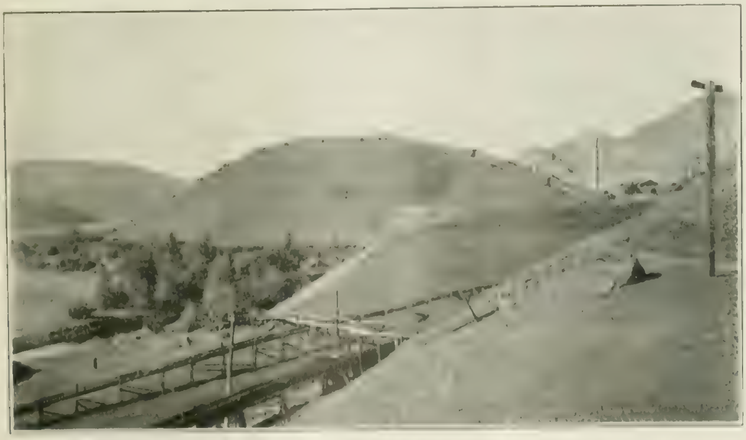
Written for *Engineering and Mining Journal*

THE GRANBY SMELTER at Grand Forks, B. C., now being dismantled, will leave, as a monument of twenty years' busy work, two enormous slag piles. From a distance they stand out on the landscape like the pyramids. In the early years the slag was granulated and flushed out over the area below. Later, when the available space filled up, the slag was poured molten, and in the course of a few years the area was again filled up with a mass of slag which extended along the river's edge in cliffs nearly 100 ft. high and a mile long. It then seemed to be necessary to transport the slag elsewhere, divert the course of the river to acquire more land, or take to the air like the birds. The last scheme was decided on, and since 1911 all the slag has been stacked.

At first, trestle work with a belt discharge 100 ft. above the old slag pile was built, and when this was filled in, further construction was made on the gradually rising slag pile. The granulated slag from the furnaces was carried along slag-lined launders to a dewatering bin, under which was a horizontal belt conveyor discharging to a north or south series of belts, as desired. In this way slag could be dumped at one place while extensions were being built at the other. The bin also had a capacity for several hours' run, so that the belts were not running continuously.

At the last, over a mile of 30-in. rubber belt was used, and the system was divided up into several units, each with an independent motor. Each end section was equipped with a telescopic belt, for discharging, which was moved ahead with a pair of jacks as required. The cost of handling under normal conditions was slightly under 4c. per ton.

The system was due to the initiative of F. M. Sylvester, general manager, and was carried out by W. A. Williams and W. B. Bishop, successive smelter superintendents. In general granulation is not a popular way to dispose of slag by American smeltermen, although costs at Grand Forks were satisfactory. Where sufficient space is available below the furnace level, the slag is ordinarily poured molten from mechanically tilted pots. With the closing down of the Grand Forks plant, the Washoe smelter at Anaconda is the only prominent American copper plant where slag granulation is practical. The illustrations presented on this page show the remarkable topographic changes such slag-disposal operations produce.



IN COMPETITION WITH THE SURROUNDING HILLS
The north slag pile, 300 ft. high and 3,000 ft. long, contains ten million tons

Early Steam Pumping in Peru

Steam-Driven Pumps of Primitive Design Were First Used At the Cerro de Pasco Mines in 1816, and Were the Invention Of Richard Trevithick, a Cornishman Born 150 Years Ago

By W. B. Paley

Written for *Engineering and Mining Journal*

ONE DAY, in the year 1811, a Spanish merchant from Lima, Peru, wandered disconsolately about the streets of London, feeling that he had come half-way around the world to no purpose. Deputed by wealthy business men of the Peruvian capital to inquire about the possibility of unwatering the drowned-out mines of Cerro de Pasco by steam power, he had consulted Boulton & Watt, of Soho, Birmingham, with discouraging results. They considered it would be quite inapplicable under the peculiar circumstances to be met, the light atmosphere of a place nearly 14,000 ft. above sea level, and the difficulty of getting such bulky machinery over the mountains.

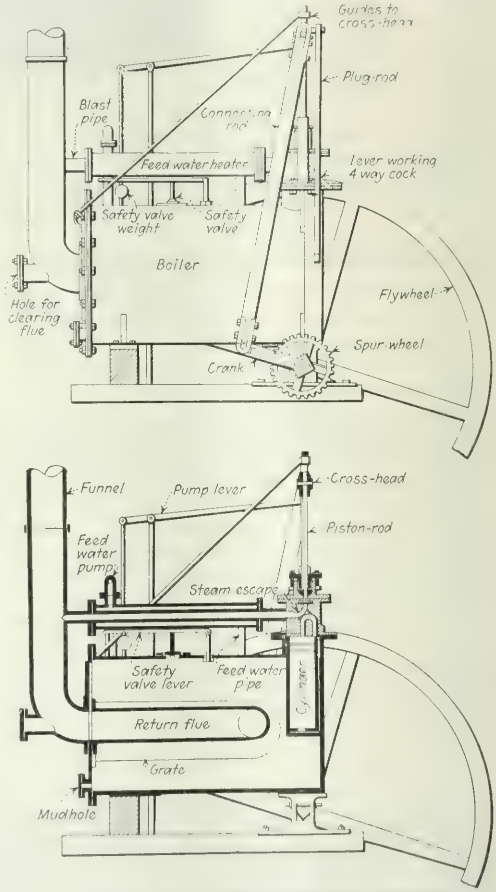
By good luck, however, the Spanish agent, Don Francisco Uville, chanced to see, in a London shop window, a neat, compact model of a high-pressure engine, guaranteed to work without condensing water, clumsy and heavy beam, or an enormous cylinder. Securing the prize at once, he brought it home by the first ship he could find, got it up to Cerro and raised steam. Rather to his surprise, it worked as well there as it did in London. The little engine bore the name of its maker, Richard Trevithick, of Camborne, in Cornwall. Uville and two others obtained a concession from the Viceroy of Peru to drain the mines, if they could, upon very liberal terms. Going back to England again in May, 1813, Uville met Trevithick and learned all he could about steam pumping machinery.

The visit resulted in an order for four pumping engines of 33 hp. each; four winding engines of 8 hp., and a portable engine, also of 8 hp., for general purposes. They cost £6,838, but a rolling mill, a mill for grinding ore, duplicate parts, miner's tools and ladders, with freight and insurance, brought the total cost to £16,152.

Results of Early Pumping

The consignment reached Lima early in 1815, but the difficulties of getting the shipment over the mountains, and having an inadequate number of men—only three—sent out to set it up, were so great that nearly a year and a half elapsed before any of the machinery was put to work at the mines of Cerro de Pasco. Every care was taken that the various parts of the engines should not be heavier than a mule could carry. To this end the boiler plates were taken up separately and riveted on the spot. However, eighteen months does not seem long for the job, all things considered, and the first engine was started at the Santa Rosa mine on July 23, 1816, and this seems to have answered the purpose extremely well.

The Governor of the Province of Tarma wrote to the Viceroy of Lima, describing the operations of the engine with great enthusiasm, although he had probably never seen any sort of steam engine at work before, and was therefore greatly impressed. The winding engine, erected at the same mine and driven by steam from the same boilers, also worked well. Similar results followed with another pair of engines put down at the Yanacancha mine in February, 1817. In fact, it is stated to have cleared the mine in nine minutes!



TYPE OF EARLY STEAM PUMPING ENGINE

Both mines were speedily at work again, and everything seemed to promise well. It was soon found, however, that more competent knowledge and better directing power were necessary if the drainage scheme was to be carried out efficiently on a large scale. One of the three Cornishmen was dead; Don Francisco Uville was but an amateur mining engineer, and found the direction of the business somewhat beyond his powers. Trevithick, therefore, decided to go out himself, and landed at Lima in February, 1817, with eight more engines which embodied some improvements on the first ones. He found two pair of the latter not yet erected, and how much more machinery was ever got up to Pasco seems uncertain. Part of the plan was to sink a central shaft at each group of mines, into which those which required pumping could drain. The following letter from Cerro, under date of Sept. 20, 1816, gives a good idea of the scheme: "By dint of searching after a vein of coal, we have at last found one near at hand, of excellent quality and of great richness. The pit which we now work is at the distance of a quarter of a league from Rancas and at the same distance from Vista Alegre which the Cerro is from these works. We have likewise found a vein of plumbago, which was an object of search on the supposition that it was coal. This substance, of which much is consumed, mixed with grease to soften the friction of the piston, etc., we have now here, and thus the necessity of sending to Lima, or perhaps to Europe, for it, is obviated."

CHARACTERISTICS OF EARLY PUMPING ENGINE

Each of the pumping engines was provided with an open-topped cylinder 24 in. x 72 in., with a crosshead working in guides, and side rods connecting to the pump rods. Two valves turned the steam on and off from under the piston, with the ordinary gear and handles. A balance beam regulated the movements, as there was no great main beam. The 8-hp. winding engine had an open-topped cylinder, 12 in. x 42 in., sunk for most of its length in the boiler, steam being admitted by a cock moved by an eccentric on the flywheel shaft. The gradual closing of the cock reduced the supply of steam at one-third stroke, and quite cut it off soon after, then exhausting through the blastpipe into the funnel. The down stroke was made merely by the weight of the heavy and deep piston. Thirty strokes a minute, at 30 lb. boiler pressure, was the usual working rate. The boiler was of wrought iron, with an internal flue and grate, but could be worked with the grate just under the boiler if necessary, brick flues directing the heat along the bottom, out through the tube, and up a chimney. This alternative system was devised to meet conditions produced by the use of poor coal, or even wood, as fuel. The internal grate was large enough for good coal, but was not suitable for other forms of fuel.

Richard Trevithick was undoubtedly the pioneer in the use of high-pressure steam, but the term is, of course, only relative. About 40 lb. per square inch, against Watts' 3 or 4 lb., and condensing, was his usual mark. More than that made the rough boiler-work of this time leak badly. At first he used small cast-iron boilers made with one end dished and the other open. Over the latter was bolted a wrought-iron plate with a tapering return flue riveted into it. Cast iron being found unreliable, he used wrought iron, to the same design. Specimens of both kinds are at the South Kensington Museum, in London.

USE OF PUMPS MADE WORKING OF MINES POSSIBLE

No drawings are known to exist of the actual engines Trevithick sent to Peru, but their general arrangement can be inferred from what has been recorded of his practice. All the same, he was a highly versatile and ingenious mechanician, always making improvements. Except for the cast-iron boiler, it is believed that the diagrams here shown represent his small winding engines. The mines were of little depth, but had been pumped by manual labor under such difficult conditions that the native population was rapidly diminishing. As the mines slowly deepened, work in them became more and more intolerable, till at last the workers rebelled. In fact, as in Cornwall in Trevithick's youth, it had become impossible any longer to work the mines without something better than muscular power.

Trevithick superintended the Cerro de Pasco mines for two or three years. He was nobly supported by the Viceroy, but found his Spanish colleagues so jealous and impracticable that at last he left them. Soon after this, civil war broke out; the mines were seized by the government troops, and the machinery was dismantled to prevent the insurgents using it. Trevithick then went to Costa Rica, prospecting for minerals, but he met no success, and finally reached home, with empty pockets, in October, 1827. The work he did bore fruit, however, and in a few years steam power was again being used in Peruvian mines.

South America undoubtedly owes much to the genius of Richard Trevithick. He was born in Cornwall just 150 years ago, on April 13, 1771, and died, poor and alone and among strangers, on April 22, 1833.

Tasmania's Mineral Production

A table prepared by the Mines Department of Tasmania showing the quantity and value of mineral products for the State of Tasmania during the year ended Dec. 31, 1920, follows:

Mineral	Quantity	Value, Pounds
Gold, ounces ...	6,246 192	29,796
Silver, ounces	623,359	166,767
Lead, tons	3,855 639	142,268
Copper, tons	4,791 750	528,237
Tin, tons	1,310 411	3,693,362
Coal, tons	75,429	64,005
Wolfram, tons.....	70 89	13,626
Bismuth, tons	0 10	9
Shale, tons........	140	172
Iron pyrites, tons	4,440	7,346
Scheelite, tons	105 09	179,905
Osmiridium, ounces	2,009 196	77,114
Asbestos, tons		
Zinc, tons	9 30	334
Barytes, tons	1,048	4,163
Total.		£1,421,104

The Electrolytic Zinc Co. recovered 5,809 tons of zinc, valued at £251,130, and employed an average of 970 men.

Calcareous Marl Production Increased in 1920

Reports made to the U. S. Geological Survey show that 97,487 short tons of calcareous marl, valued at $322,329, was produced in the United States in 1920, an increase of 6,050 short tons over the quantity produced in 1919, but a decrease of $4,955 in the total value of the product. The average price per short ton was $3.31 in 1920 and $3.58 in 1919.

Most of the marl sold in 1920 was used in agriculture, in the same manner as pulverized limestone and agricultural lime, but some was used as a filler in patent fertilizer. In Arkansas, where the product included chalk, a small quantity was sold as whiting, which brought a much higher price than the agricultural material.

Nearly one half of the total output ([illegible] short tons) was produced in Virginia and was valued at $[illegible]. The other producing states were Arkansas, California, New York, North Carolina, Ohio, South Carolina, and West Virginia.

What Is the Ideal Drill Steel?

Conclusions and Results of Numerous Experiments and Tests Which Included All Types of Bits, Grades of Steel, and Various Grades of Rocks—Theoretical Ideal Drill Steel and Suggestions for Future Experimenting Are Offered

BY FRANK H. KINGDON*

THE SUBJECT of drill steel may be made a broad one. In writing on it one could include its history and development, its manufacture, its shapes and sizes with uses, its different types of bits and shanks and their advantages and disadvantages, its forging and hardening or heat treatment, and perhaps other relative matters with respect to drill steel. I have not taken any particular one of these, and so may touch slightly on each one.

In giving data and conclusions from experiments conducted by the Sullivan Machinery Co. it is necessary to mention statements which have heretofore been published indirectly through this company, so I claim nothing new or original in what follows, and offer the suggestions in the hope that they may prove of value in future experiments.

NECESSARY CONSIDERATIONS IN STEEL PREPARATION

The essential qualities of a drill steel are: First, it must be easily forged; second, the forged bit end must be such that it can be easily heat treated to obtain hardness to resist chipping; third, the bar or body must be stiff to resist bending or twisting and yet tough to resist shock and vibration, with resulting breakage, and fourth, the forged shank end must be such that it can be easily heat treated to obtain some hardness with great toughness.

Drill steel must be properly forged either by hand or machine, and this operation requires pyrometric control. I believe two causes of grief can be eliminated at this point, as there is no doubt that drill steels as a rule are forged at too high temperatures, and the forging operation is continued after the temperature has dropped below the critical. Furthermore, little if any annealing is done on drill steel after forging; hence the forging operation must be conducted with great care.

Assuming the forging temperature is correct, the other minor requirements are that the bit and the shank be in alignment with the body; that the shank shall be of the proper shape and length and the shank collar or lugs be of the proper diameter and length; that the hole, if any, be free from obstruction; that the striking end of the shank be flat and square; that the bit be of the proper shape, with the cutting and reaming edges formed full and to the required size; that the reaming edges are concentric with the axis of the steel, and that there are no sharp corners at the shoulder where the bit blends into the body.

ADVANTAGES OF MACHINE SHARPENING

It is obvious that the above requirements can best be obtained day in and day out by means of a drill steel sharpening machine. The efficiency of such a machine will accordingly depend, first, on the initial forging temperature required, for the lower the initial forging temperature the better the steel structure; second, on the accuracy of the forged bit and shank; third, on the speed of operation; fourth, on restriction of the hole in the shank and bit when using hollow drill steel; fifth, on the number of heats or times required to heat the steel before securing the finished bit or shank, and sixth, on the air consumption or power required. The means of heating for forging will be considered later.

The drill steel must have an ideal bit and shank. The essential qualities of such a bit, regardless of the conditions under which it is operated, are that its shape be such that maximum cutting speed can be maintained for as great a distance as possible before wear of the gage and cutting edge reduces the speed of penetration to a point where a change of steel is made necessary, and that the size or diameter of the drill hole corresponding to the gage of the bit can be maintained with the least possible reduction as the depth of the hole increases, and also that the shape of the bit is such that it can be correctly and readily formed and heat treated.

DIFFICULTIES IN STANDARDIZATION OF BITS

It is doubtful whether a standard bit can or will be developed that will suit all conditions, such as the force and frequency of the blow transmitted to the bit, the speed and strength of the rotation imparted to the drill steel, the character of the rock as regards hardness, abrasion and other factors, and the method for ejection of sludge or rock cuttings. Accordingly, the following features of bit design require attention: Shape, total length, and angle of cutting edge; length and area of the reaming edges or surfaces; size and shape of clearance grooves for ejection of cuttings, and length and angle of the wings and the manner in which they are blended into the body of the steel.

The combined length of the cutting edge and the manner in which it is applied is a big factor in the drilling operation regarding the speed and the life of the drill steel and the drill. The longer the cutting edge the greater the amount of rock cuttings per blow, assuming that the cutting edge is and remains sharp or sharp enough for the conditions. Furthermore, the drilled or blunt edge, besides decreasing the penetration per blow, lessens the cushioning effect, and this causes the drill steel to rebound from the rock, which may cause breakage of the drill steel or parts of the drill. In a radial cutting-edge bit the work done is greatest at the extreme cutting and reaming edges, which accounts for the unequal wear along the cutting edge. Therefore it is apparent that the only way to improve this condition is so to shape the cutting edge that the work is evenly distributed throughout its length, and so that the extremities of the cutting edge have suitable reaming surfaces properly tapered back to improve the wearing qualities of the gage.

A good deal has been written about the angle and shape of the cutting edge, and many kinds of bits have been brought out, such as the bull bit, rose bit, double cross bit, chisel and double chisel bit, and other types; but so far as I know the only bit that approaches the ideal bit is the double-arc, double-taper bit. The accompanying illustration shows the characteristics of this bit and the features relative to this discussion, and needs no further explanation. As to the ideal shank, there is no doubt that the so-called shankless steel approaches the ideal, and it is regrettable that this type is not suitable for all conditions. Its advantages and disadvantages are evident.

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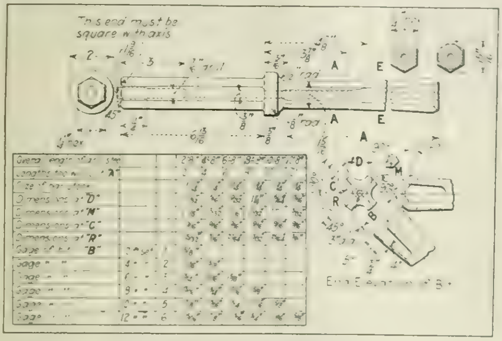
*Paper presented at a session on "The Heat Treatment of Drill Steel" on Feb. 16, 1921, at the 122d meeting of the A. I. M. E.

The third and last requirement of the drill steel which has ideal qualities is that it must be properly heat treated. This without doubt is the most essential operation in securing best results, and yet it is safe to say it receives the least attention. The good results which are expected from all previous operations can be obtained only through proper heat treatment. Theoretically, this operation of heat treating should be simple; practically it is not, for all too much depends on the equipment.



DOUBLE-ARC, DOUBLE-TAPER BIT

I desire to call attention to a few essentials. First of all, the pyrometric equipment, which is in a way the most important piece of apparatus for obtaining best results. It should be sturdy and accurate, and the cold junction should be automatically taken care of or compensated for. This function I believe is best accomplished by using lead wire of the same composition as the thermo-couple, thus bringing the cold junction to the indicator or galvanometer, where it can be compensated for by means of a coil. Of the different systems of reading the temperature I believe the potentiometer system is the most reliable for the drill steel hardening shop.

Of equal importance is the furnace, which should be so constructed that it can be used in heating for forging and tempering, that it can be adapted to heat any size or shape of drill steel, that the burner be placed so the flame does not hit directly on to the metal, that for continuous work the heating chamber have its maximum heat zone at the end from which the drill steel is withdrawn, and that the pyrometer or thermo-couple be installed in this end.

Without giving further description of the equipment, I will assume it is such that the following treatments can be accurately controlled and performed. In forging do not heat higher than 1,700 deg. F. (with steels containing about 0.45 to 0.55 carbon, somewhat higher temperatures may be used), and use that lower initial temperature which will leave the temperature of the steel just above its critical as the forging operation is finished; anneal after forging to secure uniform results by heating just through the critical; heat from 50 deg. to 75 deg. F. above the critical, and quench for hardening (with high-carbon, hyper-eutectoid steels it may be advisable to use somewhat higher temperatures to get the excess cementite into solution); draw the temper when necessary, depending on rock conditions.

In heating maintain a neutral or reducing atmosphere to prevent scaling and decarbonizing. Do not heat too rapidly or too slowly, but evenly and uniformly, as too rapid heating may develop checks or cracks, and too slow heating may cause soaking, which tends to large grain growth. For hardening, heat just above the critical temperature, as a properly forged steel quenched from this heat has in combination qualities of some toughness, with maximum hardness and maximum density. The quenching bath should be kept at a uniform and approximately constant temperature. In drawing or tempering, longer time periods at lower temperatures are better than the shorter time periods at higher temperatures.

To improve further the ideal drill steel it seems necessary to consider the steel itself. Is everything being done by the steel manufacturer that possibly can be done? I think not. But it would be useless for the manufacturer to bring out better steel and alloy steels when mine conditions are such that the present steel is not heat treated properly to obtain its maximum efficiency.

It is interesting to note that answers to a recent questionnaire brought out the following facts and are representative of all fields and conditions of mining.

To the question, what type of bit was giving the best service, returns showed that the double-arc, double-taper bit and cross bit were far in the lead.

To the question as to what necessitates the resharpening of the drill steels most frequently, wear of gage was unanimously first choice; chipping of bit was unanimously, with one exception, second choice; breakage of shank was unanimously, with one exception, third choice; upsetting of bit, upsetting of shank and breakage of body were about on a par for fourth choice.

To the question as to what was the direct cause of the necessity of resharpening, poor heat treatment was unanimously first choice, and faulty steel and severe rock conditions were about on a par for second choice.

The information set forth brings out two distinct facts which can be considered with equal advantage by the steel manufacturer as well as by those interested in this subject. There is no doubt that "wear of gage" depends on heat treatment, but, assuming proper heat treatment, could not a steel be developed which would improve this fault? For instance, chromium imparts to steel a quality of tough hardness with great resistance to wear and abrasion. Would such a steel improve our ideal drill steel?

With this in mind future experiments can be conducted so as to bring out the difference between high- and low-carbon steels, straight-carbon and alloy steels, high- and low-forging temperatures, annealing and non-annealing after forging, and, as regards the body of the drill steel, the difference between steel as rolled and steel heat treated to obtain a refined sorbitic structure. Particular attention should be given to the temperatures, for little if any data in this particular have been given on such experiments as have been conducted.

BY THE WAY

Agin the Safety Movement

At least one miner, or perhaps he is a prospector, that we know of is not in sympathy with the "Safety First" movement. To him the safety engineer is anathema. He writes, "As for safety to mining acidents, all I got to say acidents dont allways happen the same way and no set rule can be applied for avoidence. What mining needs is to kill off all the mining engineers as sure thing flunkeys so that them that are willing to venture are not hung up on tetchnickle mining lore out of a book as a safe guide to mining venture, and as mining allways was a gamble and allways will be no insurance can be had Last, if Congress has money to throw at the birds it might pension all prospectors and make it worth while to try and find mines and until same assistance is rendered to the prospector other then mining engineers' long winded reports, mining will stay Bumm."

External Combustion

"M'son," said Cap'n Dick, "This 'ere pro'ibition surely be a turrible thing, an' one o' the worst h'affects is tha recollections that a chap do 'ave that 'elps to make tha memory green, as thee might say. Not that I lays a 'eap o' stock 'longside o' this 'ere 'ome-brew, but I h'unnerstan' there's a parcel o' it bein' made an' many chaps 'ave been h'injured in tha process. Remin's me o' h'ol Jim Berryman, 'oo used to work to tha Ridge mine forty year h'ago. Strange thing to say baout a Cornish boy, but Jim wuz a teetotlar. Never touched a drop o' liquor in 'is life. One time h'ol Jim wuzn't feelin' very fitty, an' 'e gaws to see tha doctor. Doctor said 'e wuz a bit run daown an' tol' un to drink a little beer h'each day to brace un h'up. So Jim sent 'is boy to tha tavern at Maple Grove, baout 'alf mile away, to get some o' they stuff. 'Appened to be one o' they cold Lake Superior days, an' tha beer froze solid afor' tha boy got un 'ome. Jim put they bottles be'ind tha kitchen stove an' went h'up-steers. Coorse w'en tha beer started to thaw, tha bottles busted, an' with a noise like a bloody blas' tha beer blaws all h'over tha kitchen, h'even h'up to tha ceilin', m'son. Jim comes tearin' daown tha steers, an' seein' tha mess all h'over tha place, 'e sez, 'Dam-me, if 'e wuz goin' to blaw any'ow, its far better to 'ave un blaw there than h'in my h'insides.' "

The Althouse Creek Discovery

The story of the discovery of gold in the early 50's on Althouse Creek, in Josephine County, Ore., is interesting. John Althouse, the discoverer, was working on prospects in Canyon Creek in the same valley, and without much success had sought information from the Indians encamped at the foot of Eight Dollar Mountain as to other possible sources of gold in the district. These Indians were not friendly to the whites, who were then usurping their country, but had favored Althouse. At all events the Indians possessed many large nuggets of gold, but would not divulge their source. One stormy night the old Indian chief called on Althouse, at the miner's tent, and told him he would take him to the source of the big nuggets. The trail led over flats, creeks, and by a tortuous path, until, after ascending a creek leading into the heart of the Siskiyou Mountains, they stopped at an elk pit. This pit was a deep hole in the gravel bed of the stream now known as Althouse Creek. The pit was covered and camouflaged with brush, designed to entrap the elk as they crossed the creek bed. The interesting feature to John Althouse was not the pit, but the pile of gravel thrown to one side. The high waters and winter rains had washed this out in a natural hydraulic operation, leaving exposed the nuggets, one of which the Indian chief casually picked up and handed to the eager prospector. It resulted in the maelstrom of gold-frenzied miners shifting from the west bank of the Illinois River to the tributaries on the east side. The Althouse strike was made, and millions in gold was recovered from the stream and from Sucker Creek, an adjoining stream, in the course of the several years following.

The Voice of Nature

"To him who in the love of nature holds communion with her visible forms, she speaks a various language," wrote Bryant. Snatches of the conversation may be heard at times by the attentive listener. The following from the *M. C. M. Lode* proves it:

> Here's one for Seaman! Ask him if he knows that minerals talk to each other and call to their mates exactly as moose and many other animals. For instance the call of a topaz to its mate is "O-PAL, O-PAL."
>
> This may interest him. W. L. C.
>
> As a reminiscence of the field trip in geology tell W. L. C. that I am quite familiar with the language of rocks and minerals. Only a few moments ago I was in the laboratory and overheard Mag. Netite call to Sid. Erite and ask if he was Cumming to nite. Sid. replied "O nyx! I have just received two Quartz and I am going to Tac a nite and Goethite." Her only answer was "O cher!" A. E. S.

Anent Timeliness

"Joseph A. Kelly, of Bernard, Iowa, has been a late visitor at Mayer, looking toward reopening of the local onyx beds," writes a correspondent. Some one should sic Punctual Pete after Kelly and stop this sort of thing.

The Scientific Spirit

(With Apologies to Nobody)

BY FREEMAN FOSTER BURR

You musn't rely on what Smith has said,
  Or what Jones or Brown may say:
If you listen to them you'll be misled,
  For it's just the other way.
But follow me, if you would be free
  To help the truth along;
For I am right, and I know I'm right,
  And the rest of the world is wrong.

Now, Smith is a fool and a dolt at best,
  And Jones is no better than he:
And Brown and Robinson and the rest
  Are stupid as they can be.
So follow me, if you would be free
  On the wagon of truth to ride;
For I am right, and I know I'm right,
  And the rest of the world may slide.

Oh! I am the only man who deals
  In facts and in facts alone;
And the only one who never steals
  The thunder that's not his own.
So follow me, if you would be free
  From the faults of the vulgar gang;
For I am right, and I know I'm right,
  And the rest of the world may hang

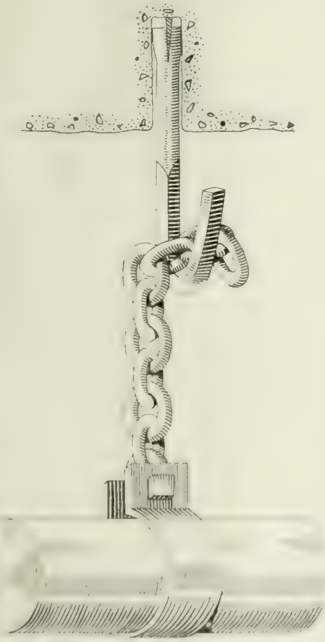
HANDY KNOWLEDGE

Method of Pipe Suspension

By R. P. Immel

Written for *Engineering and Mining Journal*

Following certain underground development, it was necessary to install two runs of 4-in. pipe in a drift 2,500 ft. long. Our practice in the past had been to hang these pipes from the roof to one side, and to make a neat job the pipes were suspended with turnbuckles so that they could be raised or lowered (owing to the irregularity of the roof) so as to keep them in alignment. This method occasioned many delays, because the holes in the roof were either drilled too deep or not deep enough and because the irregularities of the roof were either greater or less than had been allowed for, with the result that the turnbuckle rods sometimes had to be taken back to the shop, either to be cut off or lengthened.



PIPE MAY BE HUNG FROM A DRIFT ROOF IN MANNER SHOWN

The accompanying sketch shows the method adopted to avoid this difficulty. It proved successful, and the lines were put in place with minimum delay. The hook bolt was split at the end and a wedge inserted, as is commonly practiced in fastening bolts or hooks in mining. The bottom of the hook was squared and then turned so as to make a regular chain hook that would hold the link of the chain when it was placed crosswise.

The chain was the regular standard log chain. The clamp was made from various short pieces found in the scrap pile and varied from ½ x 2 in. to ¾ x 4 in., and although it is shown in one piece in the sketch, it was in a few places changed to a two-piece pipe clamp.

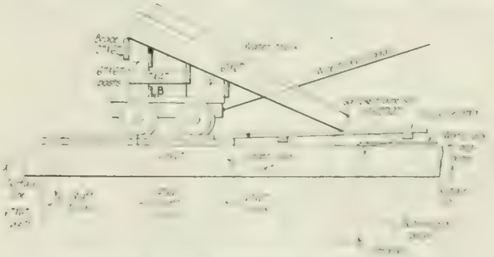
On the actual work of installation, all holes in the roof were drilled first and the hook was driven in and fastened. Then several lengths of pipe were secured together and hung in place temporarily until a piece of chain could be cut off of such length that the pipe would hang level. A coil of chain was carried along with the job, and all that was necessary when the pipe was made up was to measure off a short piece, slip the bolt in the clamp through the link of the chain and hook the other end of the chain in the hook bolt.

Dumping Ore and Water

By Charles E. Dutton

Written for *Engineering and Mining Journal*

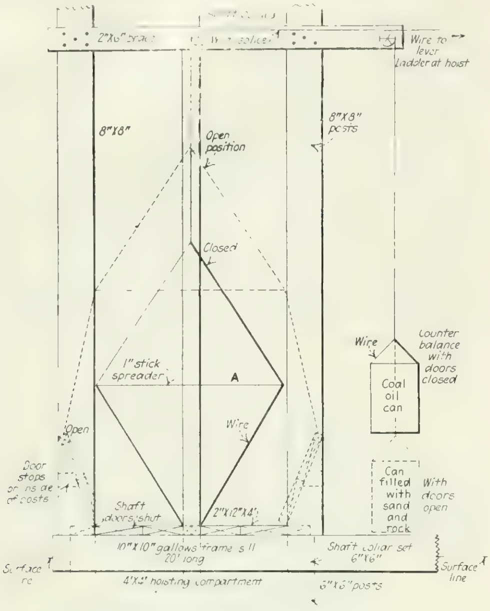
Certain methods or devices are described here which may possibly be found useful at shafts where ore and water are hoisted in buckets. At the shaft under consideration water was struck on the 300 level, draining into the sump, whence it was disposed of as follows: First a hole was dug about 4 ft. from the collar toward the hoist, and an extra ore bucket placed in it, so that the top of the bucket was flush with the bottom of the track rails. The gas engine at this shaft included a small water pump for returning the circulating water to a tank overhead. The water line between this tank and engine was cut in on so that the pump would take water from the bucket between the rails or from the tank, as desired, by the turning of either of two valves within reach of the hoistman.



TRUCK USED FOR DUMPING WATER FROM SHAFT BUCKET

Then an extra truck was taken which had formerly been used in tramming buckets underground, and six 6 x 6-in. uprights were nailed on it. The front two were 6 in. high, those in the middle 12 in., and the two in the rear 18 in. Each set was braced crosswise with 2 x 6-in. planks. The middle and rear posts were also braced with strips on the sides. A quarter circle was then cut in the top edge of the uprights, as seen in the sketch, with the sloping center line as center.

In the sloping depression thus formed a funnel 3 ft. in diameter and 6 ft. long was fitted and nailed to the truck, so that the high back end was flush with the back of the rear posts and the lower front, or discharge, end was set so that it just cleared the crossties and the top of the bucket set in the ground between the rails, as the truck moved over the track. This funnel was made out of six Standard Oil cans, one can furnishing a 13 x 36-in. sheet.



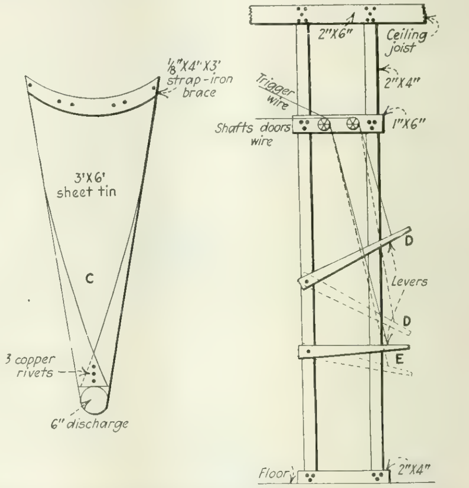
METHOD OF OPENING SHAFT DOORS FROM HOIST

The track was blocked up and graded so that the truck would run on to the shaft doors, when closed, under its own momentum, and stay there, further progress being prevented by a 2 x 4-in. timber 4 ft. long, which extended about 10 in. from the sides of the truck, and was nailed to the rear posts of the truck. These rested against the shaft guides and prevented the truck from moving at any time during the water-dumping operation. In this position the discharge end of the water truck funnel was directly over the rim of the bucket under the track. A wire was then attached to the truck and run to a lever on the "lever ladder" in the engine room, which on being thrown pulled the truck off the shaft doors some distance and locked it in place.

The "lever ladder" consisted of two 2 x 4-in. posts, conveniently situated near the hoistman while at his post, and braced at the base and nailed to the overhead joists. A 2 x 6-in. crosspiece to carry the pulleys was nailed or bolted to the posts at a height of 8 or 10 ft. The levers were made from 2 x 4-in. stuff, bolted at one end, with a hole for the wire near the handle end. Lever *D* opened the shaft doors with a 2½-ft. throw. Lever *E* released the trigger in the guide to hold up the crosshead, and had a 5-in. throw. The water truck lever, having a 4-ft. throw, and the ore chute door lever, having a 2-ft. throw, were both operated from the opposite side of the ladder, on the same principle, and are not shown in the sketch. The shaft doors and the ore chute door were counterbalanced with a weight to lessen the power required at the levers.

After a try-out it was decided that the crosshead must be hung up, so a trigger was rigged up to engage it when up near the sheave wheel. This trigger was operated by means of a wire connected to a lever in the engine room, and consisted of a long $\frac{3}{8}$-in. bolt passing through a hole bored in the guide at the desired place. The bolt carried a spiral spring and washers, properly spaced with nuts, on the outside of the guide. The bolt was set so that the washers and spring held it in place, and was only pushed 3 in. through the guide when pressure was applied to the bolt head by a cam, controlled by the lever wire.

A device for opening and closing the shaft doors from the hoist is also shown in one of the illustrations. Baling wire or (mine) bell wire, two rope or wire pulleys, and a few bolts were used in making it. The stick *A* is simply a notched spreader wired in place. When ore was hoisted it was dumped through a chute into a waiting car by the hoistman, the bucket being kept in the proper position by a chain and bar connected to a ring on its bottom, the bar engaging in a *V* notch in the chute during the operation. The chute had a swinging door 2 ft. long, which was moved in or out of position for dumping by a lever in the engine room.



LEFT—FUNNEL USED FOR DUMPING WATER. RIGHT—"LEVER LADDER"

The various devices worked satisfactorily. The procedure was as follows: When the signal to hoist was given, the bucket was raised. If containing muck it was stopped with the dangling bar ready to be engaged into the chute notch, while the chute and shaft doors were closed by levers. After being dumped, the doors were swung open and the bucket dropped to the station. While the bucket was being refilled the hoistman dumped the car and was ready for the next signal. If the bucket was signaled below the station, it was filled with water by submerging it in the sump. On coming up the crosshead was caught, the doors were closed, and the water truck was run on, all by throwing different levers. The bucket then descended and settled on the rear posts of the water truck, gradually tipping over and discharging the entire contents without spilling.

THE PETROLEUM INDUSTRY

Controlling a Gas Well at Alkali Butte, Wyo.*

By F. B. Tough

An unusual job in controlling a gas well was executed on No. 1 well, Inland Oil & Refining Co., situated on the Alkali Butte structure, Fremont County, Wyo. The work was done by the company in co-operation with the U. S. Bureau of Mines, and resulted in a fuel saving of \$6,000 in one season and of a repair job estimated at \$15,000, or a total of \$21,000.

The well had an open flow of 6,000,000 cu.ft. of gas per day, with a rock pressure of 560 lb. per square inch. A string of 6¼-in. casing with a toothed shoe was set on the cap rock above the gas sand at 2,481 ft. When the well was shut in, the gas worked out around both the 6¼-in. and 8¼-in. strings, breaking through the ground surface at several points under the derrick.

Casing troubles encountred while drilling made it unsafe to attempt moving the 6¼-in. string. Moreover, it was important from the standpoint of good management to make the gas from this well immediately available for fuel in other operations, and, in addition, to save the gas from wasting. An ordinary mudding and cementing job would have necessitated shutting down this well for probably two months out of a short operating season. For these reasons it was determined to mud the well, if possible, between the 6- and 8-in. strings by pumping mud fluid through the connection from the gas clamps. The gas clamps used were of ordinary construction with a side outlet, making them equivalent to a Braden head. When the mud fluid was pumped through the gas clamp into the space between the two strings, it began to appear inside the 6¼-in. string. It apparently entered the well either around the toothed shoe or through a "line sawed" leak in the string and was blown out of the well as fast as it was pumped in.

To stop the leaks, about half a gunny sack of finely chopped bull rope was fed with the mud between the casings as before. The hemp gathered around the valves of the mud pump to some extent, and it also stuck in the casinghead fittings a few times. An obstruction in the casinghead would be removed by permitting the well to "blow back" for a few seconds, and one in the pump valves, by removing the valves when necessary. In two days' time sufficient hemp and mud had been pumped into these strings to kill external and internal pressure. The well was shut in and allowed to stand over night. The next day, by opening and closing the master gate at intervals, and allowing the well to build up what pressure it would, it was found possible to blow the mud from the inside of the 6¼-in. casing.

The chopped rope had presumably gathered around the shoe and also filled any "line sawed" places in the 6¼-in. casing, and was holding place the mud fluid between the casings. The gas was thus made available for fuel, and the waste of gas by dissipation into the overlying formations and into the atmosphere was also prevented. It is interesting to note that after several weeks, during which period the mud had been afforded time to settle, a small amount of gas was observed leaking at the surface. About the same time it became possible to relieve the pressure by turning the well into the pipe line which had been laid to supply the camp and three drilling wells. A pop valve placed in this line was regulated by experiment to pop off at a pressure slightly less than that pressure at which gas would begin to leak at the surface around the well. Because of the demand for gas, the pop valve was seldom called upon to relieve the pressure. The wastage of gas became so small that, considering the need for fuel, it was deemed an act of true conservation to leave the well in that condition.

Although this method is not recommended for use in a proven field, it was satisfactory in the operation described, where the economic conditions seemed to justify its use.

Peru's Petroleum Law Protested

A new petroleum law was passed on March 3 by the Peruvian Senate. As Congress adjourned on that date, the bill did not have an opportunity of being presented to the Chamber of Deputies, but there is every possibility of the bill becoming a law when Congress next convenes, on July 28. Claiming that the "exploration and the search for petroleum should not be taxed, but be encouraged by every possible means, for once petroleum is actually discovered in commercial quantity the government may demand a fair participation in the industry," Victor H. Solaini protests the bill as follows:

"The law does not read like prohibition to the casual reader, but in effect it makes both the search for and the development of petroleum in the Peruvian orient an absolute impossibility so long as it remains in existence.

"Peruvian lawmakers do not seem to realize that the Peruvian orient, commonly called the 'Montaña,' is one of the most inaccessible, least-populated, least-known, and least-developed territories in the entire world. No account is taken of the fact that outside its main waterways the territory is absolutely unexplored, that it is still occupied by savage tribes and that not even the most primitive geological survey has been made.

"The law grants two classes of concessions; viz., concessions of exploration and concessions of exploitation.

"If petroleum is ever to be developed in the Peruvian orient it is absolutely necessary that besides granting these two classes of concessions under greatly modified terms, a third class of concession must be granted, which may be called a 'preliminary concession of exploration.' Both the 'preliminary' exploration concession and the exploration concession proper that would follow, should be granted to bona fide applicants absolutely free of any taxation whatsoever.

"It must be remembered that nothing is known whatsoever of the geological formation of the Peruvian orient. On all general geological maps of the world the Peruvian orient is marked blank and 'not known.' It is therefore absolutely necessary, before any capital can be invested, [illegible] a well equipped and expensive [illegible] in order to ascertain if rocks can be located [illegible] to a geological period in which petroliferous possibilities exist

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*From U. S. Bureau of Mines Reports of Investigation, March, 1921.

"Anyone desiring to search for a geological formation that might indicate petroliferous possibilities in the Peruvian orient would have to apply for a concession of exploration before sending any expedition into the territory, for naturally no one would go to the great cost of even preliminary exploration without first being sure of possessing rights over the territory explored.

"This concession, therefore, would necessarily have to comprise an area sufficiently large to warrant the great cost of equipping, dispatching, and maintaining the expedition for a period of months or years. A reasonable size for this 'preliminary concession of exploration' would be an area of about 150 kilometers square.

"According to the law passed by the Senate, any enterprising gentleman desiring merely to search for petroliferous rocks under these conditions would first of all have to pay the Peruvian government a sum considerably in excess of 3,000,000 soles; and this is not all, for if he desired an extension of the privilege to remain in the area for any length of time, he would have to pay an additional sum of over one half million soles per annum."

The Holbrook Oil Field in Arizona

SPECIAL CORRESPONDENCE

Seven corporations are reported active within the Holbrook oil field, in Arizona, including the Adamana, Apache, Black Canyon, Holbrook, Hopi, Zuni, and Bankers. The field itself is of vast extent, covering the famous Painted Desert to the north of the Santa Fe main railroad line and extending down to Springerville, ninety miles southeast of Holbrook. At this latter point the Bankers' company, a close corporation, has started drilling. The entire field lies within two carboniferous districts—the Durango coal field to the northeast, with coal measures on the Navajo reservation, near Moen Copie, to the northwest, and to the southward, west of Fort Apache, still more coal, and on the east the Gallup coal fields.

Drilling by the Holbrook company is on a sandstone plain, where the logs for several thousand feet of depth show, in alternation, various forms of sandstone, limestone, soapstone, shale, and sand. In the Zuni well, twenty-two miles northeast of Holbrook, salt water was struck between 932 ft. and 945 ft. In the Adamana well, twenty-five miles south of Holbrook, salt water was encountered at 2,060 ft., together with a strong flow of gas. The Hopi, twelve miles southwest of Holbrook, is 2,400 ft. deep and is believed to be in practically the same bottom formation as the Zuni, though the latter is only down 1,000 ft. and there is belief that both are not far from what in the San Juan field, to the northeast, is called the "baby" sand.

Within the Holbrook townsite oil indications have been found in a shallow well driven by Harry Scorse. The field is considered a deep one, and the work has been retarded by extreme hardness of rock and by generally insufficient funds.

At Yuma a well has been started near the city, with a public demonstration in which hundreds of citizens joined. At Prescott and Jerome there has been revival of interest in the abandoned Chino Valley field.

William S. Hart, movie star, and Ralph Ince, film producer, have leased 5,760 acres in the Holbrook field from the Aztec Land & Cattle Co., with a guarantee of $5,000 for the starting of a standard drilling rig within ninety days. The tract is in the same district as the Hopi well. Ince and Hart have been associated in California oil exploration work. Other leases in the Hopi region are said to have been taken by Los Angeles interests.

Report on Peace River Block Favorable

SPECIAL CORRESPONDENCE

The Hon. Mr. Pattullo, Minister of Lands, recently submitted to the provincial Legislature the geological survey report of John A. Dresser, consulting engineer, and Prof. Edmund M. Spieker, of the Johns Hopkins University, on the Peace River Block, in British Columbia, which work was done during the summer of 1920.

Closer investigation was made of the areas described by the late Prof. Gwillim as being structurally favorable, owing to the rolls and folds of bullhead sandstone, the geological equivalent of the oil- or tar-bearing strata of the Lower Peace River, Athabasca River, and of the Black Diamond area in southern Alberta.

The report confirms that of the previous year as to the oil-bearing character of the St. John shales and the possibility of oil accumulations of commercial value in the porous sandstone beds or in the upper parts of the bullhead sandstones immediately beneath them, and suggests the most suitable points at which drilling may be started.

Promising locations were determined near the Gates of the Peace, on the Red River, on Lynx Creek, near the Southwest Halfway Creek, near the trail to Hudson Hope, and the anticlines of Miller Creek, Pine River, Table Mountain, Rocky Mountain Lake, Moose Lake, Flat Creek, Canyon and Bullmoose creeks and the Boulder Creek dome show possibilities.

The Boulder Creek formation is most promising, its dome-like shape making it almost perfect as a reservoir structure, and it is also underlain within 1,300 ft. of the surface by the lower sandstones of the Bullhead Mountain formation and the upper shales and limestones of the Pine River formation, a series at least 300 ft. in thickness, and probably more, which may contain petroleum; the extremely hard Boulder Creek member of the Bullhead Mountain formation has been cut away by erosion at the apex of the dome, and the amount of hard rock to be penetrated in order to reach the lower section is less than it would be elsewhere.

Though no unquestionable seepages of petroleum were observed, a seepage of gas was found on the west flank of the Boulder Creek dome, northwest of the drilling location selected. The gas bubbles up intermittently through water in a hole at the base of a tree, the roots of the tree undoubtedly affording a channel through which the gas escapes from the underlying sandstone to the surface. The gas is highly inflammable and contains a considerable percentage of hydrogen sulphide and it gives forth a strong odor of sulphur dioxide when burned.

Referring to the absence of oil seepages, the report states that vast oil fields, today yielding millions, exist without a single surface indication, so that their absence may not be taken as an unfavorable factor, provided the other features are favorable.

Summarized, the favorable factors are as follows: The presence of a number of formations in which oil could occur; the presence of anticlines which dispose the possibly oil-bearing strata favorably to the retention of petroleum, and the comparatively reasonable depth within which the beds to be tested may be reached.

The Minister of Lands considers the report an invaluable guide to exploratory drilling operations, and it also furnishes a large amount of detailed geological information which should prove of great scientific and practical service.

COURT DECISIONS IN MINING CASES

By Wellington Gustin

N. Y. Court of Appeals Sustains David Fox

Reverses Judgment in His Action Against the Arctic Placer Mining & Milling Co.

A decision favorable to David Fox in his action against the Arctic Placer Mining & Milling Co. is reported by the New York Court of Appeals. Fox had appealed from a judgment dismissing his complaint, and now obtains reversal of that judgment with a new trial granted. In his action Fox seeks to recover the reasonable value of his services rendered the mining company between November, 1913, and April, 1915. During this time he was a director and vice-president of the company, and owned 1,000 shares of its capital stock, of the par value of $5,000, for which he paid $50.

The company appears to have been organized in 1907 after a consultation between a Mr. Cutler, a Mr. Fallows, and Fox, a mining engineer with considerable experience in Alaska. These were the active directors, and they located gold mines in Alaska. In 1908 Fox went to Alaska and took charge of the company's work there, being paid $500 a month and expenses. Each summer until 1912 he went to Alaska to supervise the operations of the company. For some of these trips he was expressly employed and his compensation fixed; for others there appears no express contract, but he was paid for his services. In 1912 he remained in New York, where he did some consultant work for the company, without express contract, but received pay. In 1913 he was again sent to Alaska relative to negotiating an option for drilling and dredging lease of the company's property.

Thereafter in 1913 and 1914 Fox advised and consulted with various officers of the company, rendering some service of a technical engineering nature with reference to the lease proposition, the preparation of maps and plans, for the purpose of effecting a sale of the property to another mining corporation. The majority opinion says these services were different and other than those usually performed by an official of a corporation. They form the basis of this suit.

Officers and directors serve without compensation for performing usual duties, unless express provision is made therefor, either by statute, charter, or agreement, said the court. And if there is no contract for personal services expressed, it may be implied from the mere rendition and acceptance of the service, upon which the presumption is created that such services were to be paid for because no one is expected to labor without hire.

An agreement to pay may be inferred from a course of practice, or where the services are outside the usual duties of an officer of the corporation. Fox alleged special services were rendered as consulting engineer. Such agreement may be evidenced by proof or circumstances which tend to show that the services were rendered with the expectation on both sides that they would be compensated for.

The services performed included the drawing of maps, plans, making photographs of the ditch system of the Alaska property, the preparation of a long and technical letter, describing the nature of the company's property and the manner in which it could be worked to best advantage, and other professional or technical work. Such engineering and technical services are not usually performed by a director as such, said the court.

The trial court and the Appellate Division had held that the services rendered were within the line of Fox's duties as vice-president and director, and, there being no prior express contract therefor, dismissed his suit.

Creditor May Not Complain of Agreement Assented To

The Supreme Court of Arizona has dismissed the action brought by Thomas Allaire against the Laurel Canyon Mining Co., with the First National Bank of Globe, Ariz., as garnishee.

It appears that the Laurel Canyon Mining Co. was a judgment debtor of Allaire and it had empowered the bank in writing to receive from Ruff and Carlson, lessees of its mines, all payment of rent accruing on said mines to the amount of $25,000, and distribute such money pro rata to all the creditors of the mining company.

The creditor alleged that this agreement was in violation of law and void, for the reason it was made to hinder, delay, and defraud the creditors of the mining company. But it was shown that the complaining creditor was notified of the mining company's agreement with the bank and acquiesced therein to the extent of receiving a portion of the payments before beginning this suit.

Hence the court said that neither the plaintiff nor other creditor who accepted a dividend, or other benefits, knowing the same was offered and paid pursuant to the agreement, can be heard to complain that he has been hindered, delayed, or defrauded by that particular agreement, for the reason that such creditor has impliedly become a party to and is benefited by it.

Corporation Books Must Show Ownership of Stock

California Supreme Court Reverses Judgments in New Pedrara Onyx Co. Controversy

The Supreme Court of California has denied a rehearing in the controversy of J. A. Young and others against the New Pedrara Onyx Co. and others as appealed from the District Court of Appeal. The complaining parties were stockholders of the New Pedrara Mexican Onyx Co., a California corporation, suing on behalf of that corporation to set aside a resolution adopted by the company's board of directors, whereby, so it is claimed, the board rescinded a transfer to the company of certain shares of the stock of the New Pedrara Onyx Co., called the Mexican company.

Two actions were brought, and in both the trial court decided favorably to the defendants. Appeals were had in both cases to the Court of Appeal, and, after decision, rehearing was granted. The present decision is final on the points involved, and the lower judgments have been reversed.

The property involved consisted almost entirely of certain onyx quarries in Mexico. The court has said that from the date of the exchange of the California company's shares for those of the Mexican company, the directors and stockholders of the former seem to have treated that company as the owner of the quarries and of all onyx quarried therefrom. But the court thought from the facts presented that the Mexican company was and is the "owner of 5,000 acres of land in Lower California in which are situated the quarries of onyx known as the Pedrara Onyx Quarries"

The case was reversed and remanded for a retrial upon the single issue of title to the 100 shares of the capital stock of the Mexican company, and the latter company directed to register the shares so that its books will correctly show the ownership as well as the several interests of all rival claimants.

be paid a fee of $5, which fee shall be considered as earned only if the entry shall be allowed. For filing and noting each yearly proof of labor or assessment work, a fee of $1. If final proof is made before the register and receiver, a fee $5 for each claim upon which proof is offered and [illegible] cents per hundred words for transcribing the testimony offered shall be paid. If proof is made before any other officer a fee of $5 for each claim shall be paid the register and receiver, but no charge for examining the testimony shall be made, and no other purchase money, fees, or commissions shall be required to be paid by the mineral entryman.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Van. H. Manning Addresses Local Section of A. I. M. E.

Need of Definite National Petroleum Policy Emphasized—Committee Will Formulate One

The international aspect of the petroleum situation was discussed at the regular monthly meeting of the New York Section of the American Institute of Mining and Metallurgical Engineers held on April 6. With an English engineer among the advertised speakers and others with British leanings expected to be present, some rather sharp discussion as to international rights in foreign oil fields was expected. In this, however, the audience was disappointed, for every one of the speakers seemed to agree with the others that the chief requirement for settling any existing disputes was co-operation and a willingness to understand the other fellow's point of view; that both the British and the American attitudes had a certain amount of justification, and that, after all, the question was more or less of a bogey which was causing more talk than the facts in the case would support.

Van. H. Manning, director of research for the American Petroleum Institute, was the principal speaker. He outlined the petroleum discussion between the United States and Great Britain, and made suggestions as to what should be done. Many British engineers were said to be unfavorable to the British attitude, and he thought there would be no trouble in coming to an understanding, provided the interested parties would get together and talk things over. Dr. Manning particularly emphasized the need of a definite petroleum policy on the part of this country, and stated that this was a matter which demanded immediate attention.

Lester H. Woolsey, who has been closely associated with former Secretary Lansing for some time, was scheduled for an address, but was unable to be present, and forwarded a paper to be read. His contribution enlarged further on certain of the points at issue.

J. A. L. Henderson, a mining engineer of London, was also unable to be present and assist in presenting the British point of view. However, several others conversant with British feeling in the matter spoke extemporaneously, and gave the impression that any fancied wrongs could be righted without hard feeling and that no encroachment upon national interests would result. One speaker pointed out that the oil supplies of the United States were in no immediate danger of exhaustion, because of the immense deposits of oil shale available.

Ralph Arnold and Leonard Waldo concurred with Dr. Manning in the necessity for an immediate decision as to an American petroleum policy, and resolutions were formulated for a committee made up of members of the American Petroleum Institute and the A. I. M. E. to study the matter and advise with the proper officials at Washington.

Cordilleran Section of G. S. A. Meets at Berkeley, Cal.

The annual meeting of the Cordilleran Section of the Geological Society of America was held at Berkeley, Cal., on March 26, in joint session with the Pacific Coast branch of the Paleontological Society, the Seismological Society of America, and the Le Conte Club. Among the numerous technical papers presented mining men might be interested in "The Probable Occurrence of Massive Triolite in Serpentine," "Jurupaite, a New Mineral From Crestmore," both by A. S. Eakle; "Collophane, a Much-Neglected Mineral," by A. F. Rogers; "The Temperature Range of Metalliferous Deposits Formed Near the Surface," by C. F. Tolman Jr.; "Some New Aspects of the Geology at Cobalt," by A. R. Whitman; "The Mechanics of the San Andreas Fault," by Prof. Bailey Willis; "The Jasperoid of the Joplin District, Missouri-Kansas-Oklahoma" by W. S. Tangier Smith; and "Certain Marked Differential Movements in the San Francisco Bay Region," by G. D. Louderback. Paleontologic papers were presented by B. L. Clark, Leonard Henry, Chester Stock, G. A. Wilcos, and others.

Colorado Alumni in New York Discuss Status of School

The Colorado School of Mines Alumni Association recently organized a New York Section, which is holding monthly meetings. The last one was on April 13, when the members met to discuss the administrative conditions obtaining at the old school and to hear the latest news concerning the activities of the state legislative committee appointed to investigate them. Various speakers presented almost as many different points of view, but all agreed on the fundamental need for a board of regents selected and appointed on the basis of their general abilities and qualifications fitting them to appreciate the intellectual and material needs of an institution devoted to technical and scientific instruction, and competent to defend its ethical and scholastic ideals. W. S. Medell, chairman of the section, and Harry J. Wolf, secretary-treasurer, were among the speakers.

F. A. E. S. Opens Permanent Washington Headquarters

All Committees Report Progress—Report on Waste in Industry To Appear in June—New Charter Members Coming In Steadily

Permanent headquarters of the Federated American Engineering Societies have been established in Washington. A desirable location has been secured on the third floor of the National Savings & Trust Building, at 719 Fifteenth St., N. W. Sufficient space has been obtained to accommodate the staff of the F. A. E. S. and at the same time provide a large lounging room or conference room for those who may desire to use the headquarters as a meeting place. Headquarters at all times plans to render as much personal service as possible to engineers visiting Washington, and special arrangements will be developed enabling them to transact business with the minimum amount of effort. Engineers, therefore, are asked to notify headquarters of an intended visit to Washington, so that arrangements may be made to care for them. Executive Secretary L. W. Wallace will be permanently in Washington in the near future.

There is great activity in a number of states regarding the licensing of engineers. It is not the desire of the F. A. E. S. to initiate such legislation nor to urge its passage, but it wishes to be instrumental, so far as possible, toward securing the passage of bills that will not be detrimental to public interests and to the engineering profession.

The Patents Committee has been carefully going over the matter of having a bill passed by Congress that will provide more adequately for the U. S. Patent Office, and has requested all member societies to urge upon Congress better support for that bureau.

The work of the Committee on Elimination of Waste in Industry is progressing according to schedule. The publication of the final report of the committee will be undertaken immediately upon the completion of the field work, on April 15. The report will be published some time in June. The findings of the committee thus far are significant, and it has every reason to believe that this report will create much interest.

Engineering societies that have not yet become affiliated with the F. A. E. S. continue to show interest in the Federation. In recent weeks two more have joined, namely, the Boston Society of Civil Engineers and the Engineering Society of Milwaukee, Wis. A number of other societies are either voting at the present time or have under consideration by the executive board the question of joining the federation. It is reasonably sure that a number of other societies will become affiliated with the A. F. E. S. before July 1, the limiting date for coming in as a charter member.

Chilean Nitrate Fields Need Simple Strong Machinery

Labor Conditions and Mechanical Aids Described—Opportunities for American Makers Pointed Out.

Labor shortage prevailed last year in the nitrate fields of Chile, and there is little promise of improvement this year. This condition is paving the way for the eventually extensive introduction of American excavating and mining machinery. This will be accomplished, however, only by an aggressive campaign of education. Present-day Chilean mining methods are the same that have obtained for half a century. Hand labor prevails throughout.

In recent years the control of this territory has passed either into British or Anglo-Chilean hands, and though new capital and new energy have been introduced there has been no corresponding increase in efficiency of mining methods. Today the problem is to work over for the second or third time what was once considered waste material.

There is scarcely half enough labor to meet the demand. The labor problem was never so acute, nor with less prospect of relief. Moreover, the class of laborer that has appeared is about 25 per cent less efficient than the trained forces that deserted within the last two years.

All excavation work is done by hand with ordinary shovels. The rock mining is done by hand drilling and blasting. Separation of nitrate-bearing rock from the waste material is by hand. Loading is by hand. The blasted rock is broken into man loads by additional blasting and sledge work.

For years it was impossible to get a mechanical drill that would operate satisfactorily, because of the varying hard and soft strata and the interspersing loose pockets of sand. Recently, however, this difficulty seems to have been overcome by at least one American drill-manufacturing concern, which has been enjoying a monopoly of what little business it has been able to develop. But the field managers are mostly Englishmen, with an inborn British prejudice against anything American. This prejudice can be overcome, however, where it can be shown that dollars can be saved.

Half a dozen steam shovel companies have been prospecting the fields for the last two years in an effort to introduce their machines for excavating and loading purposes. Their slow headway is due largely to the fact that deliveries in most cases require from four to eight months.

In clearing away the rock debris from blasting operations steam shovels that are equipped with continuous tread trucks and can move about without the necessity of a wooden planking foundation will win quickest favor and prove of far the greater efficiency. The nitrate-bearing strata vary in thickness and occasionally pinch out without notice, always leaving an uneven pathway that tremendously handicaps the shovel not so equipped.

So far no steam-shovel manufacturing company has attempted to maintain a stock of shovels or parts at Iquique, the port of entry. Eventually this will have to be done if the steam shovel is generally adopted, as seems probable. Moreover, some service arrangement must be perfected to care for the machines in the fields.

There is, likewise, a continual demand for industrial railway cars. The northern Chilean districts alone require from two to five thousand annually. The general favorite is a two-way V-dump car. All are of 30-in. gage, and rails used for the tracks are mostly 25 lb. Wooden ties are used. Steam locomotives are used in hauling.

For handling the finished product, after the boiling and settling process has separated the nitrate from the raw material, a two-way dump gable-bottom car is used. These cars are not in so great demand, as their handling is less severe. Frames of this type are good for two years, but a body will last not more than half so long. Electric hoists are used in handling these cars, but are replaced only when they are worn out.

American ingenuity that will provide a mechanical sacking and loading equipment for use in these storage grounds may speedily enjoy a monopoly in this particular field. Sacks of nitrate are filled to carry 220 lb., and the sacking charge is approximately 1c. a sack. The unreliability of the class of labor that does the sacking provides a constantly irritating problem.

Nitrate is but one phase of South American mining that offers a potential market to American machinery manufacturers; and South American possibilities in all their varied lines will be discussed at length in the various group meetings of the eighth annual convention of the National Foreign Trade Council, to be held at Cleveland May 4 to 7. The convention will consider plans, possibilities, and ways and means of extending our foreign trade throughout the world.

European Child Relief Fund Receives Large Contribution From Mesabi Range

A total of $28,667.62, turned in or pledged, is the generous sum of money raised by the residents of the Mesabi Range of Minnesota for the benefit of the European Child Relief Fund, in response to a personal appeal made by Herbert Hoover at one of his talks in Duluth, Minn. This result has just been announced by Anton Tancig, the general chairman in his final report of the campaign committee appointed by the Engineers' Club of Northern Minnesota to carry on the campaign. Of this total $26,684.87 has actually been turned over to the European Relief Council by the treasurer, Ray Moore, of Hibbing; only $1,982.75 remains as pledges. Secretary Carl Calvin, of Hibbing, was also the publicity manager for the drive, and to his energetic efforts it owed much of its timely effectiveness. All three of the general officers were ably seconded by the eleven chairmen of the local drives.

The larger among the seventeen towns on the range readily raised the larger individual contributions, but each section gave so generously that only the full list would do full justice to all. It appears that the towns of the east end of the range collected $13,355.23, which was matched with $15,312.39 from the towns of the west end. Hibbing, Virginia, and Chisholm head the list with amounts in excess of $3,400 each, but Hibbing alone raised $7,501. There were seven localities whose contributions exceeded $1,200 each, and twelve towns raised more than $500. The systematic work of the Engineers' Club of Northern Minnesota thus brought in for this good work a sum much in excess of the quota for the range.

State Batteries and Cyanide Works Help Small Mines in South Australia

In South Australia the development of small mines and prospects is encouraged by the provision of government mills and amalgamation and cyanide plants. The report for the year 1919 has just been released. Work proceeded as usual at the Mount Torrens, Peterborough, Glenloth, and Tarcoola batteries and cyanide works. Eighteen parcels of ore were treated, weighing 224 long tons and returning about 245 oz. of gold bullion, valued at £846. In the course of the year 310 assays and pan tests of small parcels of ore of a few pounds' weight and ore under treatment were made. The total weight of tailings treated by the cyanide process amounted to 770 tons.

Of the total gold recovered, 199 oz. was recovered by amalgamation, and 45 oz. was recovered by the cyanide process. The average value of the ore treated for the twelve months was £3 15s. 7d. per ton.

The work carried out by the state batteries and cyanide works during the year has, in addition to the testing of small samples for the miners, made possible a return to the prospector of £720 5s. 11d. as proceeds on the treatment of the various parcels of ore; also, through the department being a member of the Gold Producers' Association, and as a result of the profits obtained through that association on the sale of gold to foreign countries, the government has been enabled to pay to the prospector a premium of 13s. per oz. on standard gold.

The total value of gold bullion recovered to date at the state batteries and cyanide works is £92,139 6s. 11d.

MEN YOU SHOULD KNOW ABOUT

Etienne A. Ritter, mining engineer of San Francisco, Cal., has been inspecting properties at Oatman, Ariz.

A. A. Leech, geologist for the Phelps Dodge Corporation, Tyrone, N. M., has resigned and will go to Mexico.

William T. MacDonald is now mill superintendent for the Moctezuma Copper Co., Nacozari, Sonora, Mexico.

James P. Porteus, mining engineer, of Lordsburg, N. M., is in New York City on professional business.

G. M. Colvocoresses, general manager of the Consolidated Arizona Smelting Co., Humboldt, Ariz., is in the East on professional business.

M. Gaviard, mining engineer and member of the class of 1904 of Saint-Etienne, has been appointed chief engineer of the Sarre mines.

W. P. Chinn, assistant general manager of mines for Pickands, Mather & Co., has returned to Duluth, Minn., from his extended southern trip.

Max H. Barber, general superintendent for the Cleveland-Cliffs Iron Co., on the Mesabi Range, has returned from an extended trip through the South.

H. W. Hardinge, mining engineer, of the Hardinge Co., New York City, sailed by the "Aquitania" on April 12, for London. He expects to be away about a month.

H. W. Davis, of the U. S. Geological Survey, has completed an extended trip for the purpose of gathering statistics on fluorspar, barytes, lead and zinc, and limestone.

J. Ross Corbin, consulting mining engineer, of Philadelphia, Pa., has been commissioned by State Geologist George H. Ashley, to study the iron-ore resources of Pennsylvania.

C. H. McCarthy, president of the Alcan Oil Co., New York, has returned from an inspection of the Fort McMurray oil field, where his company has made extensive investments.

R. J. Frecheville and **J. A. Leo Henderson**, mining engineers of London, and **J. B. Tyrrell**, of Toronto, are representing important British interests in the northern Alberta oil fields.

Viscount Tadashiro Inouye, of Tokyo, Japan, was the guest of honor at a lunch in Washington, D. C., recently given by **Dr. H. Foster Bain**, acting director of U. S. Bureau of Mines.

Hjalmar E. Skougar, consulting industrial engineer, of New York City, is making a protracted professional trip to England, Western Europe, and Scandinavia. He may also visit Russia.

A. J. May has been appointed mine superintendent at the Tintic Standard mine, Eureka, Utah, to succeed **John Westerdahl**, recently killed during a "hold-up" of the company's store at Dividend, Utah.

Carl Brewer, of Hibbing, Minn., superintendent of the Boeing mine, a property of the Mesaba-Cliffs Iron Mining Co., left last week for an extended trip through the eastern states and a visit to New Haven, Conn.

L. W. Wallace, executive secretary of American Engineering Council, has been named to represent the Council on the U. S. Board of Surveys and Maps. Mr. Wallace succeeds **Alfred D. Flinn**, secretary of Engineering Foundation, in this assignment.

Frederick G. Clapp, petroleum engineer, of New York City, advises us that he is no longer connected with Petroleum Corporation of America, or the Pan-American Exploration Co., as was stated by mistake in our issue of March 12.

Mr. Clapp, who is a native of Boston, Mass., and a graduate in geology of the Massachusetts Institute of Technology, began his technical work while a member of the U. S. Geological Survey from 1902 to 1908. In the latter year he resigned and started a professional practice which has eventually brought him first-hand knowledge of the oil and gas fields of the United States, Canada, Hungary, China, Mexico, Colombia, Haiti, Cuba, and Central America. The results of his field work form the subjects of many professional reports, several geologic folios, and a number of contributions to technical journals. They include a large two-volume report, "Petroleum and Natural Gas Resources of Canada," published in French and English editions by the Canadian Department of Mines in 1914-15 and 1917.

Champlain Studios

FREDERICK G. CLAPP

Since severing his connection with the Pan-American Exploration Co., in 1919, Mr. Clapp has been chief geologist of the Associated Petroleum Engineers. He is a member of many clubs and technical societies, including the Geological Society of America, and is on the oil and gas committee of the A. I. M. E.

Mining and metallurgical engineers recently visiting New York City included: H. A. Wheeler, St. Louis, Mo.; **H. H. Howry**, American Can Co., Maywood, Ill.; **George C. Westby**, of British America Nickel Corporation, Ottawa, Ont.; **Edwin C. Holden**, Davison Chemical Co., Baltimore, Md.; **Alan B. Sanger**, Boston, Mass.; **Knox Taylor**, of Taylor-Wharton Iron & Steel Co., High Bridge, N. J.; **R. N. McBride**, Lore City, Ohio; **H. W. Edmondson**, of Rio Plata, Chihuahua, Mexico; **Joseph W. Ady, Jr.**, of Colorado Springs, Col.; and **Henry M. Schleicher**, 32 Thornton St., Roxbury, Boston, Mass.

OBITUARY

M. Lamborot, formerly mine superintendent at Liévin, and a graduate of Saint-Etienne of the class of 1847, died at Arras, France, about March 15. He was one of the deans of French engineering.

George W. Crismon, mining engineer, of Salt Lake City, Utah, died there on March 25, at the age of forty. He was a graduate of Utah Agricultural College and of the State University. He had a number of mining interests in Utah, notably the Utah mine, Fish Springs, and had been a member of Crismon & Nicholls, assayers, since graduation.

Byron Jackson died in San Francisco, Cal., March 28, at the age of eighty years. He founded and for a long time was identified with the company now known as the Byron Jackson Iron Works. Soon after the San Francisco fire of April 18, 1906, he disposed of his interests in the pump company. His name and the mine pumps produced by his company are familiar to many mining districts.

Charles Stead, of Eveleth, Minn., mining captain of the Oliver Iron Mining Co., in the Eveleth district of the Mesabi Range, died in Chicago on March 24. His health had been failing steadily and rapidly since early in February. Mr. Stead was born in Sweden in 1863, and came to the United States about 1890. He had worked for the same company for the last twenty-five years on the Mesabi Range, at Hibbing, Chisholm, and Eveleth.

C. Amory Stevens, of New York City, the largest individual mine owner in Grant County, N. M., died of pneumonia on March 21. He was also largely interested in holdings in Colorado and Virginia. Part of the present property of the Phelps Dodge Corporation at Tyrone, N. M., was purchased from Mr. Stevens. During the war a large tonnage of ferromanganese ore was shipped to the United States Steel Corporation from the Chloride Flat properties at Silver City, N. M., owned by him. Mr. Stevens was seventy-five years old.

THE MINING NEWS

LEADING EVENTS

Minerals Separation-Miami Case Up Again at Wilmington

Arguments Heard Re Admission of North American Corporation as Party to Suit—Miami Denies Subsidiary's Right

The case of Minerals Separation, Ltd., vs. Miami Copper Co. was again before the U. S. District Court at Wilmington, Del., on April 2, when arguments were heard as to the admission of Minerals Separation North American Corporation as a party plaintiff to the Miami suit. The testimony in this matter had been taken on Jan. 17, 1921. (See *Engineering and Mining Journal*, Jan. 29, 1921, p. 236.)

Minerals Separation contends that the Minerals Separation North American Corporation possesses only the equitable rights in the patents, and that Minerals Separation, Ltd., is still the owner of the legal title. Minerals Separation claims, therefore, that both Minerals Separation, Ltd., and Minerals Separation North American Corporation should properly be joined in the suit.

Miami Copper Co., on the other hand, contends that a certain agreement, dated July 8, 1913, was, in fact, a sale of the patents themselves, passing title out of Minerals Separation, Ltd., and that, therefore, Minerals Separation, Ltd., had no right to bring the original suit against the Miami Copper Co., and that Minerals Separation North American Corporation has no right to join in the suit now.

Though the question as to whether or not Minerals Separation North American Corporation should become a party plaintiff in the Miami suit, under ordinary circumstances, might seem to be relatively unimportant, it is thought by some connected with the Miami company that the result of this argument may be far reaching.

Should the court hold that the transaction of July 8, 1913, was a sale of all the right, title, and interest in the patents, and not merely of the equitable rights, it would establish the fact that Minerals Separation, Ltd., had no legal right to bring the Miami suit at the time it did, and that this suit should, therefore, be thrown out of court.

This would also affect seriously the "disclaimer" made by the Minerals Separation, Ltd., with respect to the three claims declared to be invalid by the Supreme Court in the Hyde case. All of the pending suits under Minerals Separation's principal patent would be influenced by such a decision. The decision will, therefore, be awaited with interest.

WEEKLY RÉSUMÉ

The flotation litigation of Minerals Separation, Ltd., vs. Miami Copper Co. was up again in court at Wilmington on April 2, when arguments were heard on the admission of the Minerals Separation North American Corporation as party plaintiff to the suit. In Denver the State Assembly committee appointed to investigate the affairs of the Colorado School of Mines has filed its report, in the main vindicating President Victor C. Alderson. The same Assembly has passed an act providing for the creation of a "metal mining fund," to aid the mining industry and to be raised by a tax of one-tenth of 1 per cent on all metalliferous property in the state. At Granite City, Ill., the new 500-ton blast furnace of the St. Louis Coke & Chemical Co. is now running successfully on Illinois coke; this operation is expected to encourage iron mining in Missouri, where the Iron Mountain and Pilot Knob properties are again shipping. From Washington, D. C., it is reported that the metal schedule of the tariff bill is ready to be reported by the subcommittee to the full committee. The metal-mining situation is essentially the same as last week, shutdowns already announced being effected as rapidly as possible. It is reported that gold operators at Porcupine, Ont., are speeding up, more power being available and labor more abundant.

American Smelting & Refining Co. Re-elects Officers

The new board of directors of the American Smelting & Refining Co. met on April 12 and organized for the ensuing year. The following retiring officers were re-elected:

Simon Guggenheim, president; Edgar L. Newhouse, chairman of the board; Francis H. Brownell, vice-president; C. W. Whitley, vice-president; William Loeb, Jr., vice-president; H. A. Guess, vice-president; H. A. Prosser, vice-president; Roger W. Straus, assistant to the president; John C. Emison, treasurer; Frank W. Hills, comptroller; Lucius A. Chapin, assistant comptroller and assistant treasurer; W. E. Merriss, secretary; R. P. Reese, auditor.

The following new members were added to the executive committee: Lyman Candee, member of the New York Board of Underwriters; E. C. Jameson, president of the Globe & Rutgers Fire Insurance Co.; Wilfred Shore, of the Irving National Bank; Frederick T. Walker, first agent Royal Bank of Canada, New York branch.

A 20 per cent cut in salaries of the executive force at all plants, effective May 1, has been announced. This will affect every executive from the president down, or 1,500 in all.

Aid for Mining in Colorado in Act Recently Passed

Creates Fund for Benefit of Industry by Levying 0.1 Per Cent Tax on All Metalliferous Property in State

A bill "To Create a Fund for the Benefit of the Metal Mining Industry," was enacted by the Colorado twenty-third General Assembly. It provides for the levy and collection of a tax of one-tenth of 1 per cent on the assessed valuation of all metalliferous mining property in the state. It creates a commission or board of nine members who are empowered to make such rules and regulations regarding the administration and expenditure of the fund as they shall deem proper.

The bill was sponsored by the Colorado Metal Mining Association, and its purpose was to establish an agency, adequately and equitably supported by the mine owners of the state, to supplement the work of the state organization; to do those things and to carry on such activities for the benefit of the industry, which, through lack of means or authority, the individual or voluntary organization could not do. The tax will, it is estimated, raise approximately $20,000 annually.

The board will be equipped to work out economic problems affecting the industry and is empowered to make investigations regarding the prospecting for, mining, transportation, buying, selling, or treatment of metalliferous ores, and such other investigations regarding the industry as the board may deem expedient or necessary.

The board appointed by the Governor consists of Bulkeley Wells, of Telluride, manager of the Smuggler Union; George M. Taylor, manager of the Portland Gold Mining Co. at Cripple Creek; Fred Carroll, manager of the Atlas Gold Mining Co. at Ouray; R. M. Henderson, of Breckenridge, manager of the Wellington Mines Co.; William Loach, manager of the Wolf Tongue Mining Co. at Boulder; Jesse F. McDonald, manager of the Down Town Mines Co. at Leadville; Charles Anderson, manager of the Smuggler Leasing Co. at Aspen; E. L. Young, manager of the Sunnyside Mining & Milling Co. at Eureka, and Charles E. Chase, of Denver, manager of the Liberty Bell, at Telluride. Bulkeley Wells was elected chairman of the board and M. B. Tomblin, secretary of the Colorado Metal Mining Association, was appointed secretary.

Though something new in mining legislation, the measure was cordially supported by the mining interests of the state, which find that individual effort or voluntary organizations are no longer able to cope with the distressing conditions of the mining industry. The chief features of the bill are as follows:

"Section 1. Upon the passage of this act and annually thereafter, in addition to any tax now or hereafter assessed, there shall be levied and collected a tax equal to one-tenth of 1 per cent upon the assessed valuation of all producing and non-producing metalliferous mining property, including lode claims, placer and mill sites, together with the improvements thereon, all more particularly defined in sections 5618, 5621, and 5625 of the Revised Statutes of 1908. Said tax shall be assessed and levied by the county assessor in the regular manner and collected by the county treasurer with other taxes, and forwarded to the State Treasurer, who shall deposit the same in a fund to be known as the metal mining fund, which shall be kept separate and apart from all other funds of the state, to be used and disbursed in the manner hereinafter provided. The State Auditor is hereby authorized upon voucher issued by the chairman and secretary of the board of directors of the metal mining fund, and signed by the Governor, to draw warrants upon the State Treasurer who shall pay the same out of this fund in payment of obligations incurred under provisions of this act.

"Section 2. The metal mining fund shall be under the direction of the board of nine members, who shall be appointed as follows:

"Upon the passage of this act the Governor shall appoint nine persons, all of whom are engaged in metalliferous mining; three shall be appointed for the term of six years, three shall be appointed for a term of four years, three shall be appointed for a term of two years, and biennially thereafter the Governor shall appoint three persons to the term of six years. In the event of a vacancy occurring by death or resignation, the Governor shall appoint for the unexpired term. Upon the appointment of the said board, it shall proceed to organize by electing one of its members as chairman. A secretary shall be appointed by the board, whose duties shall be defined and compensation shall be fixed by the board. The office of the secretary shall be at the place designated by the board of directors.

"Section 3. It shall be the duty of the chairman of the board to preside at all meetings of the board, to call special meetings of the board whenever found necessary; provided, however, that not less than four regular meetings shall be held during each year, to sign all warrants calling for the expenditure of money and to perform such other duties as may be deemed necessary by the board.

"Section 4. Said board of directors shall make such rules and regulations regarding the administration and expenditure of the fund as they shall deem proper, providing they do not conflict with this act or other laws of the state. The board is authorized to make such investigations regarding the prospecting for, mining, production, transportation, buying, selling, treatment or reduction of metalliferous ores, as well as economic conditions relating thereto, and to make such investigations concerning [illegible] ent or necessary. All departments of the state shall aid and assist the board in their investigations in every reasonable way, and its representatives shall have free and open access to the files and records of every state and county department. The board is authorized to employ such assistants as shall be needed and to fix the compensation thereof. All agents and employees of the board shall hold employment at the pleasure of the board and their term of service may be terminated at any time.

"Section 5. The directors of the metal mining fund shall receive no salary or emoluments whatsoever; providing however, that members of said board shall be paid their actual and necessary traveling expenses in attending the meetings of the board. Regular meeting of the board shall be held quarterly and at such other times as may be called by the chairman of the board. Any vacancies occurring in said board caused by resignation, absence from the state, death, or other causes, the unexpired term shall, upon notice from the board of directors, be filled by the Governor."

Preparing for Next Season's Work in Alaska

Yukon District Expected To Be Active—Miners Returning, Owing to Dull Times Elsewhere—Gold Reported Near Fairbanks

With the return of spring, the many Alaskan mining men wintering in Seattle are growing restless and anxious to return to the Northland. Many of them are busy making the final purchase of supplies for the coming season. The 1921 season of navigation between Seattle and Anchorage, Cool; Inlet, was opened on March 22 by the sailing of the steamship "Alameda." The large passenger list included fifty men for the Alaskan Engineering Commission, and a large part of the cargo was made up of supplies for the commission.

In the Yukon district the coming season is expected to be one of the busiest in many years. There will be extensive gold dredging and hydraulicking, and several new silver properties are being opened. Work has begun on a machine shop which will engage fifty men preparing dredges for Upper Dominion Creek, Gold Run Creek, and the Klondike Valley. Early in May this dredge fleet will be able to obtain hydro-electric power.

Many old timers who were unable to secure work during the unemployment period are returning to Dawson. Regular mail stages are coming through every week, drawn by four and six horses, bringing many passengers.

According to a report gold has been found on a small creek about twenty miles distant from Fairbanks. This area was prospected years ago, but it is said that the shafts then sunk were stopped at a false bedrock. Several months ago a number of prospectors resumed work along the creek and broke through the false bedrock, making a rich strike on the true bedrock. A report that the gravel is high-grade and the pay streak more than 50 ft. wide has caused a small stampede to the new workings.

Alderson Vindicated in Report to Colorado Assembly

President of Golden School Mildly Criticized—Trustees Censured for Loss of Rare Metals Station—Management Called Efficient

The committee appointed by the Colorado Twenty-third General Assembly to investigate the Colorado School of Mines filed its report with the Legislature on April 3. In the main, the report is a vindication of Dr. Alderson and the management of the school. Mild criticism is found in the statement that Dr. Alderson, president of the school, "is the storm center of criticism of the administration of the School of Mines" and that "the troubles are of so long standing and are affected by opinions and prejudices so varied and opposite that it makes it difficult to consider the evidence."

Referring to the action of the trustees resulting in the removal of the U. S. Bureau of Mines from Colorado, the report says: "Had proper diplomacy been exercised and a keen interest taken by the board of trustees and the mining men of the state, the removal of the Bureau of Mines from the state might have been avoided. We must remember that to a certain extent the Bureau of Mines was a guest of the State of Colorado, with the School of Mines acting as host, and every effort should have been made by the authorities of the state to have retained it, and suitable notice should have been given so concerted action might have been taken in the matter if found necessary."

In reference to the experimental ore-testing plant, the report says: "Since Dr. Alderson's return in 1917 there have been minor improvements and changes made (in the school experimental mill), but nothing to indicate that the proper interest in this mill was being taken by anyone."

Speaking of the trustees, the report says: "Instances have occurred where the board of trustees have failed to retain the services of faculty members without giving said members sufficient notice, and such action on the part of trustees is discourteous and tends to the demoralization of the school, and should be discontinued."

Recommendations were made as follows: "The committee believes, from the ideas and opinions of mining men that have come to it, that the purpose of the School of Mines is to assist in the development of the mining interests of the state, principally, and the oil industry, incidentally, and to that end we believe the efficiency of the school may best be advanced by having competent mining men on the board. There should be, in our judgment, at least three men on the board who are vitally interested in general mining and milling."

Unanimous approval was given to the proposed consolidation of the higher institutions of learning of the state, as suggested by House bill No. 364, by Mr. Reed.

The committee report groups the charges against the school under six headings, as follows:

1.—Trustees' interference with discipline. Finding: "The trustees did not overstep any propriety in assuming jurisdiction occasionally."

2.—President Parmalee should have been retained. Finding (quoting in part): "It rests within the province of the board to refuse to employ the president or any member of the faculty."

3.—Dismissal of faculty members without adequate notice or hearing. Finding (quoting in part): "Such action on the part of trustees is discourteous and tends to the demoralization of the school and should be discontinued."

A SAPPHIRE CLAIM, ANAKIE FIELD, QUEENSLAND, AUSTRALIA

4.—Lowering of standards of scholarship by President Alderson. Finding (quoting in part): "The committee has not been able to determine that such charge is true."

5.—Dr. Alderson used improper pressure to induce teachers to support his policies or further his personal interests. Finding: "No evidence to sustain this charge."

6.—Dr. Alderson has been guilty of plagiarism. Finding: "Insufficient evidence."

In summing up the evidence the report says: "The management and administration of the School of Mines is efficient, the trustees, officers and faculty are complete, well qualified and trustworthy; and the institution, its members, officers, faculty, and trustees are entitled to the support, respect, and encouragement of the citizens of this state, the alumni of the institution, and the general public."

"Your committee is of the opinion that the institution will flourish and its excellent reputation be maintained if it receives the encouragement and patronage to which it is so justly entitled."

New Furnace at Granite City, Ill., Using Illinois Coke

The recently completed plant of the St. Louis Coke & Chemical Co. at Granite City, Ill., is now in successful operation. It consists of a 500-ton modern blast furnace and eighty byproduct coke ovens of the Roberts pattern that cost about $9,000,000. Each oven has a capacity of fifteen tons of coal, which comes mainly from Williamson County, Ill., to which is added some from Indiana or West Virginia. The quality of the coke is first class. Mesabi and Missouri iron ores are used and about 450 to 500 tons of pig iron is produced per day for the local market.

This is the first successful effort to use Illinois coke in blast-furnace practice, and is resulting in a large saving in freight over shipping in Connellsville coke or West Virginia coal. This plant will stimulate the reopening of some of the Missouri iron mines, and the old Iron Mountain and Pilot Knob mines have again entered the producing list.

Queensland Marketing Sapphire Output Through Rubin Brothers

New Agreement in Operation—State Leads New South Wales as Producer of Precious Stones

Brisbane, Feb. 21. — The agreement entered into between the Queensland government and Messrs. Rubin Brothers, of Bombay, Paris, and London, for the marketing of the sapphires produced in this state (see *Engineering and Mining Journal*, March 5, 1921, p. 441), has been put into working order, and the result so far indicates that it will at least give a much-needed stimulus to the industry. The 75 per cent of the value to be advanced to miners is not to be provided by the government, but by the firm selling the gems, but the state will control the scheme, and proclamations have already been issued under which the government acquires all sapphires produced in Queensland, so as to insure that Rubin Brothers will have the sale of all of them, or rather of the blue stones, as fancy stones are not included in the agreement.

A paragraph published in the *Mining and Scientific Press* of Jan. 1 regarding the gems of Australia is not only incorrect but unfair to Queensland. It is there stated that "New South Wales leads all other states in the variety and value of precious stones produced." The only precious stones officially recorded as having been produced in New South

Wales during 1919 were opal to the value of £27,550 and diamonds worth £1,700, or a total of £29,250. In the same year the Queensland sapphire field of Anakie, the best in the world, produced sapphires alone to the value of nearly £43,000 (over £64,000 in 1920). The same paragraph states that it is claimed that Lightning Ridge, in New South Wales, is the only part of the world known to produce black opal. Though it is true that Lightning Ridge may be said to have "made" the black opal owing to the quantity produced and to the beauty of the stones, it is an undoubted fact that equally beautiful black opals have been found from time to time in Queensland.

Queensland has, in its far western districts, vast areas that are opal-bearing, and the gems found there are, like those of the neighboring State of New South Wales, unsurpassed. At present, however, scarcely any opal is being won in the former state. Many years ago the product reached up to £30,000 a year. The opal fields of Queensland are under a great disability from their remoteness and from the fact that in times of drought there is no water for the prospector nor grass for his horse, and in good seasons the demand for labor in the western pastoral districts is so keen, and the wages paid are so enticing, that men do not then favor the uncertain occupation of opal mining. Most of the opal deposits as yet found have been obtained near the surface, and the depth of workings in late years has ranged from 15 to 20 ft. The opals are found in beds of sandstone, clay ironstone, and other sedimentary rocks belonging to the Desert Sandstone formation in the Upper Cretaceous. Some beautiful specimens known as "boulder opal" are found in nodules of clay ironstone imbedded in sandstone or clay.

On the Anakie field, in Queensland, the sapphires occur associated with corundum in old alluvial deposits. The field covers an area of about twenty square miles, and is within easy access of the Central Railway at a point 190 miles from Rockhampton, which is about 400 miles north of Brisbane. The corundum stones, which are usually less than an inch in diameter, are all distinct crystals, although more or less corroded by the basalt magma which once contained them. Crystals of coarse corundum have been found which contain sapphires in the center, and sometimes perfect gemstones are obtained in this way.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Tariff Schedule on Metals Is Ready

Subcommittee, However, Declines To Announce Details at Present, in View of Possible Changes

The metals schedule of the new tariff bill practically has been completed by the subcommittee composed of Representatives Tilson, of Connecticut; Mott, of New York, and Timberlake, of Colorado. The subcommittee declines to announce any of its conclusions, on the ground that they are likely to be changed by the full committee and that such announcement would give rise to renewed discussion which would serve no good purpose at this time. It is pointed out that the committee was unusually liberal in granting time to all interests during the period of the public hearings. Those interested still will have opportunity to present their views after the bill is in final form.

In the case of the metal schedule it is understood that the subcommittee could not follow the Payne-Aldrich rates as closely as is being done by the subcommittees working on some of the other schedules. This is due to the fact that the war gave rise to many fundamental changes which have a bearing on items in this schedule. In some cases there are no precedents in the Payne-Aldrich Act, and, as a consequence, the committee has nothing to show the effect upon industry.

It is believed that the subcommittee has recommended a low rate of duty on manganese, chrome and tungsten ores. It is known, however, that an effort will be made in the full committee to continue these ores on the free list.

Particularly strong pressure will be brought to secure some duty on manganese ore, because of the favorable showing which has been made in the development of the rhodochrosite ores in the Butte district. It is estimated that manganese from Butte can be laid down at Pittsburgh at around 60c. per unit. The comparatively low rate of duty thus would make it possible to compete with imported manganese at this principal center of consumption.

With regard to duty on tungsten ores the House already has passed a bill placing a duty of $10 per unit of tungstic trioxide contained in crude tungsten, ores and concentrates. This was amended by the Senate Finance Committee so as to read $9 per unit. As the situation has not changed greatly since the so-called emergency tariff bills were passed it is possible that the House may insist upon consistency of action and continue the schedules contained in these emergency bills. The House also approved at the last session a duty of one-half cent per pound on magnesite ore and a duty of one-fourth cent per pound on zinc ore containing more than 10 per cent and less than 20 per cent of zinc; one-half cent per pound on ore containing 20 per cent and less than 25 per cent of zinc, and one cent per pound on ore containing 25 per cent or more of zinc.

Ferromanganese and other alloys are causing a great deal of discussion in the committee. It may be said, however, that the request for a duty of two cents per pound on ferromanganese is not being considered favorably. It is expected that a duty of one cent per pound will be written into the bill.

It is known that the committee is applying specific, rather than ad valorem, rates wherever possible. There is marked difference of opinion as to whether American or foreign valuations should be employed.

Asbestos on Indian Reservations Now Open to Location

Claims Containing This Mineral Said To Have Been Filed on Already by Subterfuge

Asbestos deposits in the Fort Apache and San Carlos Indian reservations, in Arizona, now are open to location. This is made possible by the following clause in the Indian Appropriation Act:

"That wherever the term 'metalliferous' is used in Section 26 of the Indian Appropriation Act of 1919, it shall be defined and construed by the Secretary of the Interior to include magnesite, gypsum, limestone, and asbestos."

The original provision referred to, affecting the location of metalliferous deposits within these Indian reservations, reads in part as follows:

"Mining claims may be located by such citizens in the same manner as mining claims are located under the mining laws of the United States: Provided, That the locators of all such mining claims, or their heirs, successors, or assigns, shall have a preference right to apply to the Secretary of the Interior for a lease, under the terms and conditions of this section, within one year after the date of the location of any mining claim, and any such locator who shall fail to apply for a lease within one year from the date of location shall forfeit all rights to such mining claim: Provided, further, That duplicate copies of the location notice shall be filed within sixty days with the superintendent in charge of the reservation on which the mining claim is located, and that application for a lease under this section may be filed with such superintendent for transmission through official channels to the Secretary of the Interior."

It is understood that most of the

claims thought to contain asbestos had been located previously under the subterfuge of prospecting for iron. Considerable protest is reaching the Department of the Interior in this connection and it is not unlikely that an investigation will be made with the purpose of ascertaining if there has been discrimination against prospectors who were careful to observe the law with regard to operations on these Indian reservations.

Mental Hygiene in Industry Again To Be Studied

Plans for the resumption of research on mental hygiene in industry have been completed by T. T. Read, chief of the division of Education and Information of the U. S. Bureau of Mines. This work was started more than a year ago under the auspices of Engineering Foundation. The work was begun by the late Dr. Southard. Much difficulty was experienced in conducting this research because of objections to a study of the mental conditions found among the employees of any commercial plant. The very mention of a study of the mental state of employees aroused a high degree of resentment. This apparently insurmountable obstacle, however, has been removed by an arrangement to make these studies in connection with the rehabilitation work of the Federal Board for Vocational Education. The Federal board has some 65,000 ex-service men in training, of which 10 per cent are mental cases. This provides a large amount of clinical material.

The research also has been facilitated by the appointment of Dr. J. H. Barnes, Jr., as district psychiatrist of the Board for Vocational Education. Dr. Barnes is a member of Mr. Read's subcommittee on Mental Factors in Industry, of the American Institute of Mining and Metallurgical Engineers. Both Mr. Read and Dr. Barnes have had extended experience in the study of psychiatry in industry and under the favorable conditions now offered it is believed that much progress will be possible.

War Mineral Awards

Awards totaling $56,081.03 were recommended by the War Minerals Relief Commission during the week ended April 2. In the chrome claim of C. S. Maltby the payment of $42,158.92 was recommended. The amount claimed was $77,503.87. An award of $13,406.48 was recommended in the manganese claim of Woods, Huddart & Gunn. This was 78 per cent of the amount that had been claimed.

In the light of new evidence an award of $147.13 was made in the case of Joseph Sewell, whose claim had been disallowed previously. An additional $368.50 was allowed in the claim of Ott & Thompson. This brings the total award to 32 per cent of the amount originally claimed.

Government's Silver Purchases Nearly 47,000,000 Oz.

The total purchases of silver under the Pittman Act up to the close of business on April 2 was 46,862,456 fine ounces.

NEWS BY MINING DISTRICTS

Special London Letter

Spitzbergen Enterprise Reported To Be a Failure—Modder East Borrowing £400,000—Globe & Phoenix Ore Showing Improved—San Francisco Mines Report

By W. A. Doman

London, March 29—Some time ago I referred to the Northern Exploration Co. and the disappointment it had proved. The annual report is now in issue, and shows the undertaking to be more or less of a failure. Hugo Stinnes endeavored to secure control of this Spitzbergen enterprise by lending money, but our Foreign Office raised objections, and the company has not been able to get sufficient working capital since. When the company was floated with a flourish of trumpets there were suggestions of coal, iron, marble, oil, copper, and zinc deposits to be worked. These suggestions remain, but so far as can be gathered only one of the coal deposits will pay. This is at Davis Harbor, where it is stated that 4,500,000 tons can be mined commercially. At present the necessary plant is not erected.

There is no money with which to develop the marble property, though the marble manager thinks it can be made a commercial proposition if sufficient capital is available and quarries are worked on up-to-date lines. The copper deposit does not seem to be payable, and the zinc blende deposit cannot be mined successfully. A syndicate was formed to prospect for oil on the company's property, but it does not intend to exercise the option. So another string is gone. The directors are endeavoring to raise money in other directions.

The Modderfontein East, which has no stamp battery erected on the mine, but which uses the plant formerly belonging to the Apex company, had developed so well that an extended program was planned, and the Simmer Deep-Jupiter reduction plant was acquired for £110,000, as mentioned last week. As this is several miles away, the expense of dismantling, removal, and re-erection will be considerable. An issue of £410,000 debentures falls due in July, so that additional funds are necessary beyond the present resources of about £200,000.

Conditions in the money market being unfavorable to raising new capital, the Central Mining & Investment Corporation has agreed to lend £400,000 on debentures at 8 per cent for eighteen months from July 1 next. The debentures are to carry the right of conversion into shares at par. Shareholders are to be given the opportunity of subscribing up to 75 per cent of the loan, and to have the option to convert. This will prove a satisfactory solution of the Modder East financial trouble. Milling will continue on the same scale as at present, the larger scheme of development being postponed.

Much interest centers upon the report of the Globe & Phoenix Gold Mining Co. for 1920. Various rumors circulated early last year hinted at the approaching exhaustion of the mine. That there was some basis for them is seen in the technical report, for during the first six or seven months of the year the results of development were not payable. Matters then began to mend, especially on the 14th and 15th levels, and good values have continued to the present time. The deepest levels are the 23d and 24th, and this is where interest is being reawakened. Satisfactory values are showing, and it is said that the Rhodesia Exploration directors are beginning to inquire where this orebody is worked.

The protracted action over the John Bull claims and the extra-lateral rights will be easily understood in America. Although in the courts the Globe & Phoenix won the case, litigation is not necessarily at an end, and in regard to developments at the 24th level the situation is interesting. The ore reserves are estimated at 93,852 tons, containing 145,321 oz., of a value of 84/-, or £610,348. These figures compare with 102,182 tons (175,691 oz. and £737,902 value at the end of 1919). It would seem that the old ore blocks have on stoping exceeded estimates. As much ore is locked up in pillars, there may be a cutting down presently of the monthly crushing rate.

The fall in the price of metals has hit the San Francisco Mines of Mexico hard, just when the corner seemed turned. For the year ended Sept. 30 last there was a [illegible] with metals down, debenture and share holders are asked to make a further sacrifice. The [illegible] of an increase from [illegible] per cent to [illegible] per cent in the [illegible], both on debentures and suspended coupons, and conversion rights on double the number of shares, are asked to sanction the further postponement of payment of interest until April 1, 1924, and the beginning of redemption of principal until April 1, 1925. The capital is to be reorganized and shares are to be made of the nominal value of 10/—.

Consequently, debenture holders will have an option over 400,000 10/— shares, instead of 200,000 £1 shares. Shareholders in the writing down get share for share, i.e., one 10/— for one £1 share.

CANADA

Ontario

Porcupine Companies Speeding Up—Gold Strike Reported Near Pembroke

Porcupine—Power was turned on full on April 7, enabling the Hollinger, Dome mines and McIntyre greatly to increase the scope of their operations. The Hollinger mill, working close to capacity, treated 3,000 tons of ore. Miners are flocking into the camp, and the companies are doing their best to find housing accommodations for them.

The shareholders of the Porcupine-Keora on April 4 ratified the proposed sale of two claims to a new company capitalized at $3,000,000, in which the Keora will retain a two-thirds interest.

Pembroke—It is reported that gold has been discovered on the south branch of the Petawawa River, about eighteen miles from Pembroke, where the rock is of Huronian formation with quartz similar to that found in the Porcupine district. Surface showings are said in some cases to assay high. A large number of claims have been staked.

British Columbia

Trail—Ore received at the Consolidated smelter during the week ended March 31 totaled 10,999 tons, of which 784 tons came from the Blue Bell mine, at Riondel, and the remainder from company mines.

Grand Forks.—The Granby company's plant at this place will be completely closed by the end of this month, and will be in charge only of watchmen. All movable machinery has either been sold or removed to Anyox. H. S. Munro, general manager, stated that the plant is likely never to be operated by the Granby company again.

CALIFORNIA

Rumored U. S. Steel May Ship Products to Coast via Panama—Taxes Refunded to Mountain Copper and Balaklala

San Francisco—Superintendents of gold mines along the Mother Lode and from Grass Valley held a meeting on April 7 at the Plymouth mine, in Amador County.

At a meeting on March 28 at the office of W. J. Loring, Mr. [illegible] John T. Burns, Fletcher Hamilton, Edwin Higgins, W. G. Devereaux, and others took steps to provide an appropriate mining exhibit for the national exposition of mines and mining equipment, to be held in conjunction with the convention of the American Mining Congress, Oct. 17-22, at Chicago.

Interest in the Legislature's activities is being centered about changes in the labor compensation laws. Senate bill No. 259, a recodification of the compensation act, promises to be a hard-fought battle between labor interests and employers. Increase in the compensation rate and other novel changes have roused the employers, and it is an open question whether this sixty-page bill will pass. Mining interests will be subjected to an increase estimated at over 30 per cent in existing compensation rates if the bill passes in its present form.

Rumors are current that the U. S. Steel Corporation proposes to establish a line of steamers to carry steel to the Pacific Coast via Panama. If this is true a lower price for steel on the Pacific Coast is likely. Again, efforts are being made to establish a steel industry on the coast, and this move on the part of the Steel Corporation would indicate that it intends to hold the coast market for steel products.

Shasta County—The Mountain Copper Co., Ltd., and the Balaklala Consolidated Copper Co. (First National Copper Co.) have succeeded through court action in having excessive taxes, paid under protest, returned, to the extent of $13,917.

Angels—Greater activity is reported in the Mother Lode counties. For the first time in three years prospectors are again at work.

Yreka—George Hansell and George Uhl, of San Francisco, have taken a lease on the Siskiyou Klondike placer mine near Yreka. This property, on Kiney Creek above Oak Bar, is a fully equipped hydraulic mine and as a producer dates back to the early 50's. Work will begin at once and additional equipment will be installed.

M. Dean and associates, of Yakima, Wash., have taken a lease on the Wacker or Spring Gulch group of quartz mines near Yreka. This company will be incorporated. Operations will be resumed and erection of a mill is under consideration.

Callahan—The Utah-California Gold Mining Co., of Salt Lake City, Utah, of which Henry Wade is president, has taken a trust deed on 504 acres of mining ground near Callahan, which includes such groups as the Bolder, Knox Port, Cummings, Ore Grande Summit, Buzz Saw, and Drummond, and 500 in. of water from Boulder Creek. The equipment is extensive and includes sawmills, power plant, and compressor plant. The company pays about $150,000, receives a three-fourths interest, and guarantees to spend $150,000 in development work within two years.

Gottville—The Morgan & Herzog cinnabar mine in the Gottville district has been bonded to W. A. Hutton, a local mining man. This property has been developed the last two years to a depth of 250 ft. by drifts which have cut a vein 20 ft. wide. The ore shows values as high as 10 per cent mercury and contains considerable free mercury, a characteristic of the cinnabar deposits in northern California and southern Oregon. The "quick" is seen in the bottom of the dump cars and all through the works, and any of the rich ore will give up a generous quantity on being struck a heavy blow.

NEVADA

Con. Virginia Made Notable Production Recently—Blue Horse, Near Goldfield, Giving Promise

Virginia City—Progress is reported in driving the main haulage tunnel of the United Comstock Mines Co. A storage battery locomotive has been purchased for use in the tunnel. To date about 1,200 ft., or approximately one-tenth of the entire distance, has been completed. The Con. Virginia milled 771 tons of $27.46 ore week before last, this being the largest production for a like period since the bonanza days of the Comstock. Most of the ore being mined at present is from the 2,250 level. In the Ophir the drift on the Hardy vein was driven ahead in low-grade quartz.

Tonopah — The Belmont reports active development on all levels from the 700 to the 1,400. This company, like all others in the district, is reworking old stopes with success, widening them out to obtain low-grade ore which was allowed to remain when high-grade was plentiful and the price of silver lower. In many cases stopes 10 ft. wide or less are being widened to 30 and 40 ft. and proving profitable.

The last dividend of the Tonopah Mining Co., payable April 21, brings the total dividend disbursements of that company to $14,975,000. This company is maintaining a production of 150 tons of ore per day. West End profits for March were $57,439, from 5,125 tons of West End ore and 441 tons of Jim Butler lease ore.

The Tonopah Extension is cutting a station at the 1,650 level of its McCane shaft. Production was 2,400 tons and development footage 281 during the last week.

Divide.—No favorable news has been forthcoming from the Tonopah Divide mine regarding conditions on lower levels. Drifting and crosscutting are being done on both the 800 and 1,000 levels; shaft sinking is soon to be started below the 1,000 level; 50 tons of $28 ore is being shipped daily.

The Divide Extension continues to ship, the last shipment running $104 per ton. Many of the smaller development properties are working, but no new discoveries of importance have been reported recently.

Pioche—Ore shipments from the Pioche district for the week ended March 31 totaled 1,345 tons. Virginia-Louise shipped 845 tons; Bristol 250, Combined Metals 145, and Black Metals 105.

Goldfield—The Blue Horse mine, forty-five miles east of Goldfield, is controlled by a group of San Francisco men, among whom are J. W. Plant, Roy H. Elliott, W. H. Bissell, and George K. Allen. Over $80,000 has been spent on development. A two-compartment shaft is being sunk, and the vein has been exposed by workings for a length of 1,500 ft. Encouraging shipments have been made. About $100,000 more is also to be spent.

ARIZONA

Activity in Union Pass District, in Mohave County, Attracting Attention

Union Pass — Considerable interest is being displayed in the Union Pass district, a gold section in the River Range of mountains about fifteen miles west of the halfway point on the Kingman-Chloride road. Steady and consistent development work has been going on at several properties for a number of years. The rather "pre-boom" activities have been brought on by the wonderful showing in the Katherine mine, coupled with a recent sensational strike at the Gold Chain property and the advent in the field of C. M. Miller, a well-known mining promoter, in whose interests twenty-one claims immediately surrounding the Katherine have been taken over. Six of these claims will be known as the Katherine Extension, and are held jointly with the Sutro interests, which are operating the Katherine. The new company plans to start work at once on this group. There has been a mild rush to the locality during the last ten days. Claims have been located for miles in all directions, even across the Colorado River in Nevada.

LEFT ARABIAN MINE PLANT; RIGHT KATHERINE MINE, BOTH IN UNION PASS DISTRICT, MOHAVE COUNTY, ARIZ.

Underground development work is well under way at the Arabian property, recently taken over on option by the Arabian Development Co., financed in Los Angeles. C. D. Ridgeway is the engineer in charge.

The 300 ft. 60 deg. incline shaft and the two levels at the 100 and 300 have been cleaned up and thoroughly sampled. Machinery has been installed and is in running order. Two shifts with machine drills are driving north on the 100 and south on the 300.

Huron—W. W. Lytzen, mine superintendent for the Big Ledge Copper Co., recently reported that the Henrietta mine is now in condition to produce. Operation waits on improvement in the metal market and reduction in cost of supplies. Mineralization in the Henrietta vein in connection with its length indicates that ore should extend for 2,000 ft. or more before copper is the predominant mineral. Test runs on a small scale at the new mill indicate a ratio of concentration of 3 to 1 and a recovery of 95 per cent of the copper, 84 per cent of the silver, and 93 per cent of the gold.

COLORADO

Smuggler-Union Completes Building for Flotation Plant—Standard Chemical Resumes at Radium Ore Properties

Telluride—Shipments of concentrates for March were: Smuggler-Union, 57; Tomboy, 44; Liberty Bell, 13; total, 114.

The building which is to house the new flotation plant of the Smuggler-Union Mining Co. is completed, and the machinery is being installed. Ore from both the Smuggler-Union and Black Bear properties will be treated in this plant, the operation of which will involve the employment of about 100 additional men in the mines and mills.

Leadville—The Leadville Mines Development Co. is driving a development tunnel through Canterbury Hill, toward Big Evans Gulch. The first objective is the Rosedale shaft, where the tunnel will have a depth of 225 ft. The tunnel will continue thence to the Canterbury Hill shaft, where the depth will be 4,600 ft. New blacksmith shop and tool houses have been built. John C. Cortellini is manager.

The Western Zinc Oxide Co. has recently reopened its first unit, in which additional machinery has been installed. The second unit will not be started until business improves. The company is operating at about 50 per cent capacity.

Montrose—The Standard Chemical Co. has recently resumed operations at its radium ore properties in western Montrose County. Over 100 men will be employed. J. I Mullen is manager.

UTAH

Utah Copper Co. Planning To Aid Employees Laid Off—Garfield Smelter's Refusal of Dry Silver Ores Hurting Tintic District

Bingham—The Utah Copper Co. has thus far reduced its working force to about 700 men, and when the shutdown has been completed there will be left only about fifty men to act in the capacity of caretakers. The company will make no rental charge for cottages owned by it and occupied by former employees who have been unable to find work. Plans for the welfare of the men during the period of unemployment are being considered. One of these, which is thus far only in the tentative stage, is to use ten acres of ground for a community farm, to be worked by miners and mill hands, who will receive the produce. The larger part of the employees who have families will remain in camp at least until the close of the school season.

Working forces are being reduced at the Utah Consolidated, which for some time has been making no shipments. The mill of the Utah Consolidated is rapidly approaching completion but no attempt will be made to operate it at present, owing to the condition of the metal market.

The Utah Apex has been making no shipments for a considerable period, and has also suspended development work. The Utah Metal & Tunnel has stopped work. The United States Mining Co. is working 300 men at its mines, and sending about 350 tons of ore to its concentrator at Midvale daily.

Eureka—The lack of iron ore to mix with dry siliceous ores in the charge, which has followed the closing down of the Utah Copper Co., has caused the Garfield smelter of the A. S. & R. Co., which was receiving the Utah Copper concentrates, to refuse a considerable amount of the dry silver ores offered. A number of Tintic properties are affected, the principal ones being the Tintic Standard, the Eagle & Blue Bell, and Victoria. The lead smelters are unable to handle this class of silver ores at so favorable a rate as the copper smelters. The Victoria and the Eagle & Blue Bell have entirely suspended shipments of siliceous ores, and are mining with reduced forces, shipping lead ore only.

Shipments from the Tintic district for the week ended April 1 totaled 150 cars, as compared with 174 cars the week preceding. Shippers were: Tintic Standard, 57 cars; Chief Consolidated, 25; Iron King, 17; Dragon, 9; Iron Blossom, 8; Eagle & Blue Bell, 7; Victoria, 5; Swansea, 4; Grand Central, 4; Centennial-Eureka, 3; Bullion Beck, 3; Gemini, 2; Mammoth, 2; Gold Chain, 2; Colorado, 1, and Sunbeam, 1. During the week the Chief Consolidated suspended work for two days, owing to an accident which occurred in No. 1 shaft, when mine cars which were being hoisted full of ore became wedged in between the cage and shaft timbers. Wall plates and shaft timbers were torn out, and it was necessary to chop the mine cars into small pieces so that they could be removed. The Tintic Drain Tunnel is completing the raise which is being driven near the face of its tunnel to furnish ventilation for the tunnel and preserve its timbers. The raise is up 500 ft. with 100 ft. more to go.

The Iron King, a part of which is under lease to the A. S. & R. company, is shipping three cars of fluxing iron ore daily, and thirty-five men are working. The company itself is carrying on development at depth, and paying the cost of this with the income from the iron ore.

Park City—Shipments for the week ended April 1 totaled 1,816 tons of ore and concentrates, as compared with 1,639 tons for the week before. Shippers were: Judge allied mines, 914 tons; Silver King Coalition, 463; Ontario, 438. The Silver King Consolidated has struck silver-lead ore of shipping grade in a raise started 13,575 ft. from the portal of the Thaynes Canon tunnel, which is being driven to develop new ground and to make connection with the California Comstock company's workings.

MONTANA

East Butte Continuing Production on One Shift at Pittsmont—Silver Butte Planning To Resume at Corbin

Butte—Preparations have been made by the Anaconda for a prolonged shutdown of its mines at Butte and its smelters. All the mules and horses have been hoisted and turned out to graze in the company's pastures near Georgetown, west of Anaconda. Only a force sufficient to man the pumps and keep the properties in repair is being maintained. Ore stocks at the Washoe Reduction Works are being cleaned up, and this plant will be closed. Operations will continue only at the wire works of the Anaconda at Great Falls, where the company is reported to be working on a wire order for the Western Union, which is said to total approximately 60,000,000 lbs.

Development and production are continuing at the Pittsmont properties of the East Butte company, although only one shift is working. It is necessary to maintain a certain output or else close down the smelter. With the treatment of the Davis-Daly ores from the Colorado in conjunction with its own it is possible to continue operating the reduction works. There is no intimation as yet of intention to suspend production along the lines followed by the Anaconda and the porphyries.

Drifting on orebodies with a view to increasing the reserves of the Colorado mine is proceeding satisfactorily, and more new ore was brought into sight in the last quarter than was mined. The new air shaft has been completed throughout, extending from the surface directly to the 1,800, thence by raises and crosscuts to the 2,700-ft. level, materially improving ventilation in the mine, in addition to making the Davis-Daly independent of the Anaconda for its air supply. Silver ores from the Hibernia are being shipped to the East Helena smelter of the American Smelting & Refinery Co.

North Butte is doing a small amount of development work at the Granite Mountain and Speculator.

Shaft sinking continues at Butte & Superior's Black Rock No. 3 shaft, with the 2,900 level the objective.

Crosscutting and sinking are in progress at the Plutus shaft of the Butte & Plutus, with the development of the Norwich and Plutus veins on the 400 level the objective.

Butte Western Silver Mines is continuing sinking from the 200 level.

Tuolumne Copper's development program will continue, with the Main Range shaft to be sunk to the 1,600 level, according to the company's local office. Ore production will probably be suspended, although shipments can be made of the silver ore to the East Helena smelter. The shaft is now past the 1,500, and the Spread Delight vein should be cut on the 1,600 within sixty days.

Lessees are shipping regularly from the Butte New England property, which lies to the south of the Davis-Daly's Colorado mine.

Lump Gulch District. — Operations have been suspended at the Liverpool property. Considerable development was done, and ore shipped from the 700 level. Deeper development is thought necessary, and until mining in general shows a revival operations will be halted.

Corbin District.—Plans are taking shape for the operation of the Silver Butte's property in the Corbin district, in addition to resuming work at the old Ballaklava mine, in the Butte district. The company officials are said to be thinking of taking over certain property near Bozeman.

Helena. — Announcement has been made that the East Helena smelter of the A. S. & R. Co. will continue to treat gold, silver, and lead ores. Representatives of the company are in the Butte district and in near-by camps in quest of silver ores.

MINNESOTA

Mesabi Range

Meriden Iron Co. To Drain Syracuse Lake

Aurora—Plans are being drawn by the Meriden Iron Co., for draining Syracuse Lake in Sect. 5, Tp. 58, R. 15. The lake overlies an orebody of about 3,000,000 tons, but the adjacent acreage contains a large tonnage, and it is imperative to drain the lake before any of the ore can be extracted. The project will call for several dams, will be a large undertaking, and will benefit not only the new property but some of the adjacent mines, which have found it hard to operate owing to the water conditions. The ore underlying the lake proper is the property of the State under the law.

Tower—The report of the drilling being done by the Scott-Bevier Iron Mining Co. on its lease is favorable. An orebody has been outlined, but drilling is to be continued.

The No. 8 incline shaft of the Soudan mine, a property of the Oliver Iron Mining Co., is being sunk 200 ft. further to facilitate mining.

Grand Rapids—A lease has been issued to the Tod Stambaugh Co. on a tract of land northwest of Grand Rapids which contains a considerable tonnage of washable ore. A washing plant may be erected soon.

Hibbing—The Boeing mine, of the Mesaba-Cliffs Iron Mining Co., is now on a producing basis. Development work on the main level is practically completed and slicing is in progress in the northwest part of the mine.

Nashwauk—The new approach being cut by the big Bucyrus No. 225 B electric shovel at the La Rue pit is practically completed, and preparations are being made to equip the shovel for dragline work. When equipped, the shovel will operate as a dragline machine on additional stripping for the enlargement of the pit.

MICHIGAN

The Copper Country

Quincy Curtails to 25 Per Cent Normal Following Recent Wage Cut

Houghton—The Quincy Mining Co. will begin at once to operate on a four-day-per-week basis, which will curtail operations to 25 per cent of normal. The company has announced a general reduction in all wages and salaries of 10 per cent, effective from April 1. In the same notice the management urged every employee to increase the efficiency of his labor to the highest point, so that the mine might be able to come through this depressed condition of the metal market without closing down entirely. It was also decided to discontinue the night shift at No. 6 shaft.

Calumet & Hecla has announced a 25 per cent cut in the wages of those still on the payroll, effective April 16. This includes pump men and mill, smelter, and power-plant employees.

THE MARKET REPORT

Daily Prices of Metals

April	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
7	12.50	28.25	29.50	4.25@4.40	4.25	4.65
8	12.50	28.25	29.50	4.25@4.40	4.25	4.65
9	12.50	28.25	29.50	4.25@4.40	4.25	4.60@4.65
11	12.50	28.50	30.00	4.25@4.50	4.25	4.60
12	12.50	28.50	29.75	4.25@4.50	4.25	4.60
13	12.50	28.00	29.25	4.25@4.50	4 25	4.60

*These prices correspond to the following quotations for copper, "delivered": 12.75c. for the week.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

April	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
7	69	68¾	72½	158½	161½	20¼	20⅝	25	26½
8	69	69	72½	159½	163	20½	20⅞	25⅜	26⅜
9	...	...	...	....	....	...	...	...	...
11	69¼	69¼	72½	163	165¾	20¾	21¼	25¾	27
12	69	69⅛	72½	161½	165	20⅞	21½	25⅝	26⅞
13	69	69⅛	72½	157	161	20¾	21⅜	25½	26½

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

April	Sterling Exchange	Silver			Apr.	Sterling Exchange	Silver		
		New York, Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York, Foreign Origin	London
7	391¾	99½	58⅛	33½	11	391½	99½	59⅝	34½
8	389½	99½	57⅝	33⅜	12	391	99½	62⅞	34½
9	389¼	99½	58⅛	33⅝	13	389	99½	59⅞	34⅞

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, April 13, 1921

General conditions in the metal trade are unaltered. Buying continues to be purely for immediate requirements, which are extremely small, and price changes are narrow.

Copper

The copper market has been exceedingly quiet, with practically no sales. The larger producers are quoting 12.75@13c. for prompt shipment, and one or two thousand tons was probably sold at the lower figure on the 7th, 8th, and 9th. Beginning with Monday, however, most of this business seems to have died away. Some Michigan copper is reported to be offered for shipment from Buffalo at 12.50c. delivered, and we have also heard of business at 12⅝c. delivered. We do not consider that these sales represent any actual recession in the market, however, as practically all producers are adhering to the 12.75c. delivered price or better, and business done at less than that figure is carried on under exceptional circumstances. Export demand, both through the Copper Export Association and through individual agencies, has been practically nil.

Lead

The American Smelting & Refining Co. continues to quote lead at 4.25c., New York and St. Louis, and is reported to be freely offering prompt metal to consumers at this price. The outside market in New York is higher, and prices as high as 4.50c. have been paid during the last two or three days, especially where slightly later deliveries have been desired. The market has not been an active one, though. In St. Louis prompt lead is being freely offered, by practically all interests handling desilverized lead, at 4.25c., and it is altogether likely that this figure would be shaded slightly on desirable business. Chemical lead commands 10 to 15 points premium.

Two weeks ago in these columns we mentioned the offering of Spanish lead in the New York market. Of the 2,000 tons to be shipped here for taking care of small orders, half has already been received and the remainder is said to be afloat. In addition, it now develops that a large American lead consumer has purchased 5,000 tons of this Spanish lead. The details have not been made public, but we surmise that shipment is to be immediate and that the price paid was about £19 5s., which would be the equivalent of about 4.25c., New York, after all expenses have been allowed. This would indicate that this particular consumer, who follows the market closely, does not feel that present prices are likely to recede in the next few months, and also that no large tonnage could be secured in this country at the present A. S. & R. price. The question of the valuation of this lead for customs purposes has also been discussed. The best opinion seems to be that the proposed plan of basing the duty on the American valuation is unlikely to go into effect, at least not soon. In the Fordney tariff bill, which was again introduced in the House yesterday, this provision was omitted in favor of a scheme for a quarterly valuation of foreign exchange by the Director of the Mint, this valuation being used in connection with the foreign price for determing the duty. However, a depreciation of foreign exchange greater than 66⅔ per cent may not be set, so if this bill becomes a law, importations from Germany apparently would be discriminated against.

Zinc

The market has softened slightly, and prices have declined five points to 4.60c., East St. Louis. As usual, the decline was accompanied by a drop in demand, and sales have been disappointingly small. At the lower level of the market, producers are loath to interest themselves in selling the metal, feeling that they cannot [illegible] longer. They are furthermore indisposed to make future offers, their reluctance being due to the thought of a possible [illegible] in the market. Consumers seem well supplied. The drop in steel prices has had no appreciable effect on the market. The demand for zinc pigments seems to have improved somewhat. High-grade zinc sold during the week at 6.75@7c. per lb.

Tin

All grades have been dull, with price changes narrow. Tin is becoming the object of little interest in this country among dealers, and practically all the business is being done by large houses with international connections. These are only willing to sell at the price for which they can make replacements.

Straits tin for future delivery: April 7th, 29.25@29.75c.; 8th, 29.25@29.75c.; 9th, 29.25@29.75c.; 11th, 29.50@30c.; 12th, 29.50@29.75c.; 13th, 29@29.25c.

Arrivals of tin, in long tons: April 9th, Straits, 290; China, 5.

Silver

During the latter part of the week ending April 9, small buying orders for China account came into the market, with the result that some business was done for Frisco delivery. The London and New York markets continued quiet until April 12, when buying by China and the Indian bazaars jumped the price to 36½d. in London and 62⅞c. in New York. This sharp advance brought out additional offerings of silver, and as China and the Indian bazaars turned sellers on the rise, the price broke again on April 13. The market closes uncertain.

Mexican Dollars—April 7th, 44½; 8th, 44⅛; 9th, 44½; 11th, 45⅝; 12th, 48; 13th, 45⅝.

Gold

Gold in London: April 7th, 104s. 7d.; 8th, 104s. 11d.; 11th, 104s. 10d.; 12th, 104s. 10d.; 13th, 105s. 1d.

Foreign Exchange

European exchanges have held steady, with lire continuing to gain strength, owing to silk purchases and speculation. South American money has been much depreciated recently, the Argentina peso being quoted on Tuesday, April 12, at 32.625c., compared to par, 42.44c.; the Chilean peso, 13c., compared to par, 36.5c.; and the Brazilian milreis 13.5c., compared to par, 43.45c. Francs were 7.08c.; marks, 1.62c.; and lire, 4.595c. New York funds in Montreal, 12½ per cent premium.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 22@23c. per lb.; 22½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 5¼c.; market dull. W.C.C. brand, 5¾@6c. per lb. Cookson's "C" grade, spot, 9¾c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb. Demand light, with heavy supplies available.

White antimony oxide, Chinese. guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.65 per lb., 500 lb. lots.

Cadmium—Nominal, $1@$1.10 per lb., in 1,000-lb. lots. Price reduced as a reflection of London drop. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $4 per lb.; black oxide, $3@$3.10 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $250@$300 per oz.

[1]Molybdenum Metal in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 38@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—$72@$75 per oz. Market has stronger undertone.

Quicksilver—Nominally, $44@$46 per 75-lb. flask. San Francisco wires, $46.

[1]Rhodium—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]Selenium—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]Thallium Metal—Ingot, 99 per cent pure, $20 per lb.

[1]Tungsten Metal—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 45@50c. per long ton unit, f.o.b. Atlantic ports.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $7.45; Mesabi bessemer, 55 per cent iron, $7.20; Old Range non-bessemer, 51½ per cent iron, $6.70; Mesabi non-bessemer, 51½ per cent iron, $6.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5.80; old bed concentrates, 63 per cent, $6.70; Harmony, cobbed, 63 per cent, $6.70; new bed low phosphorus, 65 per cent, $9.50.

Manganese Ore—30c. per unit, seaport; chemical ore (MnO_2) $60 per gross ton, lump; $70@$75 per net ton, powdered. Market dull.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]Titanium Ores—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]Zircon—Washed, iron free, 3c. per lb.

[1]Zirkite—According to conditions, $70 @$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., April 9—Zinc blende, per ton, high $24.80; basis 60 per cent zinc, premium, $22.50; Prime Western, $22.50; fines and slimes, $21@$20; average settling prices, all grades of zinc, $22.49.

Lead, high, $44.20; basis 80 per cent lead, $45@$47.50; average settling price, all grades of lead, $42.47 per ton.

Shipments for the week: Blende, 5,397, lead, 1,683 tons. Value, all ores the week, $192,850.

Buyers manage to secure a little over 5,000 tons of blende each week without advancing prices, but they would take more if sellers would let them have it.

Lead was advanced $5 per ton this week, with increased demand.

Platteville, Wis., April 9—No market for zinc or lead. Mining condition unchanged. Shipments for the week: Blende, 514 tons. Shipments for the year: Blende, 10,829; lead ore, 550 tons. Shipped during the week to separating plants, 664 tons.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $2,000@ $3,000; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@ $75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7 per long ton, f.o.b. Cartersville, Ga. Small lots as low as $5.

Bauxite—High-grade French bauxite, $8@$10 per ton, Atlantic ports. American quotations the same. Consumers generally well supplied. Prices vary according to grade.

Chalk—English, extra light, 5@5½c. Domestic light, 4½@5c.; heavy, 4@4½c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@ $10; washed, $10@$12; powdered, $15@ $20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $15@ $20, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $15@$25, f.o.b. American ports; powdered, $35@$45, f.o.b. New York.

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[1]Furnished by Foote Mineral Co., Philadelphia, Pa.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar—Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20 per ton, f.o.b. Illinois mines, and $20 f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, $60; lump, $17.50, f.o.b. Heathden, N. M. Ground, acid grade, 97 per cent CaF_2, $32, New Mexico. Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pa. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 7½@8c. per lb.; chip, 6@6½c.; dust, 4@4½c. No. 1 flake, 7c.; amorphous crude, ¾c.@2¾c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$2 per net ton; 1½ in., $1.50@$2. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined—Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned—$38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.) High freight rates retarding business. Steamers quoting $8, Pacific to Atlantic ports.

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); all f.o.b. New York.

[1]**Monazite**—Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $7.35; 68 per cent, $6.85; 68@66 per cent, $6.60.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 14c., c.i.f. Atlantic seaport; furnace size, 14c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$40, talcum powder grade. Southern talc, powdered, carload lots, $10@$14 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 8@9c. per lb. in carload lots.

Sodium Nitrate—$2.60@$2.75 per cwt. ex vessel, Atlantic ports. Market quiet.

Sodium Sulphate—For 95 per cent material, $20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; $32@$33 per ton, New York.

Potassium Sulphate—Domestic, $215@$220 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 15c. per lb. of chromium contained; 4 to 6 per cent carbon, 16@17c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $85@$90, f.o.b. furnace; resale, $90, delivered; English, $90@$95, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $32, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $50@$55; 50 per cent, $85@$90; 75 per cent, $145@$150.

Ferrotungsten—Domestic, 70 to 80 per cent W, 51@55c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c. duty paid f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—Basis 30 to 40 per cent, $5 per lb. of V contained, plus [illegible]@$2 differentials and according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York list price, 20@20½c. per lb.; wire, 15c.

Lead Sheets—Full lead sheets, 7½c.; cut lead sheets, 7¾c. in quantity, mill lots.

Nickel Silver—33½c. per lb. for 18 per cent nickel.

Yellow Metal—Dimension sheets, 18¾c.; sheathing, 17¾c.; rods, ⅝ to 3 in., 15¾c.

Zinc Sheets—$11 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $80 per net ton, shipping point; arches, keys, wedges, $85; splits, soaps, $100.

Fire Brick—First quality, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $45@$50.

Magnesite Brick—9-in. straights, $90@$100 per net ton; 9-in. arches, wedges and keys, $105; soaps and splits, $120.

Silica Brick—9-in., per 1,000: $45@$55 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, April 12, 1921

Operating rates of the Steel Corporation and the independent steel producers are approaching uniformity. The Steel Corporation's operations continue to decrease, a guess for this week being an ingot production about 40 per cent of capacity, whereas independent operations are increasing slightly. Practically all reports of late have underestimated the independent production, which is probably slightly above 30 per cent at the present time, though some trade estimates have run as low as 15 per cent.

Pig Iron—Merchant pig-iron production is still lighter. Consumers' stocks are not exhausted, and there remain stocks at many merchant furnaces, including many that are out of blast, and not a few of the steel works have large stocks of basic iron, some of this iron being for sale. Prices are largely nominal, at $25, Valley, for bessemer, malleable, and foundry, and $23 for basic.

Steel Corporation Tonnage—The Steel Corporation's unfilled obligations decreased 649,102 tons in March, or about the average of several months preceding, but shipments were so much lighter that it appears that scarcely any new business was booked during the month. Unfilled tonnage remaining March 31 was 6,284,765 tons.

Coke

Connellsville—Furnace, [illegible]; foundry, [illegible]

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[1] Foote Mineral Co., Philadelphia, Pa.

Policies of the Copper Companies

Largest Producers Have Shut Down, but Some Smaller Companies Continue To Operate—Production Cut More Than Half—Many Industries Affected—Export Trade Improving—Some Operators Now Bettering Their Position

THE LOGICAL METHOD of countering the blow of below-cost-of-production prices, ceasing production, is being followed by farmers and miners, whose industrial existence has been disturbed through the world-wide deflation in prices. Cotton growers have met the issue by decreasing acreage, and the copper producer has cut production. During months of threatened action much was said about abandoning operations, though relatively little was accomplished to this end, but the copper companies have finally translated words into deeds. Virtually all the large copper mines of the country are now shut down, and many of the smaller ones. The disheartening conditions under which producers have been operating for a year or more, the steady decline in the price of the metal to an abnormally low figure, and the piling up of a huge surplus are briefly the well-known underlying causes of this situation.

Some hope was expressed in February, after the financing of the copper surplus, that at least a psychological improvement in the market would ensue, possibly sufficient to ward off the necessity of the serious step the producers have now taken. Psychological effects upon the market are evidently confined to a subordinate rôle as market influences, for no noticeable improvement followed the execution of the financial arrangements. Producers were left in practically the same position as before, but with some benefit in the resultant easing of financial pressure.

The half-way measures of the copper operators in advocating a reduction in output, but reluctantly following their plans with not more than a small cut, have given way to sterner discipline. Practically over night, domestic production has dropped about 90,000,000 lb. monthly, to 45,000,000 lb., with excellent possibilities for further decreases, particularly by smaller copper operators who have not yet announced suspension but who are expected to follow suit.

The leaders in the movement to stop pouring copper on a saturated market were the four porphyry coppers, Utah, Ray Consolidated, Chino, and Nevada Consolidated, and the Phelps Dodge Corporation and the Anaconda Copper Mining Co., which, together with Calumet & Hecla Mining Co. (subsidiaries included) and Old Dominion Copper Co., have decided temporarily to cease productive operations. The following is a list of copper companies intending to abandon production by May 1 and an estimate of the effect on present production:

	Lb.		Lb.
Anaconda	10,000,000	Chino	3,000,000
Utah	7,500,000	Nevada Con.	3,000,000
Calumet & Hecla	7,400,000	Old Dominion	2,200,000
Phelps Dodge	6,000,000	Inspiration	4,500,000
Ray Con.	3,000,000		
Total			46,600,000

Well over half the current copper production is thus accounted for by these copper companies, the remainder coming from smaller companies, some of which have costs low enough to operate profitably. It is noticeable that a few of the companies that intend to continue, notably Calumet & Arizona, and Miami Copper, are not weighed down with heavy surplus stocks and have sold their copper regularly in the market—to their evident advantage. Their individualistic stand at present is prompted no doubt by their favorable financial condition and by the prospect of high precious-metal credits in reducing costs.

The effect of the shutdown in the country's leading copper districts is not confined to the visible and immediate reduction in copper output. Unemployment in Butte, Calumet, or Bisbee, wherever it occurs, lowers the purchasing power of the community and disturbs retail trade generally. Railroad companies are heavy financial losers, as the revenue derived from the freight on copper, fluxes, fuel, and the thousand and one other items which are required by a smoothly running copper-producing community is an important element in profitable operation. It is not difficult to picture the predicament of a railroad such as the Southern Pacific, serving the copper territory of Arizona, the leading copper-producing state in the Union. Incidentally, the silver production of the United States will decline through the withdrawal of much byproduct silver.

Some of the disadvantages have been enumerated. On the other hand, absolute curtailment is the only card left for copper producers to play with any prospect of scoring against the tremendous stock of surplus and unconsumed copper on hand. There is available at the present time close to a billion pounds of copper, generally produced at a cost far above the level of the market. A heavy loss would be entailed were this surplus stock to be marketed under present conditions.

The copper producers have followed in the steps of the zinc companies, which curtailed operations heavily last fall and winter. Unfortunately for the zinc industry, no improvement in zinc prices followed, but the producers were placed in a much better position than if production had been continued.

Export business has shown a decided betterment since the first of the year. The following table gives the movements of copper to and from the United States for fourteen months ended with February, 1921, from which it can be seen that the last four months of 1920 were disappointing in the net results of copper movements. November and December shipments into the United States only slightly overbalanced exports. Foreign trade in copper has improved recently, and for February—the last month for which statistics are available—a surplus export balance of over 21,000,000 lb. is indicated.

Despite the political difficulties in which Germany is enmeshed, a surprisingly large proportion of export copper has been moving to that country, and greater support has been consistently given to our copper market by Germany than by any other country during the last four months. Whereas the American copper imported by France and the United Kingdom is largely financed through liberal credit arrangements, Germany is largely paying cash, another peculiar feature of present copper movements.

COPPER MOVEMENTS IN 1920—1921
(In Pounds)

1920	Total Exports	Exports to Germany	Total Imports	Excess Exports
Jan.	49,684,000	...	37,963,000	11,721,000
Feb.	57,595,000	....	45,227,000	12,368,000
Mar.	88,035,000	10,661,000	39,144,000	48,891,000
April	64,395,000	14,003,000	27,812,000	36,583,000
May	82,792,000	7,055,000	53,861,000	28,931,000
June	57,986,000	11,415,000	51,530,000	6,456,000
July	46,869,000	5,635,000	30,491,000	16,378,000
Aug	45,859,000	4,808,000	31,361,000	14,498,000
Sept.	24,455,000	1,536,000	30,562,000	— 6,107,000
Oct.	23,302,000	3,263,000	34,187,000	—10,885,000
Nov.	38,561,000	6,347,000	38,292,000	269,000
Dec.	41,840,000	10,737,000	40,942,000	898,000
1921				
Jan.	54,857,000	18,802,000	39,770,000	15,087,000
Feb.	62,480,000	. .	40,637,000	21,843,000

Although there is no immediate improvement in sight for copper prices, either through an increased domestic or foreign demand, when a turn for the better does come the huge surplus stocks may disappear sooner than is generally supposed, and the condition of one of the country's greatest industries should return quickly to its normally prosperous status.

COMPANY REPORTS

American Zinc, Lead & Smelting Reports Deficit

The annual report of the American Zinc, Lead & Smelting Co. for 1920 states that losses from operations amounted to $92,409.20. Interest on bonds totaled $39,625.22, giving a total loss of $132,034.42. Surplus on Dec. 31, 1919, was $3,695,151.89. Deducting depreciation and dividends totaling $885,922.26 ($482,037 on the preferred stock and $403,885.26 for reserves), left a surplus of $2,677,195.21 on Dec. 31, 1920. A consolidated balance sheet follows:

ASSETS

Property account			$12,516,518.19
Investments			1,369,192.79
Cash in sinking fund			5,337.05
Current assets			
Ore stocks		$592,398.94	
Spelter, pig lead, zinc oxide and sulphuric-acid stocks		643,883.01	
Inventories of materials		1,021,090.13	
Cash		354,944.16	
Notes receivable		54,238.43	
Accounts receivable		617,456.76	
Advance to Wisconsin Zinc Co.		13,000.00	3,297,011.43
Deferred charges to operations			66,561.17
Total			$17,254,620.63

LIABILITIES

Capital stock issued	Shares	Par Value	
Preferred stock	96,560	$25.00	$2,414,000.00
Common stock	193,120	25.00	4,828,000.00
Total			$7,242,000.00
First mortgage 5 per cent. ten-year gold bonds			1,481,700.00
Reserves for depletion, depreciation, etc.			5,464,201.03
Current liabilities			
Accounts payable		$258,856.71	
Interest accrued		6,173.75	
Taxes accrued		31,839.76	
Drafts in transit		82,637.14	379,507.36
Insurance reserve fund			10,017.03
Surplus			2,677,195.21
Total			$17,254,620.63

Callahan Zinc-Lead Co.

A report of operations of the Callahan Zinc-Lead Co. for 1920 states that 128,781 tons of ore was milled, having a metal content of 332,650 oz. of silver, 18,991,830 lb. of lead, and 38,100,000 lb. of zinc. Shipments of zinc were 29,845,344 lb., containing 2,047,388 lb. of lead. Net profit from operations amounted to $266,247.73, according to the statement:

INCOME

Net value of shipments	$1,411,[illegible]	
Miscellaneous income	[illegible]	
Total income		$1,424,530.06

EXPENDITURES

Mining, milling, and royalties	$1,078,[illegible]	
Administration and general expenses	[illegible]	
Cost of maintenance and development during period of shutdown	21,937.34	
Miscellaneous items	[illegible]	
Total expenditures		$1,158,282.33
Operating profit for the year before providing for depreciation or depletion		266,247.73
Cash proceeds of sale of treasury stock	[illegible]	
Proceeds of sale of other mining companies' stock	[illegible]	
		171,062.10
Total		$437,309.83
Current surplus, Jan. 1, 1920		618,630.14
		$1,055,939.97
Deductions from current surplus during the year		
Sundry expense applying to prior years	37,691.89	
Improvements to mine and equipment	[illegible]	
Invested in other mining claims	[illegible]	
Cash distributed to stockholders from depletion reserve	[illegible]	
Total deductions		776,884.79
Current surplus at Dec. 31, 1920		$279,055.18

The company paid $2 a share dividends on 385,773 shares of $10 each. Operations ceased Oct. 31, 1920.

Calumet & Hecla Current Assets Decrease

The report of operations of the Calumet & Hecla Mining Co. for 1920 indicates that 57,627,883 lb. of copper was produced, at a cost of 20.73c. per lb.; 32,449,559 lb. was on hand Jan. 1, 1920, valued at 19c.; 43,019,141 lb., valued at 19.43c., was delivered during the year at 18.76c. per lb. Earnings statement follows:

Received for copper, delivered (18.76c.)	$8,069,949.71
Cost of copper, delivered (19.98c.)	8,596,001.49
Loss on copper (1.22c.)	$526,051.78
Loss by reduction of copper to market value (13c.)	3,635,780.81
Total	$4,161,832.59
Miscellaneous receipts, net	338,089.41
Net loss	$3,823,743.18
Dividends paid	500,000.00
Total	$4,323,743.18
Net increase in capital investments	200,243.18
Total	$4,523,986.36
Increase in reserves for depreciation and depletion	3,048,343.91
Decrease in balance of current assets	$1,475,642.45
Balance of current assets, Dec. 31, 1919	14,376,730.10
Balance of current assets, Dec. 31, 1920	$12,901,087.65

Osceola Consolidated Shows Loss

Copper; Michigan

A report of operations of the Osceola Consolidated Mining Co. for 1920 indicates that 7,465,773 lb. of copper was produced, at a cost of 24.18c. per lb.; 6,297,562 lb., valued at 19c., was on hand Jan. 1, 1920; 7,739,416 lb., valued at 19.97c., was sold at 18.61c. per lb. Earnings follow:

Received for copper delivered (18.61c.)	$1,440,016.58
Cost of copper delivered (20.53c.)	1,588,517.66
Loss on copper delivered (1.92c.)	$148,501.08
Loss by reduction of stock on hand to market	673,393.50
	$821,894.58
Miscellaneous receipts	44,379.26
Net loss	$777,515.32
Dividends paid	96,150.00
	$873,665.32
Capital investments increased	14,053.00
	$887,718.32
Increase in reserve (amortization)	336,827.92
Decrease in balance of current assets	$550,890.40
Balance of current assets, Dec. 31, 1919, adjusted	3,151,257.40
Balance of current assets, Dec. 31, 1920	$2,600,367.00

Allouez Mining Co.

Copper; Michigan

The report of operations of the Allouez Mining Co. for the year 1920 indicates that 2,499,239 lb. of copper was produced, at a cost of 23.9c. per lb.; 2,088,369 lb., valued at 19c., was on hand Jan. 1, 1920; 2,755,598 lb., valued at 20.19c., was delivered during the year. Earnings statement follows:

Received for copper, delivered (18.65c.)	$513,864.44
Cost of copper, delivered (20.75c.)	571,823.59
Loss (2.10c.)	$57,959.15
Loss by reduction of stock on hand to market	199,689.09
Total	$257,648.24
Miscellaneous receipts	[illegible]
Net loss	[illegible]
Additional taxes for 1917-1918	[illegible]
Total	[illegible]
Capital investments increased	[illegible]
Total	[illegible]
Increase in reserves (amortization)	[illegible]
Decrease in balance current assets	[illegible]
Balance of current assets, Dec. 31, 1919	[illegible]
Balance of current assets, Dec. 31, 1920	$58[illegible].74

MINING STOCKS

Week Ended April 9, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Adventure	Boston	....	....	*50		
Ahmeek	Boston	45	43½	45	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	½	7/16	½		
Allouez	Boston	18	16	18	Mar. '19	1.00
Anaconda	New York	38¼	35⅜	36⅞	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2½	2½	2½		
Ariz. Com'l	Boston	7⅞	7½	7¾	Oct. '18,	.50
Big Ledge	N. Y. Curb	5/16	¼	5/16		
Bingham Mines	Boston	....	....	8	Sept. '19, Q	.25
Calumet & Arizona	Boston	46	42½	46	Mar. '21, Q	.50
Calumet & Hecla	Boston	224	210	220	June '20, Q	5.00
Canada Copper	N. Y. Curb	....	....	*13		
Centennial	Boston	8	8	8	Dec. '18, SA	1.00
Cerro de Pasco	New York	26½	24⅛	25¾	Mar. '21, Q	.50
Chile Copper	New York	10¼	9⅞	10½		
Chino	New York	22½	19⅝	21¼	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*22½	*21½	*21½		
Con. Arizona	N. Y. Curb	....	....	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	...	...	1⅞		
Copper Range	Boston	33½	29½	33¼	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*32	*28	*28		
Davis-Daly	Boston	5⅞	5¼	5⅞	Mar. '20, Q	.25
East Butte	Boston	8	7¼	7¾	Dec. '19, A	.50
First National	Boston Curb	*75	*70	*70	Feb. '19, SA	.15
Franklin	Boston	1¾	1¾	1¾		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol.	New York	17	17	17	May '19, Q	1.25
Greene-Cananea	New York	22¾	20½	21⅞	Nov. '20, Q	.50
Hancock	Boston	....	....	2¼		
Howe Sound	N. Y. Curb	....	....	2½	Jan. '21, Q	.05
Inspiration Consol.	New York	32⅞	30¼	32⅜	Oct. '20, Q	1.00
Iron Cap	Boston Curb	6½	6	6	Sept. '20, K	.25
Isle Royale	Boston	18	17½	18	Sept. '19, SA	.50
Kennecott	New York	18⅜	16¾	18⅜	Dec. '20, Q	.50
Keweenaw	Boston	1 3/16	1	1 3/16		
Lake Copper	Boston	2½	2½	2½		
La Salle	Boston	2	1¼	1¼		
Magma Chief	N. Y. Curb	...	...	*21		
Magma Copper	N. Y. Curb	19½	18½	19½	Jan. '19, Q	.50
Majestic	Boston Curb	*10	*10	*10		
Mason Valley	Boston	..	..	1¼		
Mass Consolidated	Boston	*95	*80	*85	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	3¼	3⅝	3¾		
Miami Copper	New York	18⅝	17½	18½	Feb. '21, Q	.50
Michigan	Boston	3	3	3		
Mohawk	Boston	48	44½	48	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	4¾	4½	4½		
Nevada Consol.	New York	10½	10	10⅜	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	14	13½	14	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....	....	*5		
North Butte	Boston	9⅜	8½	9⅜	Oct. '18, Q	.25
North Lake	Boston	½	¼	¼		
Ohio Copper	N. Y. Curb	....	....	3/16		
Old Dominion	Boston	....	....	17½	Dec. '18, Q	1.00
Osceola	Boston	24	23	24	June '20, Q	.50
Phelps Dodge	Open Mar.	†160	†130	....	Apr. '21, Q	1.00
Quincy	Boston	37½	37	37	Mar. '20, Q	1.00
Ray Consolidated	New York	12½	11⅞	12⅜	Dec. '20, Q	.25
Ray Hercules	Boston Curb	*35	*35	*35		
St. Mary's Min. Ld.	Boston	30¼	30¼	30¼	June '20, K	2.00
Seneca Copper	Boston	...	...	15¾		
Shannon	Boston	1⅛	*90	*90	Nov. '17, Q	.25
Shattuck Arizona	New York	6	5⅝	6	Jan. '20, Q	.25
South Lake	Boston	....	....	1½		
Superior Copper	Boston	....	....	3	Apr. '17,	1.00
Superior & Boston	Boston	1¾	1½	1¾		
Tenn. C. & C. cfs.	New York	7⅞	7⅜	7⅜	May '18, I	1.00
Toulumne	Boston	*43	*42	*43	May '13,	.10
United Verde Ex.	Boston Curb	25	21	23½	Feb. '21, Q	.50
Utah Consol.	Boston	3	3½	3¾	Sept. '18,	.25
Utah Copper	New York	49½	46½	48½	Mar. '21, Q	1.00
Utah M. & T.	Boston	1½	1½	1½	Dec. '17,	.30
Victoria	Boston	1½	1½	1½		
Winona	Boston	....	....	*40		
Wolverine	Boston	10⅜	10	10		
		NICKEL-COPPER				
Internat. Nickel	New York	15⅛	14⅛	14⅞	Mar. '19,	.50
Internat. Nickel, pf	New York	...	...	80	Feb. '21, Q	1.50
		LEAD				
National Lead	New York	72	71½	72	Mar. '21, Q	1.50
National Lead, pfd	New York	..	..	102½	Mar. '21, Q	1.75
St. Joseph Lead	New York	12¼	12⅛	12¼	Mar. '21, Q	.25
Stewart Mining	Boston Curb	....	....	*6	Dec. '15,	.05
		ZINC				
Am. Z. L. & S	New York	8¼	8¼	8¼	May '20,	1.00
Am. Z. L. & S, pfd.	New York	27	27	27	Nov. '20, Q	1.50
Butte C. & Z.	New York	4½	4½	4½	June '18,	.50
Butte & Superior	New York	11½	11	11½	Sept. '20,	1.25
Callahan Zn-Ld	New York	5¼	4⅞	5	Dec. '20, Q	.50
New Jersey Zn	N. Y. Curb	136	132	134	Feb. '21, Q	2.00
Success	N. Y. Curb	*3½	*2	*2½	July '16,	.03
Yellow Pine	Los Angeles	..	..	*150	Sept. '20, Q	.03

* Cents per share. † Bid or asked. ‡ Quotation missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra

Stock	Exch.	High	Low	Last	Last Div.	
		GOLD				
Alaska Gold	New York	1⅛	1	1⅛		
Alaska Juneau	New York	1½	1½	1½		
Carson Hill	N. Y. Curb.	....	....	22¾		
Cresson Consol. G.	N. Y. Curb	1⅛	1 7/16	1⅛	June '20, Q	$0.10
Dome Extension	Toronto	*60½	*60½	*60½		
Dome Mines	New York	16⅞	16½	16¾	Jan. '21, Q	.25
Golden Cycle	Colo. Sprgs.	†*66	†*64	*65	Dec. '20, Q	.02
Goldfield Consol.	N. Y. Curb	*8	*6	*7	Dec. '19,	.05
Hollinger Consol.	Toronto	7.00	6.90	6.95	Feb. '21, M	.05
Homestake Mining	New York	*60	*59	*59	Sept. '19,	.50
Kirkland Lake	Toronto	*49½	*49½	*49½		
Lake Shore	Toronto	1.16	1.12	1.16	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	1.98	1.91	1.91	Jan. '21, K	.05
Porcupine Crown	Toronto	*21	*20	*20½	July '17,	.03
Portland	Colo. Sprgs.	*45	*45	*45	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*5	*3	*4½	May '19,	.05
Silver Pick	N. Y. Curb	*7	*5	*5		
Teck Hughes	Toronto	*12	*11½	*11¾		
Tom Reed	Los Angeles	1.16	1.10	1.14	Dec. '19,	.02
United Eastern	N. Y. Curb	2⅞	2½	2 9/16	Jan. '21, Q	.15
Vindicator Consol.	Colo. Sprgs.	†*20	†*17½	*1	Jan. '20 Q	.01
West Dome Consol.	Toronto	*6¾	*6¾	*6¾		
White Caps Mining	N. Y. Curb	*8	*6	*7		
Yukon Gold	N. Y. Curb	¾	¾	¾	June '18,	.02½
		SILVER				
Arizona Silver	Boston Curb	*25	*20	*24	Apr. '20, M	.03
Batopilas Mining	New York	¾	¾	¾	Dec. '07, I	.12½
Beaver Consol.	Toronto	*35¾	*35½	*35½	May '20, K	.03
Coniagas	Toronto	1.90	1.90	1.90	Nov. '20, Q	.12½
Crown Reserve	Toronto	....	....	*16	Jan. '17,	.05
Kerr Lake	Boston	....	....	2¾	Jan. '21, Q	.12½
La Rose	Toronto	*23	*21	*23	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*20	*17	*17	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.00	1.00	1.00	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	7⅛	6¾	7	Jan. '21, QX	.50
Ontario Silver	New York	4½	4	4	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	1½	1⅜	1½	Jan. '12,	.10
Peterson Lake	Toronto	*6½	*6½	*6½	Jan. '17,	.01½
Temiskaming	Toronto	*24	*24	*24	Jan. '20, K	.04
Trethewey	Toronto	*13½	*13	*13	Jan. '19,	.05
		GOLD AND SILVER				
Atlanta	N. Y. Curb	*2	*1	*1		
Barnes-King	Butte	‡....	....	1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*66	*61	*66		
Cashboy	N. Y. Curb	*7	*5½	*6		
El Salvador	N. Y. Curb	5/16	¼	¼		
Jim Butler	N. Y. Curb	*14	*10	*11	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*9	*5½	*6	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	¼		
MacNamara M.& M.	N. Y. Curb	*15	*13	*14	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1½	1 5/16	1⅜	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1¼	1	1¼		
Tonopah-Extension	N. Y. Curb	1 7/16	1⅜	1 7/16	Apr. '21, Q	.05
Tonopah Mining	N. Y. Curb	1½	1 3/16	1¼	Oct. '20, SA	.05
West End Consol.	N. Y. Curb	1 1/16	1 5/16	1	Dec. '19, SA	.05
		SILVER-LEAD				
Caledonia	N.Y. Curb	*12	*10	*11	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	1.05	1.00	1.05	Dec. '20,	.15
Chief Consolidated	Boston Curb	....	....	2½	Feb. '21, Q	.05
Consol. M. & S.	Montreal	....	....	16	Oct. '20, Q	.62½
Daly Mining	Salt Lake	....	....	2.50	July '20, Q	.10
Daly-West	Boston	....	....	3	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	....	....	2⅛	Dec. '20, K	.25
Electric Point	Spokane	*7	*7	*7	May '20, SA	.03
Federal M. & S.	New York	....	....	6¼	Jan. '09,	1.50
Federal M. & S., pfd.	New York	....	....	23	Mar. '21, Q	1.00
Florence Silver	Spokane	*16	*16	*16	Apr. '19,	.01½
Grand Central	Salt Lake	....	....	*37½	June '20, K	.03
Hecla Mining	N. Y. Curb	3 15/16	3¾	3 13/16	Mar. '21, Q	.15
Iron Blossom	N. Y. Curb	15	15	*15	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	....	....	3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*7	*5	*6½		
Prince Consol.	N. Y. Curb	5/16	¼	¼	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*6	*5	*6	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*8	*7	*7½		
South Hecla	Salt Lake	*95	*95	*95	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	3/16	⅛	1/16	Oct. '17,	.05
Tamarack-Custer	Spokane	2.00	1.90	1.90	Jan. '21, K	.04
Tintic Standard	Salt Lake	2.62½	2.27½	2.55	June '20, Q	.10
Utah Apex	Boston	2¼	2	2	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*4	*3	*3½	Nov. '17,	.01
		QUICKSILVER				
New Idria	Boston	....	....	*95	Jan. '19,	.25
		VANADIUM				
Vanadium Corp.	New York	31	28½	29½	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal	..	...	73	Jan. '21, QX	3.50
Asbestos Corp., pfd.	Montreal	....	...	89¾	Jan. '21, QX	3.75
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref.	New York	38½	36	37¼	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf.	New York	74½	69⅞	74	Mar. '21, Q	1.75
Am. Sm. pf. A	New Yor	63	63	63	Apr. '21, Q	1.50
U. S. Sm. R. & M.	New York	29½	26	29	Jan. '21, Q	.50
U.S.Sm.R.& M. pf.	Boston	42	40¼	40¼	Jan. '21, Q	.87½

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Civilization and Copper

THE BIG COPPER MINES, including some of the largest of the "porphyry coppers," have shut down because they could not foresee any trend which promised relief from existing conditions. Every analysis of the situation during the post-war period has turned out to be erroneous. It was confidently foretold by everyone that after the long famine in copper which had been undergone by central and eastern Europe, together with the rebuilding necessary in France and Belgium, and the resumption of normal industrial activity in all countries, there would be an unprecedented demand for copper, and 30c. copper was freely predicted for some time during 1921. Some of our keenest observers, successful producers of metal, great bankers, visited Europe after the war and confirmed these analyses. They reported a great lack of the metal, and, therefore, an enormous "latent demand," which would soon be transformed into a bull market. That happened over a year ago. All prognosticators were wrong. Copper has sagged in price and in demand from that day to this, and the recent closing down of the big mines was not only a sign that they had been operating at a loss, but indicated a lack of any vision of a turn for the better in the near future.

What was the compelling factor which was neglected by everyone, captains of industry and the rest? Probably this: they reckoned on the basis of the past, forgetting that the great cataclysm which had befallen Europe was unprecedented, and that the favorite analogies of the Civil War in the United States and the Franco-Prussian War in Europe really were not applicable or comparable in proportion and in purport.

Germany and Russia and other countries bought our copper before the war not because they were populous, but because they possessed a developing people, eagerly advancing in industrial and civic life. Their energies were given largely to new construction, greater public comforts, development of natural resources. In a word, it was civilization and science which bought our metal. China is populous, but it is not a great consumer of our copper: India possesses a considerable fraction of the population of the earth, but that fact does not affect our copper market. *The consumption of copper, and its price, depend, then, on the level of industrial civilization*, and on the concomitant economic and financial conditions.

The Great War struck at the heart of civilization. The catastrophe, through which we have by no means yet safely passed, set back, to all appearance, the progress of mankind enormously. Ideals of culture, of scientific progress, of universal friendship, of a breaking down of national prejudices and of economic and intellectual boundaries, were antagonized and done to death by the materialism and rude onslaught of the "Blonde Beast." The reactions of hate and violence which were awakened all over the world resulted in the miserable calamities of Russia, whose civilization has dwindled away with the most appalling swiftness.

Europe has broken up into smaller states, a turning back of the trend of history, which was plainly toward larger and larger federations of states; and the inhabitants of all Europe still think mainly in terms of war, and in a large degree have become resigned to a condition wherein they are satisfied with buying what they may wear and what they may eat, like China and India. The unattached masses in Russia have been in a turmoil of unrest and have been non-productive; and symptoms of the same disease have been marked in nearly every country of Europe, including England. We in this country have suffered from the contagion, but not dangerously. We have emerged strengthened by the test.

What of the future? And what can be done? All, we repeat, depends on the health of civilization, and the confusion of barbarism in Europe, our commercial partner. And the biggest factor in this is the United States. Had the United States been governed with superior wisdom it is altogether probable that the European catastrophe might have been prevented; as it is, the responsibility which now rests on our people and our Government is vast. Therefore, to revive business, to renew mining, the first thing we must do is to work on Europe's problems. Europe is what ails us—more than taxes or tariffs. To be puttering around about protective tariffs at this moment is to be fiddling while Rome burns.

It is Congress, however, which will put in its spare time in fiddling. Signs are not wanting that we have statesmen who see to the heart of the matter. We have such a one in Hoover, as his utterances of over a year ago testify; and we think we have such a one in Hughes. We are hopeful and optimistic over the outcome, and impatiently await the stages of action, after the disintegrating delay caused by the deadlock in the last Administration.

A Question of Policy

CERTAIN BRANCHES of the Executive Department of the National Government in Washington have adopted and gone far on a policy of some importance, which we will presently sketch out. We are not clear as to how far the propriety of this policy, as a national feature, has been investigated, how far it would be approved of by the President, how far by Congress, how far by the people at large.

The policy we refer to has, so far as our observation goes, been most actively pursued by the Bureau of Standards, which, being in the Department of Commerce, is now in Mr. Hoover's department, and in the Bureau of Mines, which belongs to us miners anyhow.

Where private corporations are found which will contribute funds toward the elucidation of a problem of scientific and economic interest, these bureaus arrange to have their own experts carry on these investigations, on funds provided fifty-fifty (or some other proportion) by the private corporation and from the public funds voted the Bureau by Congress. The results are not the exclusive property of the corporation which helps to finance the investigation: they are for the information and for the assistance of the public. These bureaus, therefore, feel that they contribute to the public service to which they are devoted, and by these thrifty strokes of business eke out the limited funds which Congress doles out to them. Of course, the corporations in question also feel that they have made a wise and thrifty deal. They do not plan it for the public good—no corporation can conscientiously contribute from its earnings to anything except what will advance its own interests—but for their own advantage.

The problem agreed upon is usually selected by the corporation, and is one the solution of which is of vital importance to its earnings. It does happen, and not infrequently, that the problem is one the solution of which will immediately benefit financially only the co-operating corporation, because of some exclusiveness of business or of control in the field which the corporation covers. In such a case the corporation gets the immediate benefit, or a running start on competition; and the public and science gets the knowledge.

This plan of business deal varies in some cases from the common type as between Bureau and corporation, in that the Bureau may and does enter into such a financial partnership with a non-Governmental or other society or similar organization, in order to promote some movement in which both are interested. What looks like a mutually profitable arrangement may be made, looking toward the common good, with an organization consisting essentially of the engineer element, or again of the employer element, or yet again of the labor element.

We have tried to outline the problem clearly. We do not know the origin of this movement. We imagine it started within the Government, where co-operation between different divisions of a bureau frequently demands a pooling from two funds assigned by Congress for two different and specific purposes; where the co-operation between different bureaus in a department often demands a similar pooling of funds and expert investigation; and where the elimination of duplication even between departments is sometimes best accomplished by similar common sense and tape-cutting methods.

It is apparently not a far step, in mental and logical processes, to proceed from these business arrangements within the Government to such an arrangement between the Government bureau and a non-Governmental technical society. In reality, however, there is a radical departure involved in this step; and a policy has been adopted which must be closely scrutinized on all sides.

From the technical society to the commercial or labor organization the change is made by easy degrees, and from that to individual corporations. The further step to the similar business partnership between bureaus and individuals has not yet been made, so far as we know, but there is no reason in the world why it should not be taken, if the other steps have been justified.

The main point at issue is: Are bureaus empowered to go into business for themselves, work on outside capital, and select their own partners, who specify the special field of this partnership? The next point would be whether, granted (which we must discover) that they are within their authority, they are wise in adopting this policy.

The Institute Transactions

THE American Institute of Mining and Metallurgical Engineers has done wisely in sending to its members a return postcard on which they may indicate which section of the current volume of *Transactions* they wish. These sections are issued really as separate volumes, and are four in number. Any member is entitled to all four if he wishes them: but if he is not interested he can save the Institute much money and himself a lot of bother by not ordering them. This plan will probably work a very considerable economy.

Systematized Shaft Work

SHAFT SINKING today is a specialized business, and the conditions under which it is done usually involve not only a considerable outlay in the matter of equipment and the employment of skilled workmen but careful planning as well. Considering the function of a shaft and its relation to subsequent operations, it is obvious that it is of the utmost importance that this first step to the opening up of an underground mine be accomplished in a manner that will fulfil all of the requirements. The shaft is, in a way, the artery of the mine, and upon its performance—we admit the possibility of an exhaustion of ore reserves, of course—depends the existence of the mine. Whether the shaft be sunk in rock, hardpan, loose ground, or quicksand, there is similarity of procedure, although each operation may involve details peculiar to the conditions met.

The concreting of shafts and the use of steel timbers are by no means new in mining, but in this particular work several innovations have been introduced, and present practice not only includes adequate facilities for handling material at the bottom and in the shaft but on the surface as well. There must be, if the job is to be efficiently done, a complete cycle of work wherein each operation follows the other in regular order. There will be, of course, unforeseen interruptions that necessitate special treatment, but such delays can usually be compensated by a gain in progress under ordinary conditions.

In his article, "Sinking and Concreting of Pyne and Songo Shafts," which appears in this issue, J. H. Stovel has brought out several points that merit the attention of those who are engaged in (we say this with temerity in these perilous times) or contemplate (this with optimism) shaft sinking. The use of drill holes for eliminating pumping in this connection is not, we believe, general practice, but the plan was successful in the operation described, and at one of the shafts the drill hole was used in grouting to good advantage.

The use of different types of drills in different rock strata seems quite obviously good practice, although we know of instances where the same machines were used throughout an entire job. The proper care of machines is another example of good practice and one which the drill-machine manufacturer is continually recommending, although it may militate somewhat against sales.

It is interesting to note that lower costs for concreting were obtained at the Songo shaft, where the pipe method of distribution of the concrete was used, in contrast to lowering it with a bucket, as practiced at the

Pyne shaft. This would seem to be an argument for a proper crushing and screening of the slag used in the concrete mixture. In general, the results obtained in the different operations at both jobs indicate the success that may be had by following a well-systematized plan, which is true in any branch of mining as in other industries.

Theology Applied to Mining

MINING MEN are not much given to discussion of theology. Their business does not tend in the direction of the heavens; so such snatches of remarks as miners let drop quite naturally are likely to be flavored rather with allusions to the lower regions. They deal and traffic, indeed, with the product of the infernal flames—ores built by the fires that are not yet extinguished, as many a hot spring testifies.

As to the supernatural, however, many of us have become bald and literal. While we may refer flippantly in conversation to spiritual manifestations, we have long ago forsaken the belief in the personal devil and in the guardian angel. We assume, fishy-eyed, that we walk alone. Yet it is not beyond the realm of comprehension that science, still further advanced, may lead us, astonished, back to where we started from.

Have you not perchance a personal devil? Oh, no; not a conventional one, with horns and tail, and transparently blue. For one thing, such a familiar spirit would be ineffective and, therefore, not practical: you and I are all altogether too wise and too well-intentioned to listen to such an adviser. If we should once see such a one, we would have no more of him. But do you know a man—or a woman—a very well-appearing individual indeed, whom you rather admire, who has the faculty of dropping in for a chat with you, and leaving you vaguely dissatisfied, with a tinge of jealousy or rancor, or with the recrudescence of the bitterness of unworthy ambition, or with the uneasy awakening of a long-slumbering greed? Have you not recognized your personal devil—it is he, this debonair and self-satisfied but more or less meddlesome and insinuating friend! Watch that fellow—some day you'll catch the suspicion of a blue flicker around the chair he has just vacated, or detect the faint brimstone odor in his cigarette.

Or, you run across some chap now and then who shames you a bit (although you do not know it) with his honesty and independence. He does not at all resemble the angels—has no wings nor lustrous hair—it is barely possible, even, that he chews tobacco—it is almost a cinch that he has never been to college; but when he has passed the time of day with you or made some comment of homely philosophy on the world, you go off amused and smiling, with a truer enjoyment of the sunshine and your job. He envies nobody—no, not he—and nobody envies him. He is neither wasting his daylight hating the rich nor in despising the low-down and unfortunate. You would hardly be expected to recognize your guardian angel—and yet, think again, dear sir—was it not perhaps he?

The Works Chemist

ROUTINE LABORATORY WORK is one of the bugbears of the practice of chemistry. Too often the graduate in chemistry or chemical engineering accepts a laboratory position in which he has the same analyses to make, on the same kind of material, hundreds of times a week. He is likely soon to become discouraged. Of course, in the first week or two he learns a great deal. In school he has taken plenty of time, and a high degree of accuracy has been demanded. In practice he must make twenty assays in one-twentieth of the time he had formerly taken.

Also, he learns that a report of 34.63 per cent of silica in a slag is ridiculous. The sampling is nothing like as accurate as that; neither is the analytical method he is taught to use. So he learns to grind out the assays, dozens of them a day, and becomes oftentimes a mere automaton, equally proficient asleep or awake, and getting deeper and deeper into a rut. Sometime he may come to be chief chemist, in which case he may do only the most important routine work, and spend the rest of his time in bookkeeping. Of course the picture is not as discouraging as this at all plants: at Anaconda, for example, the laboratory is only a stage in the promotion of technical graduates through various works activities. However, it is true in many cases, and it is a condition of affairs which managers may well seek to obviate, both for the good of the "assay office" and the plant as a whole.

Too many managers and superintendents forget they have a laboratory: at least they do not use it to the best advantage. The chemist should be given a freer rein, and his interest aroused by a variety of analytical and research work. The laboratory should be in close co-operation with the purchasing department. Not only will the chemist be a happier employee, but the company will save money. One of the members of the Institution of Mining and Metallurgy, B. W. Holman, voiced this idea at a recent meeting in London. A great many mining and metallurgical supplies should be tested and analyzed and bought under specification. Among them may be mentioned:

Drill steel: What analyses give best results?

Rubber: How much filler and remade rubber do you buy because you make no analyses? Could you even give intelligent consideration to an analysis if made? The chemist can help you if you let him do a little testing.

Lubricating oils and greases: A fertile field for misrepresentation.

Cement: How do you know that the brand which you use is the best for the money, for your purpose? Granted it was the best when made, is it the best now?

Lime: You cyanide men, how much available CaO do you get for a dollar? Your chemist can tell you quickly.

Paint: A chemical engineer knows something about paint. Do you ask him or the paint salesman?

Coal and coke: Do you buy on the basis of analysis or heating value, or does the seller palm off on you his extra wet and high-ash cars?

Candles, carbide, cyanide, chloride of lime: Here are a few more of the C's whose strength and condition should be checked.

It may be argued that the ordinary works chemist has not the knowledge or equipment to test miscellaneous supplies. However, elaborate tests are not usually needed. By far the majority of the work which should be done can be conducted by the usual type of technically trained chemist, aided by a little outside reading. Any extra equipment need will quickly be paid for by the savings made.

We hope that every chemist who reads this will ask himself if he is making full use of his ability; and that every plant manager will also question himself whether he is making full use of his chemical laboratory.

WHAT OTHERS THINK

Price vs. Analysis as a Basis For Buying Steel

I have noted with interest E. A. Wright's paper on the standardization of mining equipment, read before the Institution of Mining and Metallurgy and mentioned in the *Engineering and Mining Journal* of Feb. 12. Years of experience in buying and selling iron and steel products for the mining field have convinced me that Mr. Wright is correct and that it is high time for the managers and purchasing agents to get together and do something that will insure their getting uniform material that is adapted to the work to be done.

Mr. Wright states that one manufacturer refused to give him information. I think that the time is not far distant when manufacturers will be glad to get business by giving all possible information regarding the materials used in their products. This can be brought about by some progressive manufacturer soliciting business on this basis.

It has been pretty well demonstrated that balls for ball mills give best results when the chrome content is about 0.5 per cent or a trifle less, and the carbon about 0.65 or 0.85 per cent. The addition of about 3 per cent of nickel makes a ball of still longer life. These balls, of alloy steel, are good through to the center. The little forging done to a ball may do the outside some good, but the effect of forging does not persist to any appreciable depth, and after the ball has worn down a quarter of an inch or so, the life of the ball then depends on the alloys, including carbon. The same thing applies to a great extent to shoes, dies, and like parts.

There is a story, probably true, that a mining company in South America ordered a carload of shoes and dies, simply stating that they were to be of ———— steel. These were ordered from a reputable machinery company, which, in turn, ordered them from a manufacturer of steel. The shoes and dies eventually arrived at the mine after paying heavy freight, and when put in operation were like so much cheese. Naturally the mill owner howled, and the howl was passed through the machinery house to the steel manufacturer, who calmly said: "You are in error; some one has substituted; that material is not ours." This manufacturer had not marked his product, and the purchaser had no recourse.

Another instance: A mining company in Central America bought a ———— steel lining for a ball mill. After great expense the lining arrived, and lasted about as long as the cast-iron linings that were made by the mines foundry. The purchaser was disgruntled, but it did him no good.

A short time ago a purchasing agent bought for shipment out of this country about twenty-five tons of steel shoes and dies on a price basis without regard to analysis. He thinks he has saved money: maybe; maybe not. I would bet on the not.

About five years ago I got in touch with a small steel manufacturer, told him of the conditions existing, and obtained his co-operation in order to get some good steel. We got all the data we could, worked out a formula that we thought would pass, and the results proved very satisfactory. For three or four years I bought steel from this man, and it was all bought on analysis. The results were highly satisfactory. No more complaints were received about abnormal wear. All concerned were satisfied, and I thought that a good piece of business had been done. Whether or not this man supplied others with the same steel I received, I do not know. If he did not, he was foolish, as he had a good opportunity.

If I were selling steel today I would educate the managers, engineers and purchasing agents until they knew what good steel was, taking pains to furnish them with information concerning the best steels for different purposes. I would advertise my steel, giving the analysis, so that when my salesmen were out in the field and the question of price was raised they could point to the product and defy competitors to show their hands.

All steel manufacturers can purchase raw material at market prices. They are all on an even basis in this respect. The manufacture of steel is then a matter of ability, and desire for profit. If one manufacturer can take the same raw materials and make a better product than another, that is ability. His margin of profit is probably larger than that of the inefficient manufacturer, who, to obtain business, will reduce prices and furnish inferior material, refusing to give the purchaser full information about his product and hiding behind the phrase "trade secrets," of which he does not have any. If he did he would use them and make better steel.

It is up to the steel manufacturers to do the educational work, and the time to start is now.

New York, N. Y. E. W. LAWLER.

Domestic Copper for Domestic Uses

In recent numbers of *Engineering and Mining Journal* I have noted two statements relating to the copper industry which, it seems to me, are highly significant. One statement has appeared in the editorial columns, the other among reports of operations of companies. The first statement is to the effect that the prices of finished copper products are unreasonable, giving consumers the impression that articles of copper are luxuries out of reach of the average purchaser. Anyone who has seen direct comparative prices of iron and copper articles will certainly agree that this is so.

The second item states that the Anaconda Copper Mining Co. is now shipping a large portion of the product of its mines to its rod and wire plant, which is finding a market for the goods in the West.

Why is not this the solution of the domestic copper problem? Let the producers form their own manufacturing companies, produce the finished goods, and sell them to the public at a fair profit to themselves and an immense profit to the industry as a whole! Imagine a home with a shining row of copper cooking utensils in the kitchen, bought at a price perhaps only slightly above prevailing prices for granite and aluminum ware.

Multiply that home a few million times and the total runs into *tonnage*. Do the same with screen, tubing, sheet-metal products, builders' hardware, and the like, and the recent success of the Monel Metal distributors in creating a market would be outdone by a wide margin.

Give the American public a taste of copper goods at a reasonable price and they will want *more*. Isn't it up to the producers? H. M. KING.

Clifton, Ariz.

Low-Grade Cyanide

In the opening paragraph of my paper (to Inst. Min. & Met. See Vol. 6, p. 2) on "Sump Solutions," etc., occurs the sentence: "It is obvious that, unless these constituents are prevented from accumulating in the solutions, the solvent power on the precious metals of any added cyanide must sooner or later be impaired." We cannot afford to forget these first principles.

Mr. Kirchen, in his letter in your issue of Feb. 19, gives further results from his use of low-grade cyanide and states that he does so in response to my suggestion. I am grateful for all responses to my repeated requests for data, but I am unable fully to comprehend or indorse Mr. Kirchen's remarks. I invited him to give his experience on at least a year's run. He replied with a statement as to the value of a product for metallurgical work being determined solely by the amount of NaCN contained. This is contrary to experience. He contrasts his result of eleven months' run with a set of figures for high-grade cyanide materially differing from those given by him in your journal of Sept. 25, 1920, in which the consumption of NaCN per ounce of bullion is 0.142-lb. for high-grade cyanide, as against 0.160 lb. for low-grade.

In your issue of Dec. 4, p. 1098, you referred to the resumption of the use of high-grade cyanide at the Hollinger and Dome mines. But it is to the interest of the industry that attempts such as those of Mr. Kirchen to use low-grade cyanide should, if possible, receive encouragement. The freer the cyanide market, the greater the quantity of profitable ore. The cyanide industry was built up on the use of cyanide which would now be considered low grade. High-grade cyanide, it is true, has eventually won its way into pre-eminence, but the encouragement afforded by users of low-grade cyanide to new methods and processes incites improvement in quality. ALFRED JAMES.

London, S. W. 1.

Voodooism Applied to Mining

From time to time in *Engineering and Mining Journal* I have read with great interest articles on the invention of the so-called "wiggle stick." My experience with the people using this invention came about in a number of ways. While in charge of detail work in a Kansas field in the summer of 1916 I was by chance residing with an oil operator at Paolo, Kan. This gentleman had seen a number of my maps and inquired as to the nature of our work, but little information could be obtained from us. He stated to me one day that he had an instrument with which he could locate oil, and I decided that this was an opportunity to learn something—something new in the location of structures. This instrument consisted of a piece of clothes-line wire made in the form of a U and held in the hands, and as he would walk over the ground, when the desired oil structure was located, it would gradually bend down toward the center of the earth. He also stated that he had obtained this invention from a negro who owned the adjoining lease. I tried to use the instrument and had no success.

While at Ranger, Tex., I met another gentleman who claimed to have such an instrument for locating oil, which would do various things. This instrument consists of a tin funnel lined with copper, inside of which are small grooves for placing different vials of liquid. From the center was a wire making an apex about four inches from the top, from which a small wire plumb bob was placed. This man was a carpenter and knew nothing of geology, but afterward I learned that one of his clients had spent some $400,000 following this "wiggle stick."

In the sensational case of late of bankruptcy in the S. E. J. Cox and the General Oil Co., a few statements were brought out in reference to an instrument used by Dr. Griffith, of Houston, in locating oil structures. The president of the Humble company stated that Dr. Griffith had made two locations for them in the Humble field, and they decided to drill in the center. They struck oil. Dr. Griffith claimed that they drilled a crooked hole. The instrument he used is a silver tube which has handles on the side. It is claimed for this instrument that Dr. Griffith can locate water sand, oil sand, and gas sand, and can tell the different formations thousands of feet below the surface.

A friend of mine stated that he had switched the vials used and the instrument worked just the same.

The public who pay for the use of such intruments only have to go into the office of the large operating companies and see the nature of their routine and labors in working out the different structures to find that the geologist who gives the best of opinions does not use any of the instruments mentioned. I will admit that the Gulf Coast fields with a salt dome present a very complicated problem. FRED. F. YOCKSTICK.

Humble, Tex.

Standardization of Stamp Shoes

We have noticed with a great deal of interest from time to time articles in *Engineering and Mining Journal* in regard to standardization of mining equipment. Mining companies operating stamp mills could easily and at a small expense standardize on stamp shoes. We have found that there are innumerable sizes of stamp shoes, though there really should not be more than four or five sizes. The principal differences in dimensions on shoes are in the neck or stem. These differences are only slight and immaterial, and the only thing necessary to meet a standard dimension would be to change the shape of the hole in the boss head on the shoe end. This could be done the first time that new boss heads were purchased, and there would be no additional cost to the mining men for this change.

The standard stamp shoe would work to the decided advantage of Pacific Coast mines, inasmuch as it would be practicable for manufacturers or supply houses to bring these shoes to the Pacific Coast via water through the Panama Canal in carload lots, and thus greatly reduce freight rates.

We believe that the stamp-mill operators should look into this matter and consider the advisability of adopting standards. HICKOK AND HICKOK,

G. F. Hickok.

San Francisco, Cal.

PYNE SHAFT OF THE WOODWARD IRON CO., WOODWARD, ALA.

Sinking and Concreting of Pyne and Songo Shafts

Operations at Two Properties in the Birmingham District Which Involved Somewhat Similar Problems, Although Different Methods Were Used in the Lowering and Delivery of Concrete to the Forms—General Costs and Progress

By J. H. Stovel*

Written for Engineering and Mining Journal

THE PYNE SHAFT of the Woodward Iron Co., of Woodward, Ala., situated in Shades Valley, about three and one-half miles south of Bessemer, was the first vertical shaft of any considerable depth sunk for iron ore in the Birmingham district. The foot wall of the ore bed was 1,214 ft. below the collar of the shaft, which was lined with steel timbers and concrete throughout. The Songo shaft, also of the Woodward Iron Co., was sunk vertically to connect with the Songo slope at a considerable distance from the mouth of the slope. This shaft also had steel timbers and concrete lining. The sinking and the concreting of these shafts were done under contract by the E. J. Longyear Co., of Minneapolis, Minn.

Bolted Steel Timbering in Shaft

The Pyne shaft is rectangular in section, 13 ft. 1 in. x 21 ft. 1 in. outside dimensions, and has six compartments—two skipways, two cageways, one ladderway, and one pipeway. The steel sets were placed at 6-ft. centers, 6-in. H-beams, 23.5 lb. to the foot, being used for wall plates, end plates, and dividers, and 3-in. x 4-in. angles being used to connect the sets. The different members of the set were bolted together in the shaft. Twelve-inch I-beams were used for bearers and were put in at about 100-ft. intervals, but in one instance, owing to soft caving ground, 180 ft. separated two bearer sets. The end plates and wall plates were set with the flanges in the vertical plane, and the shaft was lagged, as shown in Fig. 1, with 2-in. planks.

During the construction of the concrete collar and of the headframe, a 3-in. diamond-drill hole was sunk 400 ft. in the center of the shaft section, and this hole discharged a full bore of water under a small head. To grout the water-bearing area, 1,006 sacks of cement, mixed with water in as thick a mixture as a Cameron pump would handle, were pumped down the hole in twelve hours without the pressure gages at the pumps showing any perceptible rise in the pressure. Not more than twenty gallons per minute was handled from the shaft at any time, so it is evident that the grouting stopped considerable water.

Ingersoll-Rand, B. C. R. No. 430 Jackhamers were used for the shale and sandstone formations, which comprised 80 per cent of the measures sunk through, and the Denver Rock Drill No. 60 demounted "Dreadnaught" drills were used in the harder chert formations. The hose-header, comprised of a 3-ft. length of 4-in. pipe, bored and tapped for ¾-in. hose connections, was connected to the air line by a 3-in. air hose and always hung within convenient reach of the men drilling. The ¾-in. drill hoses were always left attached to the header, and when drilling was finished the 3-in. air hose was disconnected from the air line, and the header, with all the hose attached, was hoisted to the surface. After each round, all the drills were sent to the shop for oiling and repairing. Drill repairs cost $1.14 per foot of shaft, a considerable portion of this being due to the use of the Jackhamers on the hard chert formations before the larger drills were available.

Timbering was done from a stage, containing trap doors for each hoisting compartment, which was hung, by means of steel cables, from the last set placed. The shaft crew worked with the timberman during the placing, lining, and lagging of the set, this work being done usually in a little under two hours. The shaft crew then resumed work on the bottom, and the guides, ladders, and other complementary construction were completed by the timbermen, the trap doors of the stage, under the compartment in which they were working, always being closed.

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*[illegible] superintendent, E. J. Longyear [illegible]

The number of holes drilled per round varied from twenty-four to forty-two, the wide range being due to the different nature of the formations encountered. A V-cut along the longer axis of the shaft was used, and this was blasted and partly mucked before the benches were blasted. Du Pont 40 per cent gelatin powder was used, and this was detonated by instantaneous and first- and second-delay electric exploders. A 220-v., d.c. circuit was used to fire the holes, and the usual safety precautions were taken in connection with the firing switch. Cost of explosives, including exploders, lead wire, and connecting wire, were $8.60 per foot of shaft.

The surface equipment consisted of three 125-hp. boilers, equipped with grates for burning coke braize; two 1,000-cu.ft. air compressors, three hoists, a 15-kw. steam-driven generator, and a well-equipped blacksmith and machine shop, in which place all the steel for the shaft was fabricated. Two out of the three hoists were always available for mucking, and the third one was used by the timbermen, pumpmen, and other employees. The buckets used would hold a one-ton net load.

Ten miners were employed, on an average, on each shift, the time distribution over the entire shaft being as follows: Drilling, 16.8 per cent; blasting, 5.3 per cent; blowing smoke, 5.9 per cent; mucking, 43 per cent; timbering, 25.3 per cent, and delays, 3.7 per cent. The average drilling per machine per hour was 5.3 ft. and the average mucking per man per hour was 0.89 tons. Sinking from the headframe was started on Aug. 11, 1918, and the ore was struck at a depth of 1,214 ft. on May 13, 1919. The highest progress in any one month was 180 ft. and the lowest was 100 ft.

PRELIMINARY PREPARATIONS FOR CONCRETE WORK ELABORATE

Some of the formations passed through in the shaft showed need of support other than the shaft timbers, and it was decided to line the entire shaft, ore pocket, and station with concrete. The quantity involved, between four and five thousand yards of concrete, was sufficient to justify considerable preliminary expense on equipment for handling concrete materials. The installing of this equipment and the general preparation work for the concreting operations were carried on during the time the pocket was being excavated.

A trestle, sufficiently strong to support a railway locomotive, was built as close to the shaft as the headframe brace legs would permit. The approach to this trestle was about 500 ft. long, with approximately a 2½ per cent grade, and the end of the trestle nearest the headframe was level for the last 120 ft. Two double hopper-bottomed bins, each of two-railway-car capacity, were so built under the trestle that a minimum tram could be obtained to the mixer. Tracks were laid to the chute doors under these bins, and small end-dump cars, of a size holding the exact amount of sand or slag needed for the mix, were used to tram these materials from the bins to the hopper of the mixer. The concrete mixer was placed opposite the ladderway of the shaft, its loading hopper being depressed in a pit below the level of the tramming tracks, which permitted the tram cars to be dumped directly into this hopper. A small shed, capable of holding from 200 to 300 sacks of cement, was built on one side of the mixer hopper, and the cement handler, working in this shed, dumped the necessary amount of cement directly into the hopper. About fifty feet away, and on the spur track of the mine, a cement storage house, of two-car capacity, was built. Cement was trammed, either from this storage house or from the cars, to the cement shed.

CONCRETE LOWERED IN SINKING BUCKETS

As the coarse aggregate furnished was unscreened slag, dug from a slag pile by a steam shovel, it naturally contained a quantity of larger material than could be handled. Much of this was eliminated by the trammers and some by a bar grizzly, with 3-in. openings, placed under the discharge of the mixer. Even then too much coarse material was left to permit of dropping this through any pipe of reasonable size without fear of blocking the pipe. This necessitated lowering the concrete in the buckets which had been used for sinking, these being 40 in. in diameter, 39 in. high, and having a flat bottom. An 8-in. x 8-in. hole was cut in the bottom of the bucket, and a discharge gate riveted on the bucket around this hole, the inside of the bucket being hoppered, funnel shape, to assist in the discharge of the concrete. The mixer discharged over the grizzly into a pipe leading through the concrete collar to a bin capable of holding a little more than one mix. This bin was built in the ladderway of the shaft and had a discharge gate on it similar to the ones used on the buckets. A stage was built below it, and from this stage one man could direct the concrete to any one of the three buckets used.

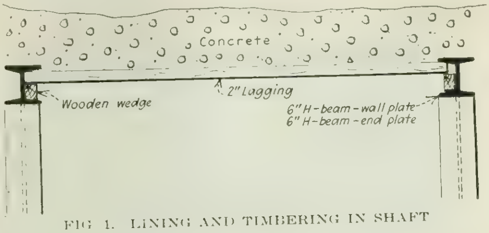


FIG. 1. LINING AND TIMBERING IN SHAFT

The lowering of the concrete in buckets involved considerable strain on the hoist brakes, and these were equipped with asbestos brake blocks. These blocks were practically worn out at the completion of the job, but it is safe to say that ordinary wooden blocks would not have lasted a single shift. Fig. 2 shows the layout of the surface arrangements and also the three compartments of the shaft through which the concrete was lowered in buckets.

WET TIMBERS MAKE TIGHT JOINTS DIFFICULT

The timbering in the station and ore pocket was also made up of 6-in. H-beams, of the same section as used in the shaft, with the exception of the roof members in the station, which were 12-in. I-beams. As shown in Fig. 1, the inside of the concrete lining of the shaft was practically flush with the outside of the steel timbers used, but in the pocket and station the concrete lining was flush with the inside of the steel timbers. By boring the necessary holes in the flanges of the timbers before they were put in place, it was a simple matter later on to place the concrete forms as shown in Fig. 3. In the roof of the station and in the hanging wall of the pocket 3-in. plank was used for forms, and 2-in. plank was used for the remainder of the work. In the shaft, the 2-in. plank which was used for lagging while sinking was also used as forms for the concrete.

The forms for the pocket and station were put in as the work progressed, and it was a simple matter to make the joint tight. Most of the lagging in the shaft, which had become water soaked, had to be taken out, to clean out behind it before pouring concrete, and in putting back this wet plank it was found difficult to make tight joints. A great deal of care was taken in caulking the joints, but, despite this, considerable sludge escaped to the bottom of the shaft, where it remained in a semi-liquid condition and afterward proved difficult to muck out.

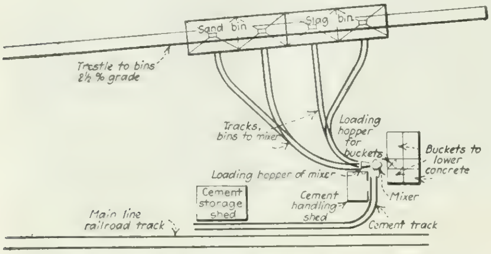


FIG. 2. SURFACE ARRANGEMENT FOR HANDLING CONCRETE MATERIALS, PYNE SHAFT

SLOWEST PROGRESS MADE BELOW STATION

The cage compartments did not extend below the station, and, consequently, only two buckets could be used to lower concrete below that point. The maximum hoist was also at this point, so that the slowest progress, in yards of concrete placed per day, was made on the work done below the station. This part of the concreting was also complicated by the placing of heavy castings in the bottom of the pocket. By taking advantage of the height possible in the shaft, all the concrete placed in the pocket flowed directly from the bucket into place without extra handling. Eliminating the first day, on which only a short test run was made, concrete was poured on twenty days in October, and a total of 800 cu.yd., or 40 yd. per day, was placed in the shaft and ore pocket below the 1,211 ft. station. This practically completed the work below the station. During November, 1919, the average pour per day was 52 cu.yd., it being possible to work three buckets above the level. In December, concrete was poured twenty-one days for an average of 55 yd. per day. In January, 1920, the actual shaft concreting was completed, concrete being poured for nineteen days at an average daily rate of 66 yd. per day. The increase in yardage poured per day was due partly to the decreasing distance the concrete had to be lowered and partly to the increasing experience of the crew in its various duties. At the outset of the work the mixer was waiting for the buckets, but the opposite condition prevailed toward the finish. The mixer was steam driven and the batch mixed in it was two fifths of a cubic yard.

In the concreting of the ore pocket, such stages as were needed for the men to work on were built as the work progressed. In the shaft, a stage, built with runners so that it would travel freely up and down on the guides, was provided for each compartment. These could be attached, for moving, to the buckets by means of cables with long hooks on their free ends. They were also so arranged that they could be detached from the buckets and be left resting securely on any set of timbers. The stage in the compartment for which there was no hoist was moved by means of a rope from the bucket in the compartment next to it. These stages, of course, were used by the men only when they were resting on the timbers and were not intended for travel.

TWO SHIFTS FOLLOW REGULAR PROGRAM

The cycle of operations in the concreting of the shaft was as follows: The night shift, comprising a foreman and four shaft miners, would work on the stages and take out such lagging as was necessary to clean out behind the lagging. Except for about 180 ft. of loose caving ground, there was not a great deal of rock to handle. The planks taken out were put back in place without wedging, and the set next above was then cleaned out, and so on. Excepting for the bad ground referred to, this crew would clean up from three to five sets per shift. Just before going off shift, the men would move their stages down and plank up the set next above the one in which the last concrete had been poured, and would caulk it up in shape for pouring concrete.

The day shift comprised a foreman, a shaft linesman, one shaft miner, and four other men, who ranked as helpers. The linesman kept lines down the corners of the shaft and watched to see that the alignment of the shaft did not shift. The shaftman watched the lagging for leaks and caulked them when they appeared, while the other four men saw to the discharge of the buckets, the tamping of the concrete into place, and other minor details of the work. As soon as this crew went down in the morning, those comprising it took out planks in the set next above the one which the night shift had prepared for concreting, making two openings for the discharge of each bucket, these six openings being equally spaced around the shaft.

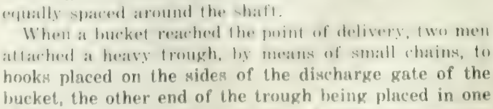


FIG. 3. TIMBERING IN STATION AND ORE POCKET

When a bucket reached the point of delivery, two men attached a heavy trough, by means of small chains, to hooks placed on the sides of the discharge gate of the bucket, the other end of the trough being placed in one of the openings in the lagging. A third man always worked at the top of the bucket to assist in its discharge if, as frequently happened, the coarse slag choked the discharge opening. As soon as the space behind a set had been filled with concrete, all of the crew worked at planking up the holes through which they had been pouring and then caulked the obvious leaks before they hoisted their stages and started pouring concrete again. The normal run was from two to three sets per day, the highest run being five sets, or 30 ft. of shaft.

The mix used was 1 : 2¼ : 5 of cement, sand, and slag. When coarse slag predominated, the slag was cut down and the sand increased, to get a mixture that would flow. There is always a decided tendency of the coarse slag to build up at the point of delivery; and where, as in these operations, it is almost impossible to tamp the concrete, unscreened slag is unsuited for the work. While working at the lower depths the concrete showed a decided settlement in the time it was being lowered in the bucket, which was probably due largely to the vibrations of the bucket. When the bucket reached the bottom there would be a half-inch film of water on top of the concrete, and the concrete in the bottom of the bucket would be fairly stiff and would not discharge freely. As the work progressed upward, this mechanical settling became less and less, and from the 600-ft. depth up no further trouble from this source was experienced. In the pocket and station considerable reinforcing was placed in the concrete, but no reinforcing was used in the shaft section.

Irregular Deliveries Cause Handicaps

The surface arrangements worked out satisfactorily, except that, owing to transportation conditions, deliveries of materials were spasmodic, and at times both sand and slag had to be dumped beneath the open parts of the trestle to release the railroad cars. This material had to be shoveled into tram cars later, which entailed extra expense. The normal day-shift surface crew was as follows: One foreman, one mixer operator, one bucket loader, one cement handler, one cement trammer, four sand and slag trammers, three hoistmen, one compressor-man, and one fireman and ashman. The tramming crew was increased when it was necessary to shovel up the sand and slag which had been dumped under the trestle. A night crew had to be kept in the engine room and boiler house, as the pumping was done on that shift. The superintendent in charge, as well as the Woodward Iron Co.'s bookkeeper and that company's warehouseman, were charged directly to the concreting. The cost of the concreting included all concreting charges, as well as power, and labor for pumping and hoisting. The actual costs, not including contractors' compensation, were $14.01 per cu.yd. of concrete placed, the labor costs being 48 per cent of this total.

Songo Slope Worked Without Interfering With Concreting

The Songo shaft is 10 ft. 4 in. x 7 ft. outside dimensions, 384 ft. deep, and provided with the same style of timbering as that used in the Pyne shaft. As this shaft connected with old mine workings, a 6-in. churn-drill hole was sunk through the center of the shaft section to eliminate pumping. Where the shaft penetrated the old workings one side of the shaft was parallel to and abutted one side of the operating slope. This slope, at the time the work was being carried on, was being operated two shifts daily, and the station at the slope, as well as the ore pocket which lay directly under the slope, had to be excavated without interfering with operations. This fact necessarily slowed up the work, but the excavation and the subsequent concreting were carried on without appreciable interference with the slope.

As this shaft was comparatively shallow, and as the pocket and station were not large, the yardage of concrete to be placed did not justify much preliminary expense. Sand and slag were dumped on a track, which passed about twelve feet from the shaft collar, and were shoveled into cars and trammed to the mixer hopper. The cement was wheeled to the mixer from a small shed near the track. In this case, slag, which had been passed through a 1¼-in. round mesh screen, was furnished, and the concrete was dropped through a 4-in. pipe into place. This pipe was put together with flanges, no gaskets being used. At the bottom of the last regular length of this pipe, a 4-ft. length of the same pipe projected into a 5-in., 45-deg. Y-fitting, and was so connected that the Y-fitting could be turned in any direction. The bottom of the Y-fitting was plugged, and the concrete discharged through the 45-deg. branch opening. From this opening, the concrete was conveyed into place by sectional spouting, similar to the kind commonly used in wheat elevators. Each 2-ft. section of this spouting was connected to the next section above by light chains, and any number of sections could be readily disconnected, as the work required. This spouting was made up as required, of 18-gage sheet iron, and, despite the rough usage it received in the shaft, was fit for further service after handling upward of 1,200 yd. of concrete.

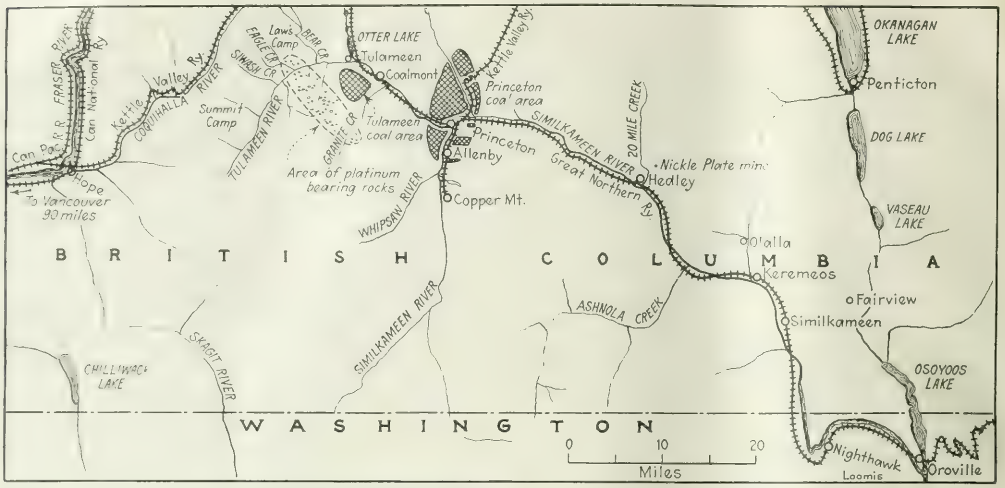
SLAG AND SAND BINS USED IN CONCRETING PYNE SHAFT

Pipe Delivery of Concrete Secures Lower Costs

The advantages of lowering in a pipe instead of by bucket are fairly obvious. Concrete could be poured as fast as the mixer could mix it. Careful observation failed to note any segregation, the concrete discharging from the spouting apparently in the same proportions as it left the mixer. Considering the entire work, the time lost by blocking of the pipe was a negligible factor. The same mixture was used as at the Pyne shaft, but the use of the screened slag made the mixture flow more freely, and there was no building up of the slag at the point of delivery.

The concrete, when stripped, showed an even surface throughout. The resulting costs in the shaft, where the work was not complicated by interference of the operating slope, were approximately $3 per cu.yd. lower than at the Pyne shaft. This does not apply to the upper 80 ft. of the shaft, as this had been sunk through clay, and the cost of preparing a set for concrete was greater than the cost of concreting.

Captain James Davey, of Negaunee, Mich., was in charge of the sinking and excavation work at both shafts, and F. O. Carter, of Marquette, Mich., directed the concreting operations.



MAP OF SIMILKAMEEN DISTRICT, IN EASTERN BRITISH COLUMBIA

The Similkameen District of British Columbia

Mineral Resources Matched by Potential Agricultural Wealth—Water Supply Inexhaustible—Gold, Copper, Silver, and Coal in Commercial Deposits—Hedley Gold and Canada Copper Principal Properties—Platinum and Microscopic Diamonds Known To Exist

By C. M. Campbell

Written for *Engineering and Mining Journal*

THE SIMILKAMEEN RIVER rises in British Columbia near the International Boundary at a point 120 miles east of Vancouver. It flows directly north to Princeton, where it is joined by the waters of the Tulameen River, and then flows southeast, entering the Okanagan River at Oroville, Wash. The district drained by it has been an important prospecting area for years. From the early 60's until recently it produced considerable placer gold and platinum. The Nickel Plate mine, at Hedley, was for many years, until the development of the properties in northern Ontario, the leading gold mine in Canada, and recently the Canada Copper property, near Princeton, appeared in the shipping list. This district also contains, at Princeton and Coalmont, two small but valuable coal basins. The timber resources are considerable, and eventually its fruit and ranching lands alone will attract and support a considerable population.

The area is served by the Great Northern Ry., which runs from Princeton to Oroville and then on to Spokane by the Kettle Valley Ry., operated by the Canadian Pacific, with a through train to Vancouver. A good auto road connects all the principal points, and trails through the hills at different places are numerous.

Oroville, just south of the boundary line, dates its importance from 1907, when the Great Northern Ry. was built into that place. Numerous showings and small mines are found around Oroville and the neighboring towns of Nighthawk and Loomis, but so far operations have been of an intermittent nature.

During the war Oroville was the center of an epsom-salt industry, the raw material being collected from some dry lakes in the Kruger Mountain district near by. A gold mine north of the town has been worked at different times, and just north of the boundary line are the Dividend and Lake Shore mines, which have shipped a small tonnage of gold and copper ores, mainly of low grade.

There are several gold properties near Nighthawk, and some silver properties, of which the Ruby is the most important. The Pittman Act is therefore of interest to this locality. The Copper World Extension mine is also tributary to Nighthawk. Loomis is the location of the notorious Palmer Mountain tunnel, a project of the 90's in which a long tunnel was driven and a huge concentrator erected without any ore in sight. The cessation of work at the Boundary smelters has been a serious matter for those mines that ship ores of medium grade in small amounts, as there is not sufficient tonnage to warrant a local plant and freights to more distant smelters are prohibitive.

The most valuable natural resource of this section is, however, an inexhaustible water supply, which is used for power and irrigation in the valley. The result is that Oroville is not dependent on the transitory importance of a mining industry, but can count on regular annual returns from agricultural resources.

Between the Boundary and Hedley, a distance of thirty-four miles, the mining industry is not important. The Horn Silver mine, near Similkameen sta-

TULAMEEN VALLEY ABOVE PRINCETON, B. C.

tion, is the only regular shipper, and its output is small, about 1,000 tons of 40-oz. silver ore per year. The citizens of Keremeos, like those of Oroville, are concentrating their attention on irrigation. Finer peaches and tomatoes than those grown in this district are not produced anywhere. There is also much additional fruit land below Keremeos, with smaller areas above as far as Hedley. Beyond Hedley fruit does not do so well.

Just above Keremeos are large talus piles, which extend for a couple of miles along the northern side of the river. These were noted by Dawson in 1877 and referred to as follows: "The rocks of the mountain are everywhere traversed in all directions by innumerable jointage planes. Exposed faces are thus easily crumbled down, and under the influence of weather contribute annually to the great slopes of broken rock, or *screes*, by which the valley is here fringed."

At the junction of the Similkameen and Twenty Mile Creek, at an elevation of 1,700 ft., are the town of Hedley and the Nickel Plate mill. Fifteen thousand feet distant by tram, but at an elevation of 5,700 ft., is the Nickel Plate mine. The ore from this mine is brought by a narrow-gage electric railway to the tipple, which is on the mountain directly above the mill, and from there to the mill by a gravity tram. The vertical distance covered by this tram is 3,600 ft. in about 8,000 ft., and it is therefore one of the landmarks of the district. There are few transportation departments of mining companies that can offer a more spectacular trip than a ride on this tram.

The development of the Nickel Plate mine is due to the initiative of the late M. K. Rodgers, to whom also can be given the credit for the early development of the Hidden Creek mine, at Anyox. Work was first started on the Nickel Plate mine in January, 1899, and the first ore was milled in 1904.

The orebody is made up mainly of garnet, calcite, and epidote, with arsenopyrite as the chief ore mineral. It is of the contact metamorphic type, lying between a gabbro intrusive and the altered limestones. The ore deposit is unique inasmuch as arsenopyrite has not before been found in contact deposits. Its dip of 25 deg. to 40 deg. is also much flatter than usual. In 1917 the reserves were stated as 423,552 tons averaging $10.39 per ton.

The mill has forty stamps, with a capacity of over 200 tons per day. Until 1916 the main product was concentrates, which were shipped to Tacoma. Since then all the ore has been cyanided at the mill. In recent years the arsenic has been recovered.

To date about 850,000 tons, valued at $10,000,000, or about $12 per ton, has been treated. The following report for 1914 shows the results for a typical pre-war year: Tonnage treated, 78,494, having an assay value of $10.80; recovery, 94.09 per cent of assay value, or $797,340.76; expenditures, $409,112.11; profits, $388,228.65. Pre-war dividends were usually at the rate of $300,000 per year, or 25 per cent on the issued capital. During recent years profits were practically wiped out,

VALLEY OF SIMILKAMEEN RIVER AT RIGHT. HEDLEY AND VALLEY OF TWENTY-MILE CREEK AT LEFT
MILL AND GRAVITY TRAMWAY OF HEDLEY GOLD MINING CO. IN LEFT CENTER

owing to circumstances under which gold mines worked, and the plant was closed down last summer pending improved conditions. It is thought that it may resume soon.

From Hedley to Princeton the country is picturesque, and, although there are numerous prospects, from some of which shipments have been made, no important mine has yet been developed.

Princeton is known in the old records as Vermilion Forks, from a highly colored cliff situated three miles up the Tulameen River. At Princeton there is a marked depression in the surface of the country, the land sloping gradually to the higher adjacent areas. A coal mine is situated near the town, and, with the recent activity in ranching, railway building, and mining, Princeton has been the most important center in the entire district.

PRINCETON, B. C., FROM THE EAST

Thirteen miles south of Princeton, by railway, is Copper Mountain, the location of the Sunset and other claims, which form the mining property of the Canada Copper Corporation, formerly the British Columbia Copper Co. Since the exhaustion of the Boundary ore deposits this is the largest copper property in the interior.

MILL OF CANADA COPPER CORPORATION AT ALLENBY, B. C., NOW IDLE

The Sunset claim was located in 1888 by R. A. Brown, trapper, fur buyer, and prospector, while on a fur-purchasing expedition. Mr. Brown, widely known as "Sunset" Brown or "Volcanic" Brown, from the names of the striking mineral showings which he has located, still lives near Grand Forks, on his Volcanic claim, and continues one of the most optimistic prospectors that southern British Columbia has produced.

The Sunset lay idle for some years, and finally, about 1900, the Sunset Copper Co. was formed to put the property on a producing basis. The prospectus of this company shows that it had a shaft down 190 ft., "all in ore," and that the dump had been drawn on quite extensively by neighboring operators "when they were shy of good specimens on their own locations." The copper minerals were bornite and chalcopyrite, which were "dissimulated" evenly throughout the mineral zone. A tonnage of 7,125,000 was announced, said to average 5 per cent copper. Though there is no doubt some of the ore was of that grade, and even better, and that the entire tonnage "should" have equaled 5 per cent, the facts of the matter are that it didn't. This circumstance, together with the facts that the ore was not of a good smelting grade, that the flotation process was unknown, and that there was no railway within 100 miles, was responsible for the property remaining idle another decade.

TALUS PILES ABOVE KEREMEOS, B. C.

About 1910 the railway reached Princeton, and in 1912 the B. C. Copper Co., then operating the Mother Lode mine and the Greenwood smelter, took an option on the property, and after extensive drilling and development stated that over 11,000,000 tons of ore had been blocked out, and that this did not exhaust the possibilities of the area. This ore has a content of 1.77 per cent copper, and about 25c. in gold and silver. The analysis is approximately 50 per cent silica, 6 per cent iron, 9 per cent lime, 1 per cent sulphur, and 20 per cent alumina.

A suitable millsite was selected five and one-half miles from Princeton, on the railway route to the mine, and arrangements made with the Kettle Valley Ry. to build a spur. The West Kootenay Power Co. also agreed to extend its power line nearly 100 miles from Greenwood to the mine. Work was also started on the erection of a suitable mine plant and town, on the building of a 2,000-ton mill and a town at the millsite, which was called Allenby, and on a pumping plant 600 ft. below, on the river. Owing to war and post war conditions delay after delay occurred, and, as evil fortune would have it, after eight years' development and construction, during a period mainly of high cost of materials and high copper prices, the work was completed and the mill started to ship concentrates in the fall of last year, just as copper slumped to pre-war prices. The operations were, however, continued for several weeks, showing that few changes would be required from a technical point of view, and the plant closed down until the arrival of more normal conditions.

The district beyond Princeton, drained by the Tulameen River, has been important in the past on account of the gold and platinum placers, and, mineralogically at least, for the occurrence of diamonds. Copper and silver-lead deposits have also been located and developed to some extent. The fact that the coal mine near Coalmont is in operation, in addition to the one at Princeton, and has extensions outlined for the future, is one of the encouraging features of the district.

Nearly all creeks flowing into the Tulameen show gold in the gravels, and the value of the output to date is over $750,000. In 1886 there were over 2,000 diggers on Granite Creek. The known placers are now all exhausted.

In addition to the gold, some of the creeks have produced platinum, and about $50,000 worth has been recovered, most of it in the early days when it was of little value. The district has been studied carefully, and the source of the platinum has been traced to the exposure of basic rocks indicated on the map. This rock mass consists of a stock containing a core of peridotite which shows a gradual transition, usually within 100 ft., into the surrounding pyroxenite. It is only the creeks which have their origin in this mass that produce platinum. The platinum grains found also include inclusions of olivine, chromite, and pyroxene, which are also constituents of the mass. The mass has also been examined, and, where altered to serpentine or where rich in chromite, platinum has been found in roughened scales or sponge-like masses. It would therefore appear that it is derived from these rocks by ordinary processes of decomposition, erosion, and stream concentration. The chromite segregations so far found are, however, small, seldom more than a few inches wide by a few feet long, so that the chances of finding ore in commercial quantity are slight.

The diamonds found to date have been of microscopic size and are also a constituent of the chromite segregations. It is possible that, owing to erosion, larger diamonds may be found in the placers, though so far none have been discovered.

Copper ores have been found and worked at Law's Camp, at the headwaters of Bear Creek, and near Tulameen, and segregations occur in the pyroxenite. Silver-lead ores occur at Summit Camp. No outstanding deposits of these metals have been located to date, and no shipments have been made.

The district has a valuable asset in the coal basins at Princeton and near Coalmont. The Princeton coal is a high-grade lignite and makes a good domestic coal. A minimum of 166,000,000 tons of workable coal has been estimated. It is being worked by the Princeton Coal & Land Co., with a colliery at Princeton.

The Tulameen area, near Coalmont, contains a good grade of bituminous coal of good coking quality and a minable content of 64,000,000 tons. It is operated by the Coalmont Collieries, Ltd., in which Winnipeg and Vancouver interests are represented. During the past season this company installed a wire-rope tramway from the mine to the shipping station at Coalmont and is now shipping 250 tons per day, which is all taken by the railways. Later the company expects to enter the Vancouver market.

The Similkameen district was explored by Dr. G. M. Dawson, of the Canadian Geological Survey, in 1877. His reports are valuable and interesting, but have been out of print for years. Prof. J. F. Kemp has also studied the occurrence of platinum in this district in detail, and Bulletin 193 of the U. S. Geological Survey constitutes his report. This is also out of print. Charles Camsell, now Deputy Minister of Mines at Ottawa, did his most important geological work in this district, and his reports on Hedley (Memoir No. 2) and on Tulameen (Memoir No. 26) are still available.

ON THE TRAIL NEAR TULAMEEN

No article on the Similkameen would be complete without some reference to Colonel Robert Stevenson, pioneer of California, Cariboo, Similkameen, and the Okanagan. Born in 1838, in Glengarry County, Ont., he went early in life to British Columbia. He took part in the rush to Rock Creek in 1860, and his work there so favorably impressed Sir James Douglas, who was then governor of the colony, that he appointed him collector of customs at Osoyoos in 1861. A few years later he was in California as a private in the Confederate army, but did not get to the front. His title, therefore, is not due to military experience, but was given him by Sir Richard McBride, when premier of the province, many years later. He was back in British Columbia in time to see most of the busy days in the Cariboo and also to explore the more southern districts. He has many stories to tell of the Cariboo and the administration of justice by Sir Matthew Begbie. He knew personally most of the leaders of those days and many of the Indian chiefs, such as Tonasket, whose names now appear as place names in the railway folders.

On one trip in the Tulameen Colonel Stevenson says that he came across a vein of solid platinum four inches wide running under a stream flowing through a canyon. A sample was taken, but the Indian to whom it was given to take out lost it. On returning to the place at a later date it was found to be covered by a rock slide. Colonel Stevenson has spent much time in clearing this up, and looks forward to the day when the re-discovery will make him a wealthy man. "I have other properties that also need my attention," he says, "but I am eighty-two years old, and I will have to hurry." The Colonel is still in excellent physical condition, and it is the hope of the district that he may live to see his famous platinum vein again.

Making Mining Engineers From Disabled Soldiers

Hundreds of Thousands Expected To Take Advantage of Federal Vocational Education Opportunities—Courses in Schools and Colleges Supplemented By Practical Work—Success of Plan Depends on Co-operation of Employers

BY W. A. CLARK
Federal Board for Vocational Education, Washington, D. C.
Written for *Engineering and Mining Journal*

THE DISABLED SOLDIERS who learn and practice the profession of mining engineering will probably be as efficient as the civilian students. In fact, something gained during the war may prove an additional asset. The Government and employers are partners in the job. If the employer does not take an active, critical interest and a partner's interest in this work, and do his part, the Government will fail. Engineers represent the big employers. It is hoped that many of them will see what they can do to stimulate and educate employers, and offer to the board such constructive criticism as they think will be for the best interests of the disabled soldiers.

VOCATIONAL STUDENTS IN THE MECHANICAL DRAWING LABORATORY OF THE MICHIGAN COLLEGE OF MINES

First consider the general features of the job. The task of rehabilitating ex-service men who have a vocational handicap was assigned to the Federal Board for Vocational Education more than two years ago. The enabling act is quite clear in its intent. For those who are, in the judgment of the board, vocationally handicapped. the board is obligated "to do all things necessary to insure vocational rehabilitation; to provide for the placement of rehabilitated persons in suitable and gainful occupation." To achieve this purpose it devolves upon the board to select an employment objective for each disabled soldier who is eligible and who desires training, and train him until he has sufficient mastery of his new vocation to command the average wages. In at least 90 per cent of the occupations for which disabled soldiers are being trained, this acid test of rehabilitation can be applied, because the average wage "at starting" is determinable. In the other 10 per cent, the application of the principle is merely a matter of common sense.

PROBLEM WAS FIRST UNDERESTIMATED

One of the important pioneers in this educational work thought the board might have to train 15,000 men. It is clear that little was known about the size of the job at the start when this figure is compared with the 86,000 who have already entered training. After two years it is still difficult to form a reliable estimate. An increasing number of men are becomning eligible for training because of disability *traceable to service.* This is the big joker in the problem. Theoretically, any one of the four million ex-service men may develop a disability traceable to the service and be eligible for training under the present law.

No time limit has thus far been fixed within which applications must be made. Every man is entitled to training, including books and supplies, if he is receiving compensation; also if he has a vocational handicap he is entitled to receive subsistence pay. This pay is $80 to $100 per month, and more in case of dependents. Only a small percentage of the men eligible for training without pay accept. It is to them only a tantalizing offer, devoid of substance. On the other hand, a large percentage of the men eligible for training *with* pay do accept. The number of men who apply and the number of men who will accept, if eligible, and if training is feasible, depends largely upon employment conditions. If unemployment increases, the number who accept training will increase; if it contracts, a large number will decline training, particularly if the wages offered are in excess of training pay. At present there is a strong tendency to liberalize the present law and give men with a 10 per cent disability training with pay. This will have a stimulating effect on both applications and acceptances.

TOTAL COST ABOUT $4,000 PER MAN

How much is it going to cost? Training is an individual matter, and must continue, within reason, until a man's employment objective has been reached. Consequently, on account of differences of preparation for a definite employment objective, together with differences in energy, ability, and other qualities, the time element is hard to determine. Perhaps the time of training will average two years, including those who train for short periods and those who are discontinued because they will not profit by their training. The monthly cost of trainees, including 11 per cent overhead, is $170. An approximate figure of $4,000 for a two years' course gives some idea of the cost.

So many indeterminate factors enter into the problem of the total number of men involved that it is impossible even to guess what the total cost will be. As to the kind of machinery and equipment used, the board faced two choices: to use existing educational plants, or to build new ones. It was determined to use existing plants; first, because they were ready and the men clamored to start their training; second, it was thought desirable to strengthen existing educational institutions, rather than to weaken them through competition; third, these educational plants were widely distributed and permitted most men to train at or near their homes; and fourth, it was more economical.

Contracts were made with selected institutions that offered the most satisfactory courses. This form of training was soon supplemented by practical work. At present the board has training contracts with over 2,000 educational institutions and over 10,000 employers. The sheer pressure of the work of deciding on eligibility for training, arranging employment objectives for those who desire training, selecting places and inducting men into training has prevented those in administrative positions from making a comprehensive and critical survey of the educational facilities employed. It is thought that such a survey could best be made by a selected committee of large employers, representatives of labor, and production engineers, a carefully chosen group, large enough to represent the various occupations for which men are being trained. Such a committee, selected by the board itself, could accomplish much within a short time. Occupations could be grouped, subcommittees appointed for each group, and typical schools and establishments selected and studied. This plan of survey which the board has under consideration can be made effective only if there is the right kind of co-operation from public-spirited employers.

FEDERAL BOARD STUDENTS AT THE SCHOOL OF MINES, BUTTE, MONT.

STUDENTS FROM ALL CLASSES MUST BE CONSIDERED

Now, in regard to the men. Here is where the greatest difficulties exist. If the job called for the vocational education of 200,000 young men who were normal, and properly prepared to enter training for a definite calling, that alone would represent a huge educational and administrative task, but the difficulties, after all, would be of the normal type. But though the number of disabled soldiers, trainees of the board, who are approximately normal, is increasingly large, the number who are appreciably abnormal from shock, gas, disease, and wounds runs into the thousands; the number who are eligible to train but not feasible to train yet, because of mental diseases, tuberculosis, and other causes, runs into thousands. In the composite group will be found disabled ex-service men from every college and university in the country, from nearly every important commercial, technical, and trade school, and thousands from industrial and commercial establishments representing almost every known occupation.

There are men with an incomplete common-school education, including large numbers of illiterates and foreign born. On the other hand, there are men with academic and professional degrees, and many with partial or complete high-school training. The foreign-born illiterates are eager to speak the language and know something of the history and government of the country they fought for, as well as to learn some useful occupation. The gifted, highly trained men need to learn a new specialty to overcome their vocational handicap. Some regard their training pay only as a new form of pension, carrying with it no obligation to profit by the opportunity for self-rehabilitation.

The effort of the training officer to stimulate self-respect and an honest effort toward self-rehabilitation is frequently frustrated or delayed by interference on the part of sentimentalists. Perhaps at no point is there need of greater wisdom than here; and the student must be taught that the Government can only give the opportunity, and that he himself must recognize an obligation to work hard and to accomplish something. The moment training pay is permitted to become a camouflaged pension a disintegrating factor enters into the whole plan.

The organization of the Federal Board is more completely decentralized than any department of the Government. There are fourteen distinct geographical divisions of the whole country, and many subdivisions of each zone or district. In all, there are more than 140 local offices. After a man has been declared eligible, his case is sent to the proper local office, and the supervisor is held responsible for the induction into training and the supervision of his training. In a large minority of cases considerable experimentation is essential before an employment objective is selected, and frequent changes are often necessary even after a selection has been made. Wastage here, both of time and money, is greater than at any other point.

THE MINING CONTINGENT

What is the Federal Board doing for men who have chosen employment objectives connected with the oil industry, and coal and metal mining? Perhaps 750 men have selected such objectives, exclusive of electricians, accountants, and others, some of whom may find their way into the employ of oil or mining companies. Of this number perhaps about 75 are taking regular mining-engineering courses leading to a degree. These men are distributed among the best schools of the country, including the Massachusetts Institute of Technology, Harvard, and the Michigan College of Mines. Some have selected assaying, some oil technology and engineering.

Though the bars have not been let down for those who want a degree, either in mining engineering or any other profession, many universities and technical schools have planned special courses to meet the practical needs and educational background of Federal Board students. For instance, the president of the New Mexico State School of Mines takes a great personal interest in the education of disabled soldiers. Short practical courses in surveying, assaying, chemistry, and drafting have been planned by him for men who could profit by the courses but who had insufficient preparation to take the regular courses in engineering. The Colorado School of Mines, on the other hand, has a number of Federal Board students, but they are taking the regular courses. "War Specials" are not admitted.

The State School at Pittsburg, Kan., Carnegie Institute of Technology, and the University of West Virginia have planned short courses particularly adapted to men with large practical experience as coal miners. Many of them are wholly unable to work as miners, on account of their disabilities; nevertheless, it is highly desirable to capitalize their experience, if possible, so they are taking courses which will fit them to secure positions as foremen, fire bosses, and in other capacities about a mine. The Allegheny Vocational School, at Pittsburgh, has planned two practical courses to meet the needs primarily of ex-coal miners whose disabilities render it impossible for them to go back to mining. Both courses usually call for considerable preliminary training in English and arithmetic. One deals with simple timekeeping, the other and supplementary course with payroll accounting. The best methods employed in coal companies furnish the technique and illustrations.

I recently returned from an extended inspection trip, visiting many universities, colleges, technical, trade and industrial schools where disabled soldiers are being trained. In the schools where there are twenty-five or more a counselor (one of the professors) or co-ordinator (a Federal Board official) usually advises the men, and in fact acts as guide, counselor and friend. He is called upon to adjudicate every type of difficulty. One of several questions that I invariably asked was: "What percentage of the men fail to profit by this training?" The usual answer was 10 per cent, sometimes 5, seldom over 10. Another stock question was: "Is there an improvement in morale?" Always the answer came, "Yes." As a rule the further observation was made that the men were mentally more alert, less nervous, and much easier to guide. Deans, professors, counselors, co-ordinators, and trained officers with practical business experience were asked repeatedly: "Is the training that the men get calculated to fit them, without loss of time, for their employment objectives?" Frankly, the answers were seldom an unqualified "Yes." Frequently it was implied that Federal Board students with definite employment objectives had clearly revealed the gap between education and the job.

Undoubtedly Federal Board students are getting the best training that the schools can give. To say that it is good enough would be going too far. Practical, progressive, co-ordinated training for the job is being provided in many establishments; but in others it is being given in an ineffective way. This method of training, however, offers, in my judgment, greater possibilities for sound training in many lines than the school. It should be surrounded, however, with safeguards to prevent exploitation.

PLANE TABLE WORK AT THE MICHIGAN COLLEGE OF MINES

Floating an Antimonial Silver Ore

Tests made by the U. S. Bureau of Mines in co-operation with Idaho state bureaus, on an antimonial silver ore, are described in U. S. Bureau of Mines Bulletin 205, recently issued. The principal mineral was polybasite $(Ag,Cu)_{16}\ Sb_2S_{11}$, which was finely disseminated through a hard, massive, quartz gangue. Analysis showed, Au, 0.04 oz. per ton; Ag, 81.4 oz.; Fe, 1.13 per cent; S, 0.15 per cent; "insoluble," 97.6 per cent. The following conclusions were reached:

1. The ore is amenable to flotation.
2. Pretreatment of the ore by sulphidization with sodium sulphide improves the silver recovery.
3. Treatment of flotation tailings on tables would seem advisable if much of the silver mineral is oxidized, and might eliminate the sulphidizing of the ore.
4. Use of sodium cyanide with the flotation agents seems to improve the grade of product.
5. It would seem advisable to make first a high recovery of silver without cyanide, then to re-treat the first flotation concentrate with a small quantity of cyanide, in order to improve the grade of the product.

Government Officials Prominent in Mining

Senator Tasker L. Oddie

By Paul Wooton

Written for *Engineering and Mining Journal*

CONSIDERING the fact that mining vies with agriculture in the matter of fundamental industrial importance, there never has been adequate representation of the mining industry in Congress. In fact, few members of the National legislative bodies have had first-hand practical mining experience. As a consequence the mining industry and those industries allied to it have been compelled to place great reliance upon such few members of Congress and various Government departments as have an intimate knowledge of that business. To the little group of men now in Congress who have had actual and practical experience in mining and in industries related to mining there just has been added Tasker L. Oddie, who has with the present session begun his service to the Government as a Senator from Nevada. Feeling as he does that he has a responsibility to the mining industry as a whole, Senator Oddie expects to give mining matters first call on his consideration and his time. He is particularly interested in legislation which will have the effect of holding out more encouragement to the prospector. Senator Oddie has been connected actively with mining since 1898. In that year he was sent to Nevada to take charge of the interests of Anson Phelps Stokes. Prior to that time he had had no knowledge of mining or of the mining industry. He was born in Brooklyn and grew up in East Orange, N. J. After completing a public-school education he begun fitting himself for the practice of law at the night school at New York University. His livelihood was obtained in the Stokes offices, where he looked after his employers' real-estate interests. His work there soon demonstrated the fact that he was a young man of good business judgment, which resulted in his dispatch to Nevada.

SENATOR TASKER L. ODDIE

Soon after Mr. Oddie went to Nevada, the Stokes interests discontinued their mining operations there. Rather than return to New York, Mr. Oddie set out for Nye County to undertake, with limited capital, an operation of his own. He began prospecting alone on an outcrop in the region of the old Belmont mine. He started an incline on the vein and constructed a hand windlass. He did all the work himself. He would fill his bucket, and then climb to the surface to hoist it. Later he was forced to abandon work and his hope of making a success of that property. The experience, however, did not discourage him. Having been told by Jim Butler, a Nye County acquaintance, of a promising prospect in an out-of-the-way section of the county, Oddie agreed to secure assays of the samples which Butler had turned over to him. As neither he nor Butler had the money to pay for the assays, Mr. Oddie had to rely upon persuasion, and he did finally succeed in getting a friend to make the assay. He was enthused and encouraged as never before when he learned that the samples ran very high in silver. On the strength of these assays, Oddie, Butler, and Wilson Brougher made a world record on an investment. The investment consisted of a few dollars' worth of supplies and tools, with which they set out for the distant vein from which the samples were taken. There they worked and suffered hardships as great as white man ever underwent in similar circumstances. The first shipment of ore netted them the tidy sum of $600, and the property paid its way thereafter. In a year the partners had 1,000 horses and mules hauling the ore sixty miles to the nearest railroad. This was the beginning of the Mizpah mine, in the great silver camp at Tonopah. A year later, the property was sold for $350,000. With the capital acquired from this operation, Mr. Oddie turned his attention to the near-by Belmont, which became even a greater producer than the Mizpah.

From his youth, Mr. Oddie has taken more than the average interest in politics. In 1910, Nevada Republicans induced him to make the race for Governor of that state. He was elected, and served for four years. Immediately after retiring from office, he resumed mining activities, and he is still largely interested in various leases and mining operations in his adopted state.

Waste in Phosphate-Rock Production

BY STRAUSS L. LLOYD

Written for *Engineering and Mining Journal*

MENTION OF THE WASTE in Southern phosphate-rock mining as stated in *Engineering and Mining Journal* of March 19, reminds me that there is considerable loss of phosphate rock in the actual mining of the material. In the hard-rock section of Florida practically all the deposits contain, with other substances, phosphate in a soft or pulverulent condition. Under present methods of mining and treatment this "soft" phosphate is necessarily lost in the process of washing, being carried to the dump, along with the sand, clay, and other constituents of the matrix. The amount of phosphate thus discarded may be expected to vary with different deposits and under different conditions.

After reaching the dump there is more or less mechanical separation, so that samples taken from one part of the dump may be found richer in phosphate than those from some other part of the same dump. Samples from some of the phosphate dumps in the hard-rock region of Florida, which I took at random and analyzed, gave the following analyses: Total phosphoric acid, 9.99 to 12.14 per cent, which is equivalent to 21.81 to 26.50 per cent tricalcium phosphate. In another case, a sample of float from the dumps in the land pebble section gave results as follows: Total phosphoric acid, 11.47 per cent, equivalent to 25.04 per cent tricalcium phosphate. In still another analysis made of the plate-phosphate, results were: Silica, 58.95 to 60.10 per cent; iron and alumina, 11.70 to 11.20 per cent; calcium phosphate 26.80 to 27.92 per cent. It was estimated in this particular instance that approximately four tons of material was excavated and washed to obtain one ton of high-grade 77 per cent phosphate. From this it is evident that of the material taken from the pit, three-fourths, carrying about 27 per cent calcium phosphate, goes to the dump, and one-fourth, carrying 77 per cent calcium phosphate, is saved; thus of the total phosphate rock taken from the pit, in this example at least, one-half goes into the dump.

ACID AND FUSION TREATMENTS GIVEN

Practically all of the phosphate ore mined at present is converted into superphosphate by treatment with sulphuric acid. The phosphoric-acid manufacturers demand a rock notably free from iron, alumina, and calcium carbonate. As a consequence it has been estimated that for every ton of phosphate rock that is converted into the superphosphate by treatment with sulphuric acid, two tons are discarded as unsuitable for such treatment.

The fusion of a mixture of phosphate rock, sand, and coke in the electric furnace permits the volatilization and subsequent collection in the Cottrell precipitator of phosphoric acid of satisfactory purity and concentration. If water power were obtainable at $5 a horsepower year, this method would be adapted commercially, but at the present price, $20 to $25 per horsepower year, the cost of production of phosphoric acid by the electric furnace is about three-quarters of a cent higher than by the sulphuric-acid treatment. Moreover, it is not likely that water power will ever be available in large quantities at a price sufficiently low to warrant its use in the production of phosphoric acid, which must be sold on the ton basis, while there is such a large and rapidly increasing demand for power by producers of the more expensive chemicals sold on the pound basis. Recent work in which oil fuel is used as the heating agent, instead of the electric furnace, gives promise of a commercial method for preparing phosphoric acid. The original Cottrell process was designed for fume-controlling, and by means of it the solid particles, which cause damage to crops, were separated by static electric discharges.

A recently conducted experimental plant operating on the Cottrell principle had an electrode area of 100 square feet, and was designed to handle 70,000 cubic feet of smoke per minute. The apparatus consisted of a precipitating chamber in which were placed 127 electrodes, strips of iron 4 ft. long by ¾ in. wide, with saw teeth throughout their length. Between the electrodes were placed flat plates of iron about six inches wide. An electrical current of 27,000 volts was delivered to the electrodes, and as the smoke circulated in the chamber the solid particles was precipitated on the plates.

PHOSPHORIC ACID DIFFICULT TO HANDLE

The experimental plant showed that 90 per cent of the solid particles carried by the smoke are precipitated by this method. The gases from the main flues were drawn into the precipitating chamber and driven into the main stack by two fans 187 inches in diameter, whose combined capacity was 500,000 cubic feet per minute. Nine permanent units comprised the plant, seven for constant service and two for reserve purposes. The cost approximated $125,000.

There are advantages and disadvantages in the use of phosphoric acid. One of the disadvantages is the difficulty attending the transportation of a corrosive liquid. However, this can be readily overcome by converting the acid into one of its solid salts. Some of the advantages are that it can be produced at the mine from run-of-mine material, because the presence of impurities which offer objections to sulphuric-acid treatment are necessary for successful furnace treatment. If the rock is high grade, sand must be added to displace the phosphoric acid. The presence of relatively large percentages of alumina, instead of being a drawback, greatly facilitates the smelting of the phosphate charge. The mine-run material, therefore, is generally more suitable for fusion work than high-grade rock.

It seems best to convert the phosphoric acid produced from furnace operations into a solid salt by neutralizing it with ammonia or potash. The substitution of these bases for lime saves a considerable part of the freight and yields a soluble product which does not revert to an insoluble compound, as with the acid calcium phosphate. The fusion process will have other advantages, in that several of the products from the nitrogen-fixation plants in the South can be freely mixed with the ammonium or potassium phosphate, which cannot be mixed with the acid calcium phosphate without reversion of the latter and decomposition of the fixed nitrogen product.

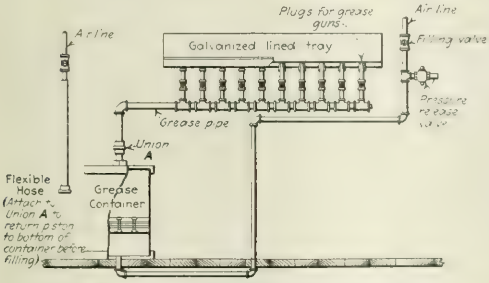
HANDY KNOWLEDGE

Storing and Distributing Grease, Using Air Under Pressure*

BY F. J. EAGER

In various mining and smelting operations large amounts of the different oils and greases are used, and the supplies are commonly stored at central points, from which they are issued daily in small quantities. For the purpose of storing and issuing oils, several excellent tank and pump systems have been developed. By these means the different oils may be conveniently stored and issued in a clean and efficient manner. The greases, however, are by their nature more difficult to handle, and I do not know of any devices by which they may be handled in similar ways.

This difficulty became evident some time ago when the underground drill was changed from the piston to the Leyner type. It then became necessary to use grease as well as oil for lubricating the drills, and small quantities of grease had to be issued daily to each drill runner.



DEVICE FOR STORING AND DISTRIBUTING GREASE. USING AIR UNDER PRESSURE

The drillers take the grease into the working place in what we call "grease guns." The "guns" hold sufficient grease for a working shift, the grease being forced from the "guns" into the drills. At first the grease was allowed to remain in the original container, either a tub or a barrel, and filling the grease "guns" was a slow and dirty operation. It was accompanied by appreciable waste, and the grease often came in contact with, and picked up, dust before it was introduced into the drills.

To overcome these difficulties, we have devised a machine by which, with the aid of air pressure, all the lighter grades of cup greases can be handled as easily, as efficiently, and in as clean a manner as oils. The details of this machine are shown on the accompanying drawing. The device has three essential parts:

The first is the grease container, which is a bored iron cylinder, inside of which there is a piston without a rod. This piston is built up from three steel plates and two leather packing rings, and travels from the bottom to the top of the cylinder.

The second part of the machine is the grease-distributing system, through which the grease is piped from the top of the grease container to the different discharge openings. These openings may consist of taps of any desired form of discharge opening. In the machine in question the grease is forced to a manifold pipe, which is fitted with a number of $\frac{3}{8}$-in. couplings to which the grease "guns" are screwed for filling.

The third part of the device is the operating arrangement. This consists of an air-pressure line that enters at the bottom of the grease container. This line has an operating valve and also a pressure release valve. The latter is placed between the operating valve and the grease container. At the left of the drawing will be seen a section of flexible rubber hose that terminates with a union.

The device is used in the following manner:

The grease-container cap is removed by unscrewing. With the piston at the bottom of the cylinder, the container is filled with grease. In this particular machine, the container has an inside diameter of 12 in. and is about 20 in. in height. It holds about 60 lb. of grease, and therefore takes easily the contents of a 50-lb. tub. This charge will fill from 125 to 150 grease "guns." After filling the container, the grease pipe is attached and the machine is ready for use.

In the regular routine all the grease "guns" are filled at one time. Ten can be filled at one operation. A grease "gun" is attached to each filling plug while all the filling-plug valves are open. The operating valve is then opened, and the "guns" are quickly filled. If fewer than the total number of plugs are to be used, the valves of the other filling plugs are closed. Before unscrewing the grease "guns," after filling, the pressure on the grease is relieved by closing the operating valve and opening the pressure-release valve.

When the grease container becomes empty, the grease pipe is disconnected at the union at the top of the container. The rubber hose is then attached to the above opening and the valve on the hose line opened. This returns the piston to the bottom of the cylinder and eliminates having to introduce a dirty implement of any kind into the grease container. The container may now be refilled, after which it is ready for further use in the same manner.

This arrangement is satisfactory for handling and issuing grease. The device is practically fool-proof. It never gets out of order, and there is nothing to wear or be easily broken.

For the purpose for which this machine has been designed, the quantity of grease used at one time is not large. However, the device works so freely that I do not see why much larger quantities of grease could not be stored and drawn off in this same manner. Taps could be used and the grease drawn off in much the same way as that in which we handle oil through tanks and pumps.

Window shades white or light cream in color are preferable to dark shades for engineering offices and drafting rooms having an east or west exposure.

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*A paper read before the Sudbury branch of the Canadian Institute of Mining and Metallurgy, and printed in the *Bulletin* of that institute, for March, 1921.

To Lay Off Degrees With a Steel Square

By William Kirkpatrick

Written for *Engineering and Mining Journal*

Referring to the method of laying off angles expressed in degrees with a steel square that is given on p. 391 of the *Engineering and Mining Journal* of Feb. 26, I have used a method for years that appears to be simpler than that. It is as follows:

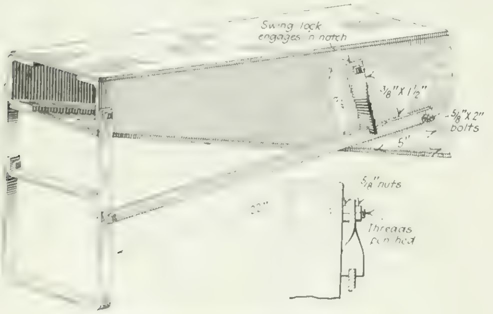
Move the decimal point of the tangent one figure to the right, which multiplies it by ten. Then multiply the remaining figures to the right by sixteen, inserting the decimal point in the proper place in the product, which will give in inches and sixteenths the distance to be used on the tongue of the square while using 10 in. on the blade. If the angle is, say, 40 deg. or less, the tangent may be multiplied by two after changing the decimal point and then using 20 in. on the blade. In that way the square will make a larger protractor.

Movable Steps for Dump Cars

By H. H. Hunner

Written for *Engineering and Mining Journal*

The sketch shows how a stationary brakeman's step may be changed to one that can be quickly moved in or out. To make the change, the diagonal brace is removed and slotted on the lower side to drop over the bolt at the upper end. It is also given a taper notch on the upper edge. The position and detail of the swing lock are shown in the illustration. This does away with considerable train delay on dumps where chunky material is handled. A large chunk hanging up close to the train can be passed without stopping to remove it or without battering the steps by striking it in passing.



MOVABLE STEP FOR DUMP CARS

Meeting Emergencies at a Chromite Plant During the War

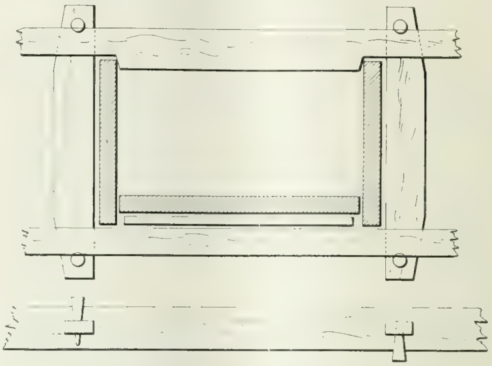
By S. H. Hamilton

Written for *Engineering and Mining Journal*

The winter of 1917-1918 had meatless, heatless and wheatless days, but in the mountains of North Carolina it was chronically nailless, especially with respect to the larger sizes of nails. To concentrate chromite from the rotted dunite it was necessary to build about two miles of flume. Plenty of rough lumber of good quality could be had locally. Labor was of the mountaineer woodsman type. These men are very handy with an axe and really good rough carpenters. It might also be mentioned that the manufacture of locust insulator pins for telegraph cross arms was a local industry.

By making up a supply of cross and side pieces, according to a template, and by generous use of wedges or gluts, made as the work of erection progressed, it was possible to construct an excellent flume in a short time and with the use of few nails.

We had just succeeded in getting the mill running smoothly when hold-up litigation was begun. While we were shut down and the flume was empty it shrunk to such an extent that it looked as though it could never be used. When we were finally permitted to resume work, I telegraphed our foreman. Much to my surprise and pleasure, when I arrived on the property the next day following, the flume was hardly leaking at all. The only thing done had been to drive up the pins and wedges.

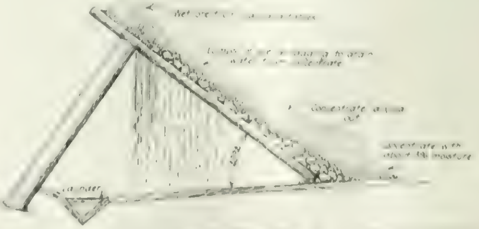


FLUME BUILT WITH WEDGES AND PINS

Drying Concentrates by Crude Means

The chromite concentrates made in the mill that was erected in the emergency during the war had to undergo a long haul to reach the railroad station. This was followed by an expensive rail haul. Had it been possible to buy a drier and to succeed in having it delivered, it is a regrettable fact that there would have been no money to pay for it. A home-made drier was devised as follows:

A crude frame was built out of light lagging having a pitch of 35 to 40 deg. Some lumps of rich ore were piled on this and on the floor at the base. The concentrates, as made, were poured on the top of this drain pile. An area of about 5 x 6 ft. drained and dried about a half a ton a day in this fashion. As it dried it gradually rolled to the bottom, where it was sacked and shipped with about 3 per cent water.



DRYING CHROMITE CONCENTRATES IN AN EMERGENCY

THE PETROLEUM INDUSTRY

Oil-Shale Deposits in Germany

Restriction of Petroleum Imports Inadvisable—Oil Shortage Encourages Exploration of Shale Deposits Which Give Evidences of Potential Productivity

SPECIAL CORRESPONDENCE

Germany's pre-war production of natural oil was rather insignificant compared with the tonnage annually required by her industries, a liberal estimate placing the annual output at 8 per cent of the total consumption, and this percentage has now experienced a further reduction by the loss of the famous Pechelbronn wells, in Alsace. In view of the fact that the latter supplied approximately 50 per cent of the entire inland production, the question of increasing production by the exploitation of new wells and deposits is one of the problems ranking foremost in importance with the German industry, the more so as the importation of foreign oils and oil products will probably be restricted to a minimum for some time to come, on account of the deplorable state of Germany's finances.

Foreign oils are not barred from entering Germany; on the contrary, as was stated at a recent sitting of the Technical Committee of the German Mineral Oils Distribution Bureau, a general restriction of mineral oil imports was neither considered practicable nor desirable except in the case of high-priced oils and such products as were supplied in sufficient quantities by the home industry. In the course of the proceedings, interesting data covering German mineral imports were given. The import total of all kinds of lubricating oils during 1920 was estimated at from 170,000 tons to 180,000 tons (compared with an average pre-war import of 260,000 tons). Out of this total, approximately 157,000 tons were mineral oils, which are classed as follows:

	Tons
Crude oils	49,400
Spindle oils	6,100
Machine oils	55,000
Cylinder oils	10,000
Asphalt	11,300
Fats	24,500

It is estimated that about 25,000 tons of oil entered Germany illegally through the so-called "gap in the west."

The existence of bituminous oil-shale deposits in various parts of Germany was known long before the war, but no serious attempts were ever made toward their exploitation. This was due primarily to lack of data regarding the caloric value of the oil and to the relative cheapness of foreign oils. The oil trickling from the deposits was collected and used for local consumption only, serving either as a raw material for the production of cart-grease or as, in the case of the oil extracted from the Tegernsee shale deposits, for medicinal purposes. Isolated attempts were made to distill the oil, but the question of systematic and scientific exploitation of the shale on revenue-paying lines for industrial purposes was not seriously considered.

However, as the war was progressing the shortage of oil made itself increasingly felt, and steps were taken with a view of exploring the oil-shale deposits in Germany and investigating the possibilities for a profitable exploitation. As the result of extensive geological research, the fact became known that shale deposits were of greater occurrence than had been generally assumed, the oil shale being principally a slaty marl. The oil content varied considerably, ranging between 1 and 30 per cent.

As a natural result of formation of strata, the principal deposits are in central and southern Germany, especially around Reutlingen (in Wuerttemberg), where nearly 250 liters of crude oil are obtained from one cubic metre of shale. Some time ago, an enterprise for the exploitation of deposits was formed at Holzheim, with the active support of the state, under the name of "Jura Oelschiefer G. m. b. H." The capital amounts to sixteen million marks, of which seven millions were subscribed by the government. At a recent session of the State Finance Department it was stated that output was satisfactory and that permanent profitable operation seemed assured. The company will principally engage in the extraction of oil, and production of slag bricks—which have proved their serviceableness beyond a doubt—will form a side line of the undertaking.

Other slaty marl deposits of considerable extent have been discovered in Baden, but operations were eventually discontinued after some trial borings, owing to the poor oil content. On the other hand, deposits rich in oil exist in the Harz Mountains, Saxony, Hanover, Hessen and the Alps, as well as Bavaria. In some parts of the Jura Mountains in Bavaria a peculiar kind of oil shale containing approximately 6 per cent oil has been discovered. Before the war quantities were obtained from that source, but operations were discontinued, the cost being too high in relation to the price for American and Russian petroleum.

Owing to aforementioned reasons, it has recently been decided to resume operations, the "Bayrische Mineraloelwerke" having plants erected in Upper Franconia, near Bayreuth, where schist-oil is to be produced, together with benzine, paraffin, lubricating oils, and byproducts. It is planned to use the mineral residues in connection with cement production as well as in fertilizers. Operations will be conducted on an area measuring about 2,700 acres, which has been assigned to the company. The calorific value of the oil is claimed to be equal to that of the more inferior grades of German brown coal.

The extraction of the oil takes place at special distillation plants, the most advantageous process being by the employment of heated retorts, the gas obtained as a byproduct in this process being used for heating the retorts. The ashes serve either as a raw material for cement production or are pressed into briquettes while the crude oil is undergoing the usual distillation process by which benzine, illuminating oil, gas engine oil and lubricating oil are derived. Wherever oil shale is obtainable at favorable freight rates, it is frequently used as a direct fuel.

No exact figures of the potential productivity of the shale deposits in Germany are available as yet, but there can be little doubt that, with an intensified exploitation of available deposits and continued exploration of new ones, the tonnage annually produced will materially assist toward rendering German industry less dependent upon foreign supplies.

Naval Reserve Lands in California

WASHINGTON CORRESPONDENCE

The Secretary of the Navy has announced that private operators are to be given an opportunity to lease certain sections of the Naval Reserve oil lands in California. The formal statement follows:

"The last naval appropriation act authorized the Secretary of the Navy to operate Naval Reserve lands in California either directly or by lease whenever the interest of the Government would seem to demand such action. A condition has arisen in Naval Reserve No. 1, in California, which makes it necessary for wells to be drilled on Naval lands in order to offset wells drilled on adjacent property and which are now drawing oil from the Naval Reserve lands.

"An advertisement which the Secretary of the Navy has just issued provides for the lease of a certain portion of land for the drilling of a double row of offset wells such as will prevent other operators from securing the oil that is the property of the Navy. The leasing of this land is open to operators of experience who can assure the Navy Department of their capability in the matter, and intending lessees are required to state in their proposals the royalty in fuel oil which they will offer for the privilege of the lease. This oil is to be delivered at such points on the Pacific Coast as the Secretary of the Navy may direct.

"The proposals are to be received either in San Francisco or in Washington, as the bidder may elect. Following are the instructions sent by Secretary Denby to Lieutenant Commander I. F. Landis, retired, U. S. N., San Francisco, Cal.:

"Sealed proposals will be received until noon April 25, 1921, at Room 217, Post Office Building, San Francisco, Cal., or at the Bureau of Engineering, Navy Department, Washington, D. C., for lease of a strip of land within Petroleum Naval Reserve No. 1, Kern County, Cal., along the north side of Sec. 1-31-24, M.D.M., and along the east side of the northeast quarter of said section, nine hundred feet wide, and to have drilled thereon twenty-two wells in two rows, properly and economically spaced, as rapidly as men, material and supplies therefor can be obtained. Bidders must furnish evidence of their ability to begin promptly and prosecute diligently the work of drilling and production. Bids must state when work will be started and the time for drilling the first and each succeeding well; and the royalty that will be paid in crude oil delivered on the lease or the equivalent in fuel oil delivered at tidewater at the option of the Navy Department. Each proposal must be accompanied by a bond or a certified check in the sum of $10,000 as a guarantee that the bidder will, if his proposal is accepted, enter into contract, and furnish satisfactory bond for the fulfillment thereof. The right is reserved to reject any or all bids or to accept any bid, as the interests of the Government may require.'"

British Guiana Oil Possibilities

SPECIAL CORRESPONDENCE

D. Elliott Alves, president of the British Controlled Oil Fields, Ltd., according to reports received at Georgetown, Demerara, British Guiana, is to visit British Guiana to study local conditions.

Several years ago Mr. Alves obtained through the British Colonial Office a permit to explore all unoccupied Crown Lands in British Guiana for oil, and for the expenditure of a stated sum of money on exploration work he was to receive 2,000 square miles in concession. In January, 1919, Mr. Alves sent [illegible]ge E. Reynolds to the colony, with several assistant geologists. This expedition, after several months of general exploration, left for Trinidad without giving out any information. In April, 1920, a second expedition, in charge of B. T. Macrorie, arrived in British Guiana, and spent several months. When Mr. Macrorie left without starting any serious work, such as test borings, the general opinion prevailed that Mr. Alves had given up British Guiana as an unpromising field.

It is stated that Mr. Alves is to have an aerial survey made of his oil concessions in Venezuela, and that he has engaged the services of a company already operating in the West Indies to make a survey within six months, the sum to be paid being £12,000. The concessionaires are to supply boarding and lodging for the staff of the aerial fleet as well as fuel. It is hoped that this fleet will extend its operations to British Guiana.

Chamber of Commerce To Discuss Oil Resources

At the ninth annual meeting of the Chamber of Commerce of the United States to be held at Atlantic City, April 27 to 29, the question of "Our Government's Relation to Domestic and Foreign Oil Resources" will be discussed by leading business men from various sections of the country. The subject will come up for discussion before the group meeting of the chamber's department of natural resources production.

"The importance of this subject," says this department, "rests on the fact that certain foreign fields are closed to American exploitation. Our exclusion from those fields is viewed with concern by American business men since our own oil fields tend to exhaustion." The discussion will bring out some interesting arguments on the international oil situation.

Red River Boundary Settlement Deferred

SPECIAL CORRESPONDENCE

In the suit between Oklahoma and Texas over the Red River boundary, involving valuable oil lands, Oklahoma won the first point in the Supreme Court on April 11. The court decided unanimously, except that Associate Justice Clark took no part, that the south bank of the Red River must be taken as the true boundary between Texas and Oklahoma from the southeastern corner of Oklahoma to the point where the river crosses the 100th meridian of longitude.

The limitation of the exact location of the south bank was postponed until the entering of the formal decree. This will probably be within thirty days. The court based its finding on the terms of the treaty between the United States and Spain in 1819 regarding the Louisiana Purchase.

Book Reviews

Structural and Field Geology. By Jas. Geikie, LL.D. Fourth edition, revised. Cloth; 5½ x 8½; pp. 433. D. Van Nostrand Co., New York. Price, $7.50.

The textbook of geology by Professor Geikie was one of the stand-bys thirty years ago, along with those of Dana and Le Conte. The present volume, however—"Structural and Field Geology"—was issued in 1905. Since the death of Professor Geikie, it has been revised by Dr. Robert Campbell, of the University of Edinburgh.

After looking over this volume, we do not feel that we can recommend it to American readers. Its examples are drawn almost entirely from the United Kingdom, with a minor amount from Europe. Authorities, quoted very sparingly, are similarly selected. The nomenclature differs considerably from that which has been adopted in America, Canada, and also largely in Australia. We do not refer to an "outcrop" as an "outgoing"; few of us have any idea of what "cockade" ores are; we are not familiar with "calc-silicate hornfels" or "schorl"; the choice of "aplite or haplite" looks to us like a problem in dropping the "h's"; we spell felspar with a d. How many of our geologists know what "mylonites" are? As a clue, they are rocks—not fossils.

Moreover, the volume is plainly old fashioned, elementary, and too academic: it smacks too much of the lecture room and too little of the field. American students will do well to study Pirsson and Schuchert, or Chamberlain and Salisbury; and, for ore deposits, Kemp, Lindgren, or Emmons. We are almost tempted to give the same advice to English students; but there is some advantage for these in the citing of British and European examples.

The geology is curiously simplified and textbookized. Though the elementary student may acquire a knowledge of many useful geological facts, he will not get a real breath of the great out-of-doors; and the book is evidently not written for the advanced student. A number of chapters on geological surveying comprise obvious and simple matters that should be imparted in the classroom or the field, or gathered by experience.

The two chapters on ore deposits are not to be recommended: they remind one of all the old textbooks from Von Cotta down, with a faint aroma of the modern. Californians will be interested to know that the Mother Lode is probably the most persistent lode in the world, running straight for more than seventy miles, whereas some lodes die out in much less than a mile! (P. 246). Food for much thought, as regards "fissure veins or lodes," is given by the remark that "As vertical fissures of all kinds tend to die out upward, while the amount of displacement by faults diminishes in the same direction, we may infer that many fissures may never have reached the surface at the time of their infilling, the outcrops we now see having been exposed by denudation." (P. 247.)

We are interested to know that some veins have been followed to depths "not far short of 3,000 ft." Not so very far short. We pause to consider what "secretionary ore-formations" may be (p. 276), and when we have found out, maybe we had better forget it. Lateral secretion and Sandberger are among the latest news in these pages. Finally, we read again with excitement, as in our youth, of the evidence of foul play among the fishes in the copper slates at Mansfeld. These fish, according to the view—one of the views—cited, were "poisoned by an abundant influx of water charged with salts of copper. Certainly the fossil fish of the copper slate often occur in bent and contorted attitudes, as if they had suddenly been killed." An ancient geologic joke recites that the prehistoric fishes were caught by the prehistoric fissures; but this does not answer the problem of the wholesale extermination of the finny tribe at Mansfeld, by a method which so far as we know has always been illegal.

J. E. S.

Metal Statistics, 1921. Published by the American Metal Market, New York. Cloth; 4 x 6; pp. 560 inc. advts. Price, $1.

The edition of this book carrying statistical information concerning the ferrous and non-ferrous metals up to the close of 1920 has just been issued. Prices, production, consumption, and other data are given for iron, steel and fabricated products, copper, tin, lead, zinc, aluminum, antimony, nickel, silver, and miscellaneous ores and metals.

Recent Patents

Magnetic Separator—No. 1,371,825. Franz Uhlig, Berlin, Germany. A magnetic separator for removing tramp iron from a stream of falling ore, together with a receiver for catching the extracted articles.

Method of Depolarization—No. 1,371,826. G. D. Van Arsdale and C. G. Maier, New York, N. Y. The use of a soluble salt of a metal as a depolarizing agent and a method of regenerating it after it has been transformed at the electrode.

Vanadium for Making Sulphuric Acid—No. 1,371,004. Franz Slama and Hans Wolf, Ludwigshafen-on-the-Rhine, Germany, assignors to General Chemical Co., New York, N. Y. The use of vanadium compounds as catalytic agents in the manufacture of sulphuric acid.

Flotation—No. 1,370,843. R. E. Sayre, Pittsburgh, Pa., assignor to Metals Recovery Co., New York, N. Y. The use of a ketone condensation product as a flotation agent.

Technical Papers

Petroleum Concessions—An opinion by Hon. Manuel Calero, formerly Mexican Ambassador to the United States, on petroleum concessions in the "federal zones" in Mexico, is expressed in a memorandum to Frederic R. Kellogg (52 Broadway, New York) entitled "Petroleum Concessions in the 'Federal Zones' of Mexico." In his report regarding the validity of oil concessions granted by the Mexican government in the so-called "federal zones," Senor Calero states that they are illegal, basing his opinion on the following conclusions: In the greater number of cases property rights are violated because they refer to channels owned by private individuals as part of the tracts in which they are found; when these channels are not the property of individuals, such concessions violate private rights, because they extend to the banks which are always the property of the owners of the tracts running along the rivers; in any case, concessions violate private rights by being extended to the so-called "federal zones," because this term, speaking of waters of federal jurisdiction, involves only the imposition of an easement, of common use, which does not alter the basis of the right which the owner of the land has in respect of the land; and if the validity of the Constitution of 1917 and of the precept of Article 27, which declares the subsoil of the country to be the property of Mexico, is admitted, even so the concessions which have been considered are illegal, because they are issued without the adoption by the Mexican Congress of any law which carries into effect said Article 27.

Nickel in South Africa—In the *South African Mining and Engineering Journal* of Feb. 19, 1921 (Johannesburg, Transvaal; price 6d.), is published some of the particulars regarding the recent discovery of nickel deposits in the Barberton district. The metal occurs in the form of garnierite, the same as in New Caledonia, and the deposits promise to be so extensive and high grade that commercial development is being started. The South African Nickel and Talc Mines, Ltd., has been formed in Johannesburg to handle the proposition, and it is planned to ship the ore to Europe for treatment.

Canadian Mineral Production—Preliminary reports of the 1920 mineral production of Ontario, of Quebec, and of Canada as a whole have been issued. The value of mineral products for the Dominion exceeded any previous year. Copies of the bulletin may be had on application to the Department of Mines at Toronto, Quebec, and Ottawa, respectively.

Massachusetts Geology—Bulletin 704 of the U. S. Geological Survey, Washington, D. C., 132 pages, obtainable on request, describes the geology of igneous rocks of Essex County, Mass.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Hoover Tells A. E. C. of Needed Changes in Federal Machinery

Budget System Desirable, but Thorough Reorganization of Executive Departments Essential

The following summary presents the chief points made by Secretary Herbert Hoover in his last address as chairman of American Engineering Council at its session in Philadelphia on April 16:

There is one problem of the new Administration that has received the attention and thought of the organized engineers of America for many years past. This is the problem of the reorganization of the Federal Government. Government waste during the war amounted to millions.

Congress has placed the problem in the hands of an able Congressional joint committee, but if it is to succeed in securing the imminently necessary results it will only be by full insistent support by public opinion. Many previous attempts at reorganization have gone to the same crematory—the interminable differences in opinion among the executive and legislative officials over details.

One sweeping and fundamental necessity stands out above all others, and that is that the administrative units of the Government must be re-grouped so as to give each of the great departments more nearly a single purpose. Economies can be accomplished from a public point of view by an elimination of the overlap in the different units of administration through unification into groups of similar purpose. The real economy to the nation, however, does not lie here, however great this may be; it lies in their more effective functioning in their daily relation to the public.

Of equal importance with economy is it to secure effective concentration of Government effort into service to the community. No constructive vision or policies can be built around a national service directed by from two to ten Cabinet members, more especially when this particular purpose is a side issue to all of them. No better example of this exists than the deplorable handling of our relations to our veterans.

There are other reasons that render reorganization imperative. The changed economic situation of the world demands that the functions of the Government in aid to commerce and industry be given more concentration and wider scope.

The enlarged activities of the Government as a result of the war greatly affect certain departments. The Treasury today as the fiscal office of the Government must handle an annual budget of $5,000,000,000, as compared with $1,000,000,000 before the war. Activities of the Army have increased from a budget of $200,000,000 to $400,000,000; activities of the Navy have increased from a budget of $125,000,000 to $425,000,000. In the interests of efficiency the gentlemen conducting these departments should not be called to responsibility for the administration of at least some of the matters not pertinent to their major functions but which now clutter their departments.

We have also some confusion between executive, advisory, and semi-judicial functions. One of the tendencies of Government, both local and national, during the last twenty years has been to add executive functions to commissions and boards created primarily for advisory or regulatory purposes. It requires no argument to show our business public that the executive functions can not rise to high efficiency in the hands of Government boards, where, from the very nature of things, each member has a separate responsibility to the public and is primarily engaged in a semi-judicial function.

Furthermore, during the last few years there has been a great growth of independent agencies in the Government, reporting directly to the President, until his office is overburdened almost beyond the point of endurance. Not only do these outside functions today overburden the President, but they render co-ordination with executive departments extremely difficult. Much could be done to mitigate the situation.

One of the great steps in Federal reorganization is the erection of a budget system, but it will not serve its real purpose until the departments have been so reorganized that they represent a common purpose. Without this, Congress will never have before it budgets showing the expenditure of the Government in its relation to any particular function.

I have daily evidence in the Department of Commerce of all these forces. The economic changes in the world, growing out of the war, and their reflex upon our trade and industry, make it vital, if we are to maintain our standard of living against increasing ferocity of competition, that we concentrate and enlarge our national effort in the aid, protection, stimulation and perfection of our industrial and commercial life. There can be no real Department of Commerce or commercial policies to these broad purposes so long as the instrumentalities of the Government bearing on these questions lie in half a dozen departments.

We want no paternalism in Government. We do need in Government aids to business in a collective sense. In a department we do not want to either engage in business or to regulate business. We need a department that can give prompt and accurate diagnosis, from both foreign and domestic points of view, of economic events, of economic tendencies; of economic ills; that can promptly and accurately survey economic opportunity, economic discrimination and opposition; that can give scientific advice and assistance and stability to industry in furnishing it with prompt and accurate data upon production, supplies and consumption; that can co-operate with it in finding standards and simplifications; that can by broad study promote national conservation in industry and the elimination of waste; that can study and ventilate the commercial side of our power possibilities; that can study and advise national policies in development of rail, water, and overseas transportation; that, in fact, covers, so far as Government functions can cover, the broad commercial problems of trade, industry, and transportation. This can be accomplished more by co-ordination of existing governmental facilities than by increased expenditures.

Fairbanks Experiment Station Proves Its Value to Alaska Miners

Under the superintendency of John A. Davis, the experiment station maintained at Fairbanks, Alaska, by the U. S. Bureau of Mines is carrying out a number of studies along lines suggested by the existing needs and conditions of the distant isolated territory. Some of the results have recently been reported by the Bureau and may be summarized here.[1]

Investigations are mainly along two lines: the recovery of gold from black sands and the study of milling methods.

In the effort to devise a means of preventing waste, the Alaska station has experimented with various methods for recovering the gold.

These experiments have aroused a great deal of interest among the Alaska placer miners, many of whom are taking advantage of the results obtained, with a consequent greater saving of gold in their mining operations.

The Alaska station is also making a study of the ores and of the methods and processes employed at mines and concentrating plants in the district, together with laboratory tests of products obtained during their operation. Ordinarily the Bureau does no ore-testing work for the benefit of private companies or individuals.

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[1] *Reports of Investigations*, U. S. Bureau of Mines, March, 1921, Serial No. 2,231.

MEN YOU SHOULD KNOW ABOUT

J. B. Tyrrell has returned to Toronto from a recent trip to Alberta and the West.

W. A. Nelson, state geologist of Tennessee, conferred with officials of the U. S. Geological Survey in Washington recently.

Jay A. Carpenter, consulting metallurgical engineer of Los Angeles, Cal., was in San Francisco, Cal., recently on his way to Ione, Nev.

George Hanson, of the Canadian Geological Survey, British Columbia branch, should be addressed at 510 Pacific Building, Vancouver, B. C.

George P. Tweed, of the firm of Coates & Tweed, Hibbing, Minn., has returned from a business trip to the large furnace towns of the East.

H. A. Buehler, director of the Missouri Bureau of Geology and Mines, was in Washington, D. C., recently, conferring with Government officials.

F. C. Thompson, Survey Research Fellow at the University of Sheffield, has been appointed professor of metallurgy at the University of Manchester.

A. H. Brooks, of the U. S. Geological Survey, recently spoke at the General Staff college of the army, on "The Application of Geology to the War."

J. S. S. Brame, professor of chemistry in the Royal Naval College, Greenwich, London, England, is president of the Institution of Petroleum Technologists for 1921-22.

W. C. Agnew, general manager of the Rogers-Brown Iron Mining Co. and the Mahoning Ore & Steel Co., has gone to Baltimore, Md.

Dr. F. H. Hatch, has been appointed advisor to the Mines Department of the Geological Survey of Great Britain, on questions relating to the metalliferous mining industry.

A. S. Eakle, professor of mineralogy in the University of California, at Berkeley, is in charge of that university's extension course in mineralogy conducted by correspondence.

R. H. Carr, vice-president of the Demerara Bauxite Co., Ltd., left Georgetown, Demerara, British Guiana, March 24, by the "Maraval" for New York. He is expected to return soon.

F. L. Ransome has completed a reconnaissance of the ore deposits in the Oatman district of Arizona for the U. S. Geological Survey. He was assisted in this work by **M. G. Gulley**.

J. J. Warren, president of the Consolidated Mining & Smelting Co., has returned to Montreal from a trip of inspection to the company's workings and plants in western Canada.

George W. Wooster, treasurer, and **G. L. McNichol**, purchasing agent for the Granby Consolidated Mining, Smelting & Power Co., have resigned after completing twenty-two years of service.

C. W. Cooke and Miss **Julia A. Gardner**, of the U. S. Geological Survey, are making a field examination of the Upper Eocene, Oligocene, and Miocene formations in Alabama, Florida, and Georgia.

G. M. Colvocoresses, general manager of Consolidated Arizona Smelting Co., and president of the Western Metallurgical Co., has just returned to Humboldt, Ariz., from a six-weeks' trip east.

William Spry, the new Commissioner of the General Land Office, is charged with the survey, management, and disposition of the public lands, the granting of railroad and other rights of way, and the execution of laws relating to surveying, prospecting, entering, and the like in national forests. His official duties thus bring him into contact with the land-classification board of the U. S. Geological Survey as well as with the officials of the U. S. Forest Service. Ex-Governor Spry has declared it as his firm conviction that the mining industry is entitled to more co-operation from the Federal Government than it has been receiving.

WILLIAM SPRY

Commissioner Spry was born at Windsor, England, in 1864, but came to the United States when eleven years old. His extensive business experience began when he was a general merchant in Salt Lake City, Utah, from 1891 to 1893, after which he took up farming and stock raising, with some success. From 1894 to 1896 he was also county collector of Tooele County, Utah. In the following years he was successively councilman of Grantsville, president of the Utah Board of Land Commissioners, and United States Marshall for Utah. In 1908 he resigned this last position and ran for Governor, was elected, and served two terms, from 1909 to 1917. He was appointed to his present position on March 17, 1921, and assumed office a few days later.

C. L. Nelson has been granted a year's leave of absence by the U. S. Geological Survey, to accept employment with the Sinclair Exploration Co. He has been assigned to work on the island of Timor, in the East Indies.

Robert McF. Doble has been appointed on the staff of the Metals Exploration Co. as consulting engineer on electric and hydro-electric power installations and operations. His headquarters are at 201 14th St., Denver, Col.

Frank H. Sistermans, mining engineer, has returned from a three months' trip to Mexico, where he investigated various mining properties for New York clients. His present address is Room 1505, 60 Broadway, New York City.

J. O. Elton, metallurgical engineer with the Anaconda Copper Mining Co., Great Falls, Mont., has received an honorary degree from the University of Idaho in recognition of his work in the hydrometallurgy of zinc. Mr. Elton is a graduate of that university.

Charles A. Mitke, consulting mining engineer of Bisbee, Ariz., was in New York City last week on his way to Cambridge, Mass. Mr. Mitke is to give a six weeks' course of lectures on mining methods to classes in mining at the Massachusetts Institute of Technology.

Key Pittman, senior Senator from Nevada, has been making a short trip through some of the principal mining districts of his state, with the object of personally assuring the residents and operators that he firmly believes in the practical impossibility of the repeal of the Pittman Act.

Engineers recently engaged by the Guiana Development Co. for its mining operations on the Marowine River, French Guiana, include **R. Sargent, G. E. Mish, W. Piel, C. Apfel, W. C. Norton, James Bowe**, and **A. Box.** They sailed from Georgetown, Demerara, on March 24, by the "Kon. Wilhelmina" (D. G. S.) for Paramaribo, en route to Surinam.

Colin G. Fink, electrometallurgist, organizer, and for the last four years director of the research laboratory of the Chile Exploration Co., New York City, has resigned that position. Dr. Fink recently developed a new tin reduction and refining process, and his insoluble anode is being introduced at the Chuquicamata, Chile, copper refinery. He has opened a consulting engineering office in South Yonkers, N. Y.

SOCIETY MEETINGS ANNOUNCED

The Arizona Chapter of American Mining Congress will meet at Bisbee, Ariz., on June 13. J. E. Curry, Bisbee, Ariz., is secretary.

The Chamber of Commerce of the United States holds its ninth annual session on April 27, 28, and 29, at Atlantic City, N. J.

Mining Men of Pacific Northwest Meet Again In Portland

Second Convention of Season Follows Soon After That at Spokane — Nelson Selected for Next Gathering — Address By Edwin Ludlow, President of A. I. M. E., Features Occasion

BY ROBERT DUNN
Written for *Engineering and Mining Journal*

THE question of raising the tariff on imported metals, the problem of production and distribution of coal, the encouraging of the prospector, and generally the fostering of the mining industry of the Northwest were considered by the International Mining Convention held in Portland, Ore., April 5 to 9. More than 600 delegates from Washington, Idaho, Montana, California, Alaska and British Columbia were present. Exceptionally fine weather marked the days of the convention and the time that was not spent in the transaction of business was spent by the visitors in the enjoyment of the entertainment features provided. Nelson, B. C., was selected for the next International Convention.

The delegates were welcomed by Governor Ben W. Olcott, of Oregon, and Mayor George L. Baker, of Portland. Responses were made by delegates from the various sections of the Northwest already named. Perhaps the most notable address of the day was that of Marshal N. Dana, of the *Oregon Journal*, who dealt in general terms with the basic industries of the Northwest.

Wednesday was given up entirely to consideration of the coal resources of the Pacific Northwest, to methods of mining coal, its preparation and its distribution. The first paper was that of George W. Evans, of Seattle, who dealt with the geology and coal resources of Washington and Oregon with brief reference to the coal fields of other sections of the Northwest. Mr. Evans' address was followed by a paper presented by S. H. Green, manager of the Pacific Coast Coal Co., of Washington. E. R. McMillan spoke on the preparation of coal. This was followed in the afternoon by two interesting papers, one by Ralph Gault, a fuel engineer, on the utilization of coal, including hand firing, automatic stokers, and carbonization, with special reference to powdered coal for steam generating. A. W. Perley, of the Oregon Washington Railroad & Navigation Co., then opened a discussion on the [illegible] fields of the Northwest. A paper that may be mentioned in this connection but which was delivered later was one on the low temperature distillation of coal, by Elroy Thomas, of New York. There was marked unanimity of opinion as to the desirability of abandoning present wasteful methods in burning coal. The solution accepted seemed to be to treat coal by low temperature distillation [illegible] and to recover the by-products.

This discussion was entered by Edwin Ludlow, president of the A. I. M. E., who spoke of a good coking coal as being essential to the success of an iron and steel industry. To get this industry the West's only problem was that of obtaining the required metallurgical coke. Develop such an industry in the coal fields of Washington and Utah and the rest would follow. There seemed to be no lack of iron ore, especially when the magnetites of British Columbia and the proximity of the resources of Mexico and of the Orient were borne in mind. Nichol Thompson, of Vancouver, dealt with the magnetites of British Columbia, with the fine coking qualities of the coal of the Crow's Nest Pass district and with the high-grade metallurgical coke which has been produced from the coals of Vancouver Island.

PRESIDENT OF A. I. M. E. ADDRESSES CONVENTION

British Columbia day, April 7, was opened with Dr. Edwin T. Hodge in the chair. An address was delivered by Mr. Ludlow on "The Mining Industry in Relation to Business." The inhabitants of this country, he said, are directly dependent on the products of agriculture as well as of copper, lead and coal. The products of farms as well as of mines of America must find a market at a price higher than the cost of production. He traced the commercial history of the last few years, pointing out that the United States had been a heavy exporter with the balance of trade very markedly in its favor. Under present conditions if trade was to be maintained it must be based on barter rather than credit. Europe owes the United States fifteen billion dollars. Never before had a depression been experienced in this country at a time when the nations of Europe were not financially able to take advantage of the fall in the value of American securities during such periods to purchase the same in large quantities. Local production had been keyed up by war efforts far beyond the local power of consumption. There also was to be considered a very serious adverse factor; namely, the matter of exchange. This might be simply explained by the statement that a South American merchant with $10,000 in United States currency to invest would be able to purchase $13,000 worth of goods in England, more in France, and $20,000 worth in Germany. The condition was further aggravated by the prevalence in the United States of a "buyer's strike."

In Europe cotton, wheat, copper and coal were badly needed, said Mr. Ludlow, but could not be obtained from America unless the trade was based on barter rather than credit. This brought up the question of the tariff and whether a tariff wall will be built around this country "to protect the manufacturing interests, rendering it impossible to extend that assistance which is needed, not only to the majority of our people, but to the war-ridden nations of Europe, who have nothing but the work of their hands with which to pay for the raw material needed." It is hoped, continued Mr. Ludlow, that they (Congress) will examine carefully the question whether the manufacturers who are demanding this protection have done their share toward reducing the cost of living. Copper, lead, zinc and the products of the farm already are selling not only below 1914 prices, but below the cost of production and coal is arriving at this point. Mr. Ludlow concluded by sounding a solemn note of warning. Mining and agriculture were basic industries, he said, and their future should be based solidly on good business principles and not on the protection of favored industries. If the tariff wall were built for the protection of the products of the mines and farms the production of those industries must be reduced to meet the needs of America alone. In the war of the survival of the fittest that would follow railroad rates would handicap the industrial advance of the West. Many of the higher cost mining projects would be closed down and, besides, the industrial recovery of Europe would be immeasurably delayed.

WILLIAM SLOAN DISCUSSES MINING IN BRITISH COLUMBIA

Nichol Thompson presided in the afternoon and introduced William Sloan, Minister of Mines for British Columbia. Mr. Sloan referred to the international character of the gathering and the manifold evidences of good fellowship and thorough understanding between the American and Canadian delegates. He extended an invitation to the former to visit British Columbia, not because the Provincial Government had just concluded the passage of a liquor control act, but because the Canadians would like to have their cousins with them and because he believed in the axiom that "neighborliness is both sound Christianity and good business." He gave the production of British Columbia in mineral values from 1852 to the end of 1920 as $705,230,519. After outlining results of mining operations during 1920 he pointed out that British Columbia's advance in volume of mineral production had been steady during the past twelve years, in which respect it compared more than favorably with the records of most of the large mineral producing states. He touched on developments of the Salmon River section, in the Portland Canal district; on the progress made in the Alice Arm district, but emphasized that, in considering the silver camps of his province, the Slocan and other sections of the Kootenay districts should not be overlooked, as they still furnish the greater part of the silver production of British Columbia. He enumerated what the government of the province has done to stimulate interest in the mining industry, pointing out that among other things there had been constructed and maintained since 1917 3,901 miles of mining roads and trails. He spoke, too, of the institution of series of lectures by the mining engineers in their various districts for the benefit of prospectors and small operators, and also drew attention to the fact that an appropriation had been made for the purchase of powder for distribution at cost among the bona-fide mineral prospectors of the province. Mr. Sloan added "With regard to capital, so essential for continued and increased development, we realize that capital must have a legitimate return, and to that end our mining laws are founded on stability and are recognized throughout this continent as fair and equitable. This also it may be stated is our policy with regard to the important question of taxation."

The Prospector Receives Due Attention

"The Problems of the Prospector" was a subject very entertainingly handled by J. W. Mulholland, president of the British Columbia Prospectors' Protective Association, of Nelson, B. C. He commended the government of the province for the various steps taken to encourage the prospector in his search for mineral, but declared that the real old "sour dough" was now but very seldom found. He soon would be as extinct as the dodo. Mr. Mulholland gave various explanations, chief among which was that the pioneering efforts and the genuine worth of the prospector had not been recognized. He thought that the merchants and the business men would be well advised to heed more often the prospectors' request for grub stakes. The day was when the prospector had no difficulty in finding necessary financial support, but that day had passed.

S. S. Fowler dealt with the "Mining Industry of Southeastern British Columbia." By means of a map Mr. Fowler illustrated the country whose mining industry he outlined.

A paper was read by Robert N. Bell, formerly state mine inspector of Idaho, on "Potential Copper, Gold and Silver Resources and Transportation Advantages of the Snake River Canyon." Mr. Bell enumerated some of the recent important mining developments in his state and expressed the opinion that the construction of a railroad to the Coast by way of Snake River Canyon would mean much not only to the mining industry of Idaho but to the development of business in Oregon as well.

T. A. Rickard and Sidney Norman Speak

An evening session was marked by two papers, one contributed by T. A. Rickard, of San Francisco, on "Prospecting, Past and Future," and the other by Sidney Norman, of Spokane, on "Protection for the Promotor." Mr. Rickard referred to the many accidental discoveries of important mineral deposits in the past and then went on to deal with the scientific process of prospecting. As instances of the latter he called to mind the persistence of the search of James S. Douglas in sinking a deep shaft on the United Verde Extension, even after a first disappointment; also to the opening of the Suan concession in Korea by British and American engineers. In referring to proposed easy ways of locating ore underground he spoke of "the divining rod," the "magnetic needle to find masses of iron ore," "the method of measurement of electric resistance whereby the resistance of the earth circuit between two points is measured in order to detect abnormalities that point to the presence of orebodies," and "the telephonic method," in which the passage of electric currents in the earth is observed, etc.

He continued: "The hazel twig as a means of divination may yet have as its successor some accurate method of finding ore; the alchemy of one age is the chemistry of another. I am quite prepared to believe that honest scientific investigation will succeed in devising a way of obtaining guidance for the miner in his prospecting by detecting and measuring the emanations, resistances and other intangible reactions of matter on matter in such a way as to indicate not only qualitively but quantitively the presence of ore at a distance underground. Meanwhile it remains for the prospector to use the methods on which he can rely rather than allow himself to waste time and break his heart on schemes that are either inchoate or fraudulent. The core drill and diamond bit are well tried tools; the shaft and the prospect hole will not deceive. After all, the best instrument of divination is the pick. There is intelligent curiosity in the point of it; there is strength in the handle of it; there is rhythm in the swing of it."

Mr. Norman spoke very strongly regarding the ill effects of blue sky legislation now in force in about thirty states of the Union. He went into the subject very exhaustively and maintained that the small promotor who is responsible for so much of the mining development of the past is being driven out of the business. Illustrations were given to point out the absurdity of some of the methods adopted in some states in connection with the enforcement of this legislation. It was his argument that if this legislation continued as at present it would mean the strangulation to a large extent of mining development. He advocated that if blue sky legislation were at all necessary it should be unified in its application to the United States, its administration being placed in the hands of a Federal board.

This matter was the subject of much discussion the next day, the outcome of which was the passage of a resolution endorsing the principle advocated by Mr. Norman and calling upon those in authority to take concerted action.

Convention Against Increased Tariff on Lead and Zinc

Some resolutions passed by the convention may be summarized as follows:

That immediate steps be taken by carriers or producers and shippers jointly to secure such readjustment of the present ore and bullion rates as will permit of continued operation of metal mines, and at the same time give to the carrier a just and reasonable compensation for the service rendered by it.

That the Federal Trade Commission be requested to make an immediate investigation of the affairs of the so-called "Powder Trust," and the attention of Congress is respectfully invited to consider its exactions, with a view to bringing the price of explosives down to a level justified by present conditions, thus aiding materially in restoring prosperity to the mining industry and reducing the cost of the great highway building campaign being carried out in the Western States.

That the homestead grazing act, providing for entry to the extent of 640-acre lots, is detrimental to the mining industry, opening the way for unscrupulous individuals to make entries and hinder legitimate development of the mining industry, and that this act be immediately repealed.

A more or less persistent effort was made to have the International Convention put itself on record as being in favor of a considerably increased tariff on lead and zinc imported to this country. This movement was initiated particularly by the delegates from Idaho. A meeting of the American delegates was called especially to consider the question. Strong opposition to the convention putting itself on record developed, and the matter was dropped.

An Oregon section of the American Institute of Mining and Metallurgical Engineers was formed during the convention, a very enjoyable "get-together" dinner being held for that purpose. Officers were elected as follows: Henry M. Parks, president; M. Bailey, vice-president, and F. S. Cook, secretary-treasurer.

THE MINING NEWS

LEADING EVENTS

Walkout at Tonopah and Divide Following Wage Cut

Crafts Object, Claiming Living Cost Has Not Decreased 25 Per Cent —West End, Halifax and Cash Boy Running

Mine and mill workers in the Tonopah and Divide districts of Nevada walked out on April 16, the day when a wage cut of 75c. per shift, announced on April 11, was to become effective. On the earlier date a majority of the operators of the district had posted a notice of this reduction and there was very little discussion among the miners. This reduction brings wages of miners and muckers to $5.25 and $4.75 per day respectively, hoist engineers $5.75, blacksmiths $5.75, machinists $5.75, and mill men $4.75 to $5.25.

Reasons for the reduction were that wages are higher in the district than in any other camp in the state, and probably in the West, with the possible exception of isolated districts; that the ores of these districts are getting lower in grade, making it increasingly difficult to operate at a profit in spite of the advanced price of silver; and that the drop in the cost of living justifies a corresponding drop in the wages. The drop in the cost of living, the operators claim, has amounted to at least 25 per cent in the past year, the drop being aided very materially by the successful operation of the Mine Workers Mercantile Co., an organization financed by the mining companies, which is running one of the most modern and up to date retail and wholesale stores in the state, selling practically at cost.

The crafts met, however, and made public objection to the reduction on the basis that living costs had not been reduced 25 per cent during the last year, although operators claim that they have. On the 16th the walkout was complete at all mines and mills where the reduction notices were posted. The only mines operating normally in the Tonopah district are the West End, Halifax and the Cash Boy. At Divide operations are practically discontinued.

Iron Ore Taxation Bill Signed in Minnesota

The Occupational Tax Bill, taxing mining in Minnesota, passed the state senate by a vote of 38 to 27 and was signed by Governor Preus on April 11. The bill provides for a 6 per cent occupational tax on ore mined in the state and will yield approximately $4,500,000 in revenue. As signed the bill is nothing more or less than a tonnage tax with the word "Occupational" added.

WEEKLY RÉSUMÉ

The iron-ore shipping season opened on the Great Lakes on April 11, but few boats are reported to be moving. Ore prices for 1921 are not yet fixed, and operators are said to be anxious. The U. S. Steel Corporation's act in cutting the price of its products, it is hoped, will stimulate trade. In Minnesota the iron-ore taxation measure has been signed. In Nevada, announcement of a 75-c. cut in wages at Tonopah and Divide was followed by a walkout. The Jackling group of porphyries has also announced a 20-per cent cut in salaries. The Silversmith mine, at Sandon, B. C., has shut down indefinitely. The Hecla, at Wallace, Idaho, has decided to remain open. Calumet & Arizona will cease all production of ore and copper at once. On the other hand, conditions in the gold camp of Porcupine, Ont., are said to be the best in six years, and things are flourishing. A reduction in freight rates on ores of certain grades at Pioche, Nev., has been authorized for a limited period. The Seneca Mining Co., at Calumet, Mich., has started its first stope.

In Manitoba the Flin Flon property has been taken under option by the Mining Corporation of Canada, it is said, and $350,000 paid. In Louisiana, Calcasieu Parish is reported to have agreed to a compromise in the Union Sulphur Co. suit over assessed valuation. On April 11 the U. S. Supreme Court handed down a supplemental decision of minor importance in the Conkling-Silver King Coalition case, favoring the latter.

At Washington Secretary Hoover has announced his intention of making a survey of the world's zinc markets. The bill providing for the appointment of a Federal Coal Commissioner has again been introduced. The Senate has once more received H. Foster Bain's nomination as head of the Bureau of Mines.

Porphyries To Cut Salaries 20 Per Cent May 1

Salaries of officials and employees of the "porphyry" group of copper companies, including Ray, Chino, Nevada Consolidated and Utah Copper, are to be cut 20 per cent on May 1. This reduction will apply to those who are on other than a daily basis, provided the rates do not go below pre-war levels.

Hoover Resigns as Head of Engineering Council

Herbert Hoover resigned as the head of American Engineering Council at a meeting of that body in Philadelphia on April 16. Mr. Hoover took the ground that as Secretary of Commerce he could not continue to hold the position.

Flin Flon Now Under Option to Mining Corporation

Owners Said To Have Received $350,000 in Form of Unsecured Loan

The Mining Corporation of Canada has taken an option on the Flin Flon property in northern Manitoba. The price is the same as that which Col. William Boyce Thompson and associates had, the latter's option having expired with the end of March, as stated in *Engineering and Mining Journal* of April 9. The Mining Corporation is reported to have already paid $350,000. It is said that the understanding is that if they are unable to finance the proposition and should fall down on the deal, the $350,000 would be returned to them at any future time that the property is sold. This payment of $350,000, it is said, really represents an unsecured loan to the owners of the property.

Union Sulphur Would Compromise Tax Dispute With Parish

Reported Latter Has Accepted Offer—Seemingly No Dispute Over Valuation of Plant and Equipment

In the dispute over assessed valuation between the Union Sulphur Co. and Calcasieu Parish, Louisiana, the sulphur company has offered to compromise with the parish on the following terms: That the company will pay the taxes for 1919 on the full levied assessment of $31,039,395, plus certain attorneys' fees, interest, etc.; that the assessment for 1920 be based upon a valuation of $3.417 per ton on the 4,009,394 tons estimated remaining in the mine, and that the 892,945 net tons in stock piles (1,042,945 tons gross less 150,000 tons for permanent bases of bins) be valued at the market price f.o.b. mine; that proper tonnage-depletion deductions be made from each future year's assessment, and that the deduction of 150,000 tons from stock piles be a permanent one from year to year. Apparently there is no dispute over the valuation that has been placed on the plant and equipment.

The figures of the agreement in full indicate that the sulphur tonnage reserve in the mine Jan. 1, 1920, was 4,009,394; that the production during 1919 was 526,250 tons and during 1920 was 37,635 tons; and that the gross stock of sulphur on hand Jan. 1, 1920, was 1,042,945 tons valued at $15 per ton, and Jan. 1, 1921, was 271,049 tons valued at $13.50 per ton.

Later advice from Lake Charles, La., indicates that the parish has agreed to the terms of the compromise. This, however, has not been verified.

Utah Engineering Council Holds First Dinner

Sidney J. Jennings Suggests International Council To Regulate Conditions of Silver Production

The Utah Engineering Council, recently formed to bring about the affiliation of engineering societies functioning in the state, held its first dinner in Salt Lake City at the Hotel Utah, on the evening of April 11. There were 400 to 500 engineers and their friends present. The central theme of the speeches of the evening was the use which could be made in modern society of the creative power and experience of the engineer. The newly-elected Governor of the state, Governor Mabey, was present, and gave an address on "The Engineer and the Commonwealth." Clarence Neslen, Mayor of Salt Lake City, also spoke.

The aims of the organization were discussed by Hylon T. Plumb, who introduced Lafayette Hanchett as toastmaster. Sidney J. Jennings, of the United States Smelting Co., was present as a guest of the Utah section of the A. I. M. E. Mr. Jennings spoke on the Pittman Act and its importance to mining, stating it to be his belief that the silver mines of the nation could not operate without the execution of the provisions of this measure. Mr. Jennings urged, furthermore, that mining men co-operate to have the conditions of silver production, as regarding price especially, regulated by an international council.

Other speakers were: Prof. R. R. Lyman, who spoke on the "Value of Technical Training," and W. R. Armstrong, chief engineer for the Oregon Short Line Railroad, who gave a description of pioneer railroad building, asserting that the same qualities needed a few decades ago for accomplishment are equally necessary, if not more so, to solve present-day transportation problems. Rev. J. Sherman Wallace was also on the list of the speakers of the evening.

Montana Society of Engineers Meets at Anaconda

Members of the Montana Society of Engineers held their 34th annual meeting at Anaconda April 7, 8 and 9. Sight-seeing trips were made through the various departments of the Washoe Reduction Works of the Anaconda Copper Mining Co.

George T. McGee, of Helena, was named president of the society. Other officers elected were: Chauncey L. Berrien, Butte, first vice-president; Leon D. Conkling, Bozeman, second vice-president; Earl B. Young, Butte, secretary and librarian; Harry H. Cochane, Butte, treasurer; Charles H. Clapp, Butte, and Frank A. Linforth, trustees for three-year term. C. A. Lemmon the retiring president, in his annual address reviewed the progress of oil development as well as that of highway construction in Montana.

Court Gives Coalition Company Extra-Lateral Rights in Conkling Claim

By a further decision of the U. S. Supreme Court in the litigation between the Conkling Mining Co. and the Silver King Coalition Mines Co., of Park City, Utah, rendered April 11, the Silver King Coalition has extra-lateral rights in the Conkling claim of the Conkling company as well as ownership to a strip of ground in dispute between the two companies, and awarded the Silver King Coalition Feb. 28 by a decision of the same court. The later decision is rather of technical than of vital interest, as most of a large body of ore mined by the Coalition and also claimed by the Conkling company came from the disputed strip of ground, and not from the Conkling claim proper. The length of the Conkling claim, it will be remembered, as given in the patent did not agree with the length as indicated by the location posts, and by survey; and the strip of ground comprising the difference fell by the decision of the court to the Coalition. The decision of April 11 conceding apex rights to the Coalition in the Conkling claim settles the ownership of about $20,000 worth of ore, which is given to the Coalition by virtue of its apex rights on the Crescent fissure. The decision of April 11 is of interest in that it holds that a vein (here the Crescent fissure), which crosses through the sidelines of some of the Coalition claims, has extra-lateral rights in the direction of these sidelines produced, which in this case have become the endlines, that is—it places a liberal interpretation in regard to the locator's intention with reference to the strike of the vein, in that the locator may not always guess correctly as to the direction of the strike of the vein and locate his claim along it but across it, as happened here. The Supreme Court held that because the discoverer has not claimed as long a portion of the strike as he might have, he should not be deprived of even his diminished lateral rights.

Apache Powder Plant Expected To Be Complete in September

Three hundred men are employed in construction work on the plant of the Apache Powder Co., nine miles south of Benson, Ariz. Completion is expected in September. It is understood that the larger mining corporations of the Southwest are interested in the enterprise, which is being managed by Charles E. Mills, former general manager of the Inspiration Consolidated at Miami.

The Phelps Dodge Corporation has purchased the "Skeet" Jones nitrate properties in the Peloncillo Mountains. It is understood that this property was purchased with an idea of using the products in the manufacture of explosives at the Apache plant. A road is being built to connect the property with a side track on the E. P. & S. W. railroad.

Lake Ore Shipping Season Opened

Few Boats Moving in Contrast With Former Years—1921 Ore Prices Not Set Yet; Operators Uneasy

The 1921 ore season has been opened on the Great Lakes, the steamer "Frank Billings," of the Hutchinson line, having left one of the Duluth docks on April 11 with a cargo of iron ore consigned to the McKinney Steel Co., Cleveland. Although navigation has been opened for over a week there are but few ore vessels moving and it is unlikely that very much shipping will be done until after May 1. The fleet of the Pittsburg Steamship Co., which carries the ore of the Steel Corporation, will not start until that date. There was no string of ore carriers waiting at the Soo this spring to get through to Lake Superior and only a few carriers have left for the ore docks on Lake Superior. Ore prices for 1921 have not been set as yet, but it is believed that some action will be taken about May 1. The operators are very uneasy as they do not know whether they are going to move thousands or millions of tons this year. The decision of the Steel Corporation to reduce its prices was very well received throughout the Lake district, as it is thought that this will have a good effect on the ore market. Several more underground mines have been closed.

Non-Corrosive Steel Discovered in Krupp Laboratories

From Our Berlin Correspondent

After years of experiments in the laboratories of Krupp's, the latter firm has succeeded in producing a steel alloy which is claimed to be non-corrosive. It contains over 70 per cent of iron, its other components being chromium, and in a lesser degree, nickel. The alloy is made in three different varieties. The first resembles silver in chemical qualities, but has inferior mechanical qualities. It is recommended for medical instruments, turbine blades, valves, and the like. It is said to be immune against water and nitric acid, but not against sulphuric and muriatic acid. It is marketed at a price of 75 marks per kg. A second variety offers non-corrosiveness in a lesser degree, but is more ductile and malleable. As regards immunity against the chemical action of water, it is claimed to be superior to all existing steel alloys. A third brand, still more compromising between non-corrosiveness and mechanical qualities, is made for being used in cutlery manufacture, and the like.

Aluminum Company Must Sell Stock

The Aluminum Co. of America has been ordered to dispose of its stock in the Aluminum Rolling Mill Co., of Cleveland, Ohio, within one year, by the Federal Trade Commission. The commission found that the company's methods created a monopoly in sheet aluminum.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Secretary Fall Mum on Subject of War Minerals Relief

Only Five Claims Awaiting Decision—Commissioners Uncertain as to Further Duties

The new Secretary of the Interior has made no announcement of policy with regard to the War Minerals Relief Commission. Pending such an announcement, members of that commission are uncertain as to when they may be relieved from their duties. Senator Shafroth, the chairman of the commission, has planned to sail for Europe within a month. Philip N. Moore, another of the commissioners, has made arrangements to begin active work in his St. Louis office about May 15.

As this is written, decisions are pending on only five claims. There are still pending numerous matters connected with claims in which awards have been made, but matters of that kind, it is believed, can be handled by the chief engineer, who necessarily must remain with the work for some time to come. It is within the range of possibility, however, that Secretary Fall may disagree with the findings of the last administration with regard to the "request and demand" feature of the War Minerals Relief Act. If he were to request the new Attorney General to render an opinion, and if that opinion were to be at variance with the one issued by Attorney General Palmer, it would mean that several hundred cases would have to be reopened. In that event, the commission's work would be extended.

Senate Gets Bain's Nomination

The nomination of Dr. H. Foster Bain to be director of the U. S. Bureau of Mines was sent to the Senate by President Harding on April 16. At the time of this writing, the nomination has not been confirmed, but as no objection to Dr. Bain has been indicated by any member of the Senate, it is probable that his nomination will be confirmed in due course.

Legislative Transmutation of Non-Metals Into Metals "Riles" Engineers

The action of Congress in legislating [illegible] non-metalliferous minerals into the metalliferous class is coming in for sharp criticism. The action was taken in the recently enacted Indian Appropriation law, in which [illegible], [illegible], limestone and asbestos are to be regarded as metalliferous for the purposes of that act. This provision is thought to have been slipped into the bill for the sole purpose of opening to entry certain [illegible] deposits within Indian reservations.

Sentiment very generally favors the exploitation of mineral deposits, but mining engineers in different sections of the country are protesting against any effort to make black into white by legislative process.

Harding and Fall May Visit Alaska This Summer

Tentative plans have been made by the President and by the Secretary of the Interior to visit Alaska this summer. As such a trip is contingent upon circumstances that may arise regret is expressed that the plan should have been announced at this time. If conditions should arise which will prevent President Harding from making the trip it is probable that Secretary Fall's plans will be carried through.

House Committee on Mines and Mining Selected

Selection of the membership of the Committee on Mines and Mining in the House of Representatives during the 67th Congress, just beginning, was completed April 18. The Republican members of the committee are as follows: Marion E. Rhodes, Missouri, chairman; Leonard S. Echols, West Virginia; John M. Robsion, Kentucky; Edwin D. Brooks, Illinois; Oscar R. Luhring, Indiana; Charles R. Connell, Pennsylvania; Samuel S. Arentz, Nevada; William Williamson, South Dakota; Don B. Colton, Utah; Dan A. Sutherland, Alaska.

The Democratic members are Otis Wingo, Arkansas; Lilius B. Rainey, Alabama; George K. Favrot, Louisiana; F. B. Swank, Oklahoma. Meyer London, the Socialist member of Congress, also is assigned to the Mines Committee.

Zinc Markets of the World To Be Surveyed

After conferring with a number of the representatives of the zinc industry, the Secretary of Commerce has undertaken, in co-operation with the industry, a survey of the zinc markets of the world. Those who conferred with Secretary Hoover were: H. W. Lohman, United Zinc Smelting Corporation; E. H. Wolff, Illinois Zinc Co.; E. R. Grasselli, Grasselli Chemical Co.; Wade A. Taylor, American Zinc Producing Co.; Charles W. Baker, American Zinc Lead & Smelting Co.; H. V. Pretzel, American Metal Co.; John A. McCarthy, Anaconda Copper Mining Co.; William A. Ogg, American Zinc, Lead & Smelting Co.; [illegible] M. Evans, Eagle Picher Lead Co., and S. S. Tuthill, of the American Zinc Institute.

Coal Commissioner Bill Again Introduced

George Otis Smith Said To Be Opposed—Prefers First To Try Publicity Without Regulation

Senator Frelinghuysen has reintroduced his Federal Coal Commissioner bill, revised so as to vest in the Director of the U. S. Geological Survey the duties prescribed for the coal commissioner. The bill provides that, in addition to the $6,000 now received by the Director of the Survey, he is to be paid $5,000 as coal commissioner.

Dr. George Otis Smith, director of the U. S. Geological Survey, is understood not to be in accord with the proposal. He has stated that, in his opinion, fact-finding and administrative functions should be vested in separate agencies. It is his belief that the powers conferred in the Frelinghuysen bill should head up in the Secretary of the Interior. Some of the duties then could be assigned to the Bureau of Mines, some to the Geological Survey and the regulatory features of the measure could be handled through a special assistant to the Secretary or some other agency entirely removed from the bureaus undertaking to ascertain facts.

Dr. Smith told the LaFollette committee during its hearing that he believes regulation of the coal industry along public utility lines is certain to come. In his opinion, this is practicable and is fundamentally sound, not only from an economic viewpoint but with due concern for the equities of all affected. Nevertheless he states very positively that no such regulations should be undertaken until publicity, without regulation, will have been tried out to see if it may not accomplish the results hoped for in the operation of a more or less drastic form of Federal control.

The Frelinghuysen bill provides for a searching investigation covering "the organization, management and practices of dealers and operators, costs and profits in connection with the mining, sale and distribution of coal, the terms contained in leases of coal mines, the prices demanded or received for coal, the distribution, storage, and sale of coal and the methods and processes employed therein, the consumption of coal and the transportation of coal in commerce, including the distribution of coal cars." While the measure is far less drastic than that proposed by Senator Calder, the purport of the bill with its power to subpœna and to enforce penalties is of the type calculated to stir up friction and animosities. Were all the powers lodged in the Geological Survey, it is believed that that Bureau soon would be in disfavor with industry, as is the Federal Trade Commission.

NEWS BY MINING DISTRICTS

Special London Letter

South Crofty Only Cornish Tin Mine To Earn Profit—West Springs on Rand Cuts Reef, Finding Great Width Running 2.04 Dwt. —East Rand Prop. in Bad Position

By W. A. DOMAN

London, April 5—The only tin mining company in Cornwall to make a profit last year was the South Crofty, and it had the unusual experience of raising the surplus of £3,489 for 1919 to £7,563. It is nothing to boast about so far as actual amount is concerned; it is the fact that with the low prices ruling for metals a profit was earned at all. Tin realized an average of nearly £180 per ton and arsenic approximately £65, the averages for 1919 being £140 and just over £52 respectively. Costs necessarily advanced, the chief item being that of coal. As I have previously reported, the mine, like all others in the Duchy, is now closed down, only pumping being in progress. The question of keeping the mine free of water is a vital one. In fact neighboring properties are affected and for a considerable time the matter of a joint pumping scheme has been discussed. The South Crofty management cannot agree with the proposals of the East Pool and Agar board. It appears that on a former occasion the South Crofty put forward a proposal under which the East Pool should share expenses. The latter refused, preferring to take measures underground to preserve their own property. Now the East Pool finds pumping essential and the expense heavy and desires the South Crofty to take part in a scheme. This the South Crofty refuses to do, and suggests that at the back of the proposal is amalgamation which it would only join if its manager were appointed to a similar position in the merger. The matter is still under discussion.

In the West Springs mine on the Far Eastern Rand the No. 1 shaft has intersected the reef at a depth of 3,890 ft., the width being 8 ft. 4 in. This is exceptional for the district, and as no one expected great width to be accompanied by high values there was no disappointment when as the result of assaying 213 samples only 2.04 dwt. was shown. The mine is being opened up from the workings of the Springs Mines, and some fair grade ore has been disclosed. The West Springs is a large property and is at present only scratched. It is the experience in this part of the gold field that only from one-third to one-half of the area contains reef that can be profitably worked.

Regarded a few years ago as an investment for the capital of widows and orphans the East Rand Proprietary Mines is now looking very ragged. In fact the consulting engineer in his report for 1920 says the position is unsatisfactory in the extreme. It was only saved by the price realized for gold, the "premium" having been no less than £537,000 or nearly 25 per cent of the total income. Working costs required an extra dwt. per ton to cover them, i.e. 27/7 against 23/6. The result is that despite the gold premium the total profit was only £192,994 in comparison with £303,816. A comprehensive development program has been followed with, however, but little success. Taking the different sections, the Driefontein-Angelo indicates approximately 50 per cent of payability, the Hercules only 20 per cent, which is too low to warrant further work, and the Cason-Cinderella promises certain quantities of ore over six levels toward the east. The ore reserves are estimated at 2,410,850 tons averaging 6.1 dwt. per ton, of which nearly 10 per cent in the form of shaft and boundary pillars assays 7.8 dwt.

CANADA

British Columbia

Silversmith Mine Suspends Operations Until Market and Costs Improve

Grand Forks—The dining room and cook house of the Rocky Candy mine, the Consolidated M. & S. Co.'s fluorspar property on the North Fork of the Kettle River, were destroyed by fire recently.

Trail—The Consolidated smelter received 7,713 tons of ore for the week ended April 7, all coming from company mines.

Nelson—The Mountain Chief Mining Co., with claims at Renata, on the lower Arrow Lakes, has reorganized and increased its capitalization from 500 shares, par value $100, to 60,000 shares, par value $10. The company produced and shipped a considerable tonnage of copper-bearing ore in 1919.

The Velvet Mine

Property Opened in 1897 Taken Over by Rossland Velvet Mines, Ltd.

By C. M. CAMPBELL

The Velvet mine, about six miles west of Rossland, B. C., on the old Dewdney trail, has some claim to be considered in Canadian history, aside from its record as a mine. This is due to its connection with Sir Charles Tupper, one of the fathers of the Canadian Confederation and later Premier of Canada. In 1896 Sir Charles was defeated and Wilfrid Laurier became Premier, with the result that the former head of the government retired from active participation in politics. In 1897 he organized the English company that started the development of the Velvet and adjoining claims. For several years this mine produced in some quantity ore running from 5 to 20 per cent copper and from $10 to $20 in gold and silver. Owing to exhaustion of the best lenses and excessive pumping on the lower levels it was shut down about 1902. At that time S. S. Sorensen, now of South America and New York, was superintendent, and F. W. Maclennan, now general manager of the Miami, was assayer. For some time later it was worked by lessees, who confined their attention to the upper levels, which were drained by a tunnel. In 1918 the Granby Consolidated Mining, Smelting & Power Co. optioned the property in the hope that enough ore could be developed

VELVET MINE, NEAR ROSSLAND, B. C. THE BOUNDARY DISTRICT LIES BEYOND HILLS IN DISTANCE to justify the construction of a crosscut tunnel at depth, but the work done did not apparently warrant the expense. It has now been taken over by the Rossland Velvet Mines, Ltd., and active operations are again about to be started.

Some chromite deposits were located on the neighboring hills several years ago, but when the war stopped, development ceased. The situation of the Velvet, on the upper slopes of a heavily timbered valley, is picturesque in the extreme.

Sandon — The Silversmith mine, the only property that has run with a full crew since the One Big Union strike began last spring, and which continued development during most of the winter with about 40 men, has suspended operations almost entirely. Only three or four men remain. It is officially stated that this policy will be continued in force until such time as an improvement is shown in metal marketing conditions or lower production costs are manifest.

Ontario

Conditions at Porcupine Best in Years —Nipissing Cuts Dividend—Powder Drops in Price

Porcupine—For the first time in six years conditions are favorable at Porcupine. Cost of commodities is declining and there is an ample supply of power and of efficient labor. At present, while there is an industrial depression throughout the whole country, the Porcupine district is probably the most prosperous and progressive section in Ontario, and as the camp is just now getting into its stride, every confidence may be expressed as to the future. There can be no question but that 1921 will much surpass 1920, and, as evidenced by the report of the Timmins Board of Trade, last year was the best to date. The report states:

1. That freight receipts for the past year were exceeded by only one town of equal size in Ontario, and amounted to $725,000.
2. Bank clearings for the year amounted to $7,000,000 and largely exceeded those of the best town in Ontario having a population of 10,000.

Indications point to the resumption of work on some of the older properties, and there also appear to be a great deal of interest shown by outside capital, and a number of deals are reported pending.

The North Crown Mines has issued bonds to the extent of $100,000. It is expected that the mill, which had to close down last year on account of the power shortage, will reopen next month. Development work has been carried on in the interval, and some new ore found.

Cobalt—At the recent meeting of the directors of the Nipissing it was decided to reduce the quarterly dividend, which is payable May 20, to 3 per cent. For some time past the company has been paying 5 per cent regularly, and a 5 per cent bonus quarterly. The main shaft house east of the lake was destroyed by fire, and shipment of mill ore by the aerial tramway has been stopped. Production is being maintained, however, from shafts west of the lake. During March the company mined ore of an estimated net value of $156,775 and shipped bullion from Nipissing and customs ore of an estimated net value of $336,584.

The Hudson Bay, which has been operating with a few men, has closed.

The Cobalt Aladdin has started shipments of milling ore to the Bailey customs mill.

The Kerr Lake is getting about $60,000 oz. a month from its Vipont property in Utah.

The Frontier silver mine in South Lorrain is making arrangements to ship ore as soon as navigation opens.

Another drop in the price of powder for Northern Ontario, of approximately $1.50 a hundred pounds, has been announced. The new prices effective are $19.50 for 40 per cent forcite, $21.50 for 50 per cent and $23.50 for 60 per cent.

MEXICO

Zacatecas

Dos Estrellas Company Sampling Veta Grande Properties; Acquisition Said To Be Less Desirable Since Silver Dropped

Zacatecas, March 30 — The Dos Estrellas Mining Co., of El Oro, State of Mexico, has been actively engaged since Jan. 1, 1921, in opening up and sampling the famous Veta Grande properties, situated at about eight kilometers east of Zacatecas City. At this time George F. Schattinger, the engineer in charge, has about 350 men at work. Much interest is being manifested as to whether they will exercise their option upon these properties, as in the event of their so doing a new era of prosperity is in store for Zacatecas. It is known that there is well over half a million tons of siliceous silver ore in the dumps and there is reputed to exist upwards of twice this amount of siliceous fills in the mines, which have an unbroken length of over four kilometers, but as both fills and dumps are supposed to carry but about 8 oz. silver and about 50c. gold, it will be interesting to see whether the general manager of the company, Mr. T. Skewes Saunders, who is here on an inspection trip, will decide to erect a power plant and mill for the purpose of treating these low-grade ores. It is understood that there is a quantity of lead-zinc ore in one of the veins below the present water level, but the management has not attempted to unwater the mine but has confined examination and sampling work to those workings above water level. These properties were the subject of active investigation at the beginning of last year when the price of silver was over a dollar and were then believed to constitute a most desirable acquisition, but with silver at around 55c. per oz. it is much feared that such will not be considered by the Estrellas company as having sufficient merit to warrant the big expenditure that will be entailed in providing suitable mining, milling and power equipments.

The Cia. de Inversiones, a subsidiary of the El Oro Mining & Railway Co., is actively engaged in unwatering and examining the San Bernabé and Los Campos properties in the immediate vicinity of Zacatecas City. The same company is reported to have obtained an examination option upon the well known Noria mine in the Sombrerete district of this state.

Engineers on behalf of New York capitalists are examining the San Rafael mine, located in the heart of Zacatecas City, said property being controlled by John Lee Stark, who is well known in local mining circles.

Coahuila

Seeking Fuel for Torreon Smelter

Torreon—A number of Chinese business men of this city are preparing to develop the Caridad group in the Velardeña district. The property lies adjacent to the Wa Hu mines, which were formerly operated by Chinese and produced some good commerical ore.

An effort is still being made by the Peñoles Mining Co. to obtain a sufficient supply of fuel to blow in a few furnaces at the Torreon smelter to smelt the ores on hand. Owing to the conditions of the railroads caused by the strike which was started the latter part of February it is impossible to get cars to bring in fuel.

Word has just been received here of the suspension of the Aguascalientes smelter likewise owing to lack of fuel.

Saltillo—Ramon R. Trevino, of Monclova, has denounced six *pertenencias* in the Fueste Mountains near the village of Ocampo. The survey will include a portion of the old Messina mine, which was formerly owned by Carlos Mosler, deceased.

Joaquin F. Mendoza is developing some extensive iron deposits carrying lead and silver and located in the Santa Rosa Mountains about four miles south of the Muzquiz mining camp in this state. The property consists of six claims adjoining the Porvenir and the old abandoned mines of San Juan.

ARIZONA

United Verde's Man Hoist Completed—Arkansas & Arizona Copper Co. Sues United Verde

Jerome—The new United Verde man hoist is practically complete, succeeding No. 3 shaft, which will be used in the future only as an air shaft. The new top station is on the 500 level, reached by a 500-ft. tunnel, through which runs an electric railway, with 20-man cars. Each double-deck cage will handle fifty men, who will be taken down in veritable elevator cars, each weighing 10 tons, with safety devices that will prevent lowering before all doors are locked. The several large rooms of the station are walled with concrete. Power is electric and an electric crane is provided for shifting machinery or material. Communication through the shaft is to the 1900 level, though it is to be continued down to the lowest workings, at 2400 ft.

Prescott—Suit has been filed in Prescott by the Arkansas & Arizona Copper Co. against the United Verde Copper Co. to prevent the latter from securing patent to a part of the Diamond lode mining claim, alleged to be the property of the plaintiff, but included by the defendant within its Chrome Fraction mining claim. Plaintiff relates that the Diamond claim was located in 1911 by William Bracken, that it passed to the company in June, 1916, and that all assessment work has been done upon it save in the years when no assessment work was required.

The Jerome-Prescott Copper Co. has leased its thirty-two Copper Basin claims to F. M. Parker, L. O. Williams and W. E. Sanders, on a royalty basis. The deepest development is 126 ft.

Globe—There has been a general exodus of unmarried American miners, most of them going to points in Southern California, though many have headed for gold camps known to them in Nevada, California and Colorado. Hundreds of those who remain will be given work on the roads. A well developed plan of road work has been announced from Superior, where 350 men are to be employed on the rock work of the Miami-Superior highway and on the Ray-Superior and Ray-Mesa roads. Hundreds more of the unemployed are to find work on silver mines that have been idle for a decade or more, including the old Centennial mine and mines in Richmond Basin and in the Ramboz section. Much of the new work is being done under lease agreements.

It is announced that the plans of the Louis d'Or mining company will not be affected by the shutdown of local copper producers.

Old Dominion has added a 1200-hp. Diesel engine to its equipment.

Parker—T. J. Carrigan has started construction of a 300-ton mill on the Arizona Standard Copper Co.'s property, fourteen miles east of Parker and seven miles from a station on the Swansea railroad. Machinery is from the Llewellyn works of Los Angeles. Concrete houses are being erected for employees.

Tombstone — Local lessees recently "cleaned up," more than 40 cars of ore, which were rushed to Douglas before April 12, the final date set for reception at Douglas, where April 15 had been designated for complete closing of the Phelps Dodge smelter. It is possible that activities will be continued at Tombstone, even at the Phelps Dodge mines, for it is understood that a silver stack is to be kept in operation at the El Paso smelter. Several silver concentrators are available in the camp and it is suggested that the ores running 10 oz. or less be milled and that the richer ores be held for the reopening of the Douglas smelter. The relatively slack water supply has been taken into consideration, though an inexhaustible supply could be had by pumping from the old Tombstone Consolidated Boom shaft. Transporation from the shafts to the mills will be afforded by a fleet of large motor trucks. One company is reported to be planning mill additions covering flotation and cyaniding, with enough smelting equipment to turn out bullion.

The Old Guard mill has been rebuilt by the National Metals Recovery Co., which will rework a number of the old waste ore dumps of the district. About 80 tons of ore is being handled daily on three shifts.

NEW MEXICO

Great Eagle Fluorspar Mill Makes Trial Run—Tullock Silver Property Near White Signal Leased—Shipping Iron Ore From Jack's Peak

Lordsburg—A trial run of the new mill of the Great Eagle fluorspar property indicates an 80-ton capacity of 100-mesh product. At present fluorspar from this property is being milled en route, a special freight rate having been made to cover this condition. The marketing of this product has been placed in the hands of W. J. Prowell, of Philadelphia, and the demand for this particular grade of fluorspar for enamel, glass and acid purposes is good. Alfred Roos is manager.

Development work on the 1050 level of the 85 mine is showing copper sulphide ores from 7 to 10 ft. wide, running very high in copper.

The Co-operative Mining Co. continues to produce lead-silver ore of excellent grade from the ore shoot on the 4th level which shows a width of 4 ft. A considerable tonnage of mill rock is being put on the dump and in No. 1 and 2 stopes on the third level, awaiting the completion of additions to the mill which will give a daily capacity of 100 tons. About 35 men are working. H. C. Walters is manager.

White Signal—C. W. Mitchell has taken a lease and option upon the Tullock silver property, three miles south of White Signal, and is in New York in consultation with interested parties. On the gold property near by, also owned by Tullock, William Sellers is unwatering an old shaft. He has installed a string of sluice boxes and is using water from the shaft to wash the dirt from the dump, which is yielding about half an ounce of gold per ton. About fifty tons of sulphide copper ore carrying 1 oz. gold and 12 oz. silver has been mined from the surface near the old shaft.

Tecolote — Beeth Brothers have started iron-ore shipments from the Jack's Peak properties, using the five-mile narrow-gage line installed several year ago by Delhart (Texas) interests which have adjoining properties. At present a gasoline locomotive is used, but is not adequate, as the grade is in places 5 per cent. A steam locomotive has been purchased and will be in operation soon. Side-dump cars of five-ton capacity are used. Shipments for the present are about 150 tons weekly to the Colorado Fuel & Iron Co. at Pueblo.

UTAH

Ontario Silver Shuts Down After Smelter Refuses Ore

Eureka—Ore shipments from the Tintic district for the week ended April 9 amounted to 135 cars as compared with 150 cars the week preceding, the decline being due largely to the order of the Garfield smelter of the A. S. & R. suspending shipments of dry silver ores. The Centennial-Eureka and Bullion Beck mines of the United States Smelting Co. have closed down, owing to the closing of the copper smelter of the A. S. & R. at Garfield. The Grand Central has also closed down. It is probable also that the Eureka Hill will suspend. This property, which is being operated by lessees, is worked through the Centennial-Eureka.

Park City—Shipments for the week ended April 9 amounted to 1,489 tons. Shippers were the Judge companies, 840 tons; Silver King Coalition, 649. The Ontario Silver has ceased shipments, owing to an order from the Garfield smelter refusing to take its ore.

IDAHO

Cœur d'Alene District

Callahan Deepening Main Shaft 200 Ft.

Wallace — The Callahan Zinc-Lead Co. is extending the main shaft 200 ft. deeper, which will make the total depth from the main working tunnel 1,450 ft.

Wallace—At the annual meeting of Hecla Mining Co., held here on April 12, all former directors were re-elected. James F. McCarthy was re-elected president and general manager; W. J. C. Wakefield, vice-president; James F. McCarthy, treasurer, and L. E. Hanley, or Wallace, Idaho, secretary.

Much interest attached to the outcome of the meeting, as it was known that a desire existed among a section of the shareholders to suspend operations pending more favorable conditions. The directors, however, decided that for the present, at least, operations should continue at the present scale, in an effort to hold the organization together and prevent as little distress as possible in the ranks of the mining company's working forces, during the difficult readjustment period.

WASHINGTON

Bead Lake Gold-Copper Elects Officers

Northport—The lead smelter of the Northport Smelting & Refining Co. has closed down temporarily. The shutdown was occasioned by the closing of several Cœur d'Alene lead mines from which the smelter receives the greater portion of its ores.

Newport—The Bead Lake Gold-Copper Co. recently held its annual directors' meeting and elected the following officers: president, G. C. Geisler; vice-president, C. C. Witt; and secretary-treasurer, W. E. Allen; superintendent, C. H. Curtis. During the last year the company completed about 500 ft. of drifting and crosscutting, installed a small sawmill and cut sufficient lumber for a 100-ton concentrator, administration building, and superintendent's residence. All of these buildings were completed but the mill machinery is not yet installed. The adjoining Conquest mine was purchased and the company now plans to retimber the old Conquest Shaft and then deepen it 200 ft. Before the mill is put in operation it will be necessary to build an 800-ft. aerial tramway to link the Bead Lake openings with the concentrator. The holdings of the company are in Pend Oreille County, 5 miles east of Newport and within a mile of the boundary.

Chewelah—The United Silver-Copper company is employing a small crew to mine on the high-grade shoot of tetrahedrite between the 600 and 800 levels. Nine cars of this sorted ore were shipped during the first three months of the year. These averaged 40 to 50 oz. of silver and 10 per cent copper to the ton and netted about $1,200 to the car. The concentrator closed down several months ago, for the lower-grade milling ore can not now be treated at a profit.

Oroville—The Washington State Public Service Commission has ordered the Great Northern Railway to continue its regular six-day passenger service on the Marcus-Oroville and Curlew-Republic branches until further notice and to file weekly reports with the commission. This order was made pursuant to announcement by the railway company of intention to reduce the present daily service to a tri-weekly service effective April 1.

Danville—Plans are being considered by La Fleur St. James Mining Co., following a directors' meeting held at Oroville in March, for resumption of development on the company's property near here this spring.

MINNESOTA

Stevenson Mine First Shipper From Mesabi

Superior—The construction work on the No. 3 Great Northern ore dock is rapidly nearing completion. The dock is up to date. Spouts are operated electrically and the pockets are lined with concrete slabs.

Cuyuna Range

Adbar Development Co. Diamond Drilling Joan No. 4 Property at Trommald

Brainerd—In the case of Mines Timber Co. and others against the Oneida Mines Co., District Judge W. S. McClenahan has recently handed down a decision which holds that the fee owners of mines are "bound under well-recognized principles of equity" to pay for improvements on their properties providing the lessees fail to do so. The Mines Timber Co. and other plaintiffs were lien claimants against the defendant company in the sum of more than $100,000 for materials, labor, and supplies furnished for the opening up of the Clark mine, a manganiferous iron ore property closed down after the armistice before any ore had been produced. The fee owners had cancelled the leases, owing to failure of the lessee to maintain royalty payments. Should Judge McClenahan's decision be sustained in the higher courts, it is expected that it will bring about some material changes in the form of Minnesota mining leases.

Crosby—The Inland Steel Co. reopened its Armour No. 2 mine on April 5 after a five week's shutdown, and made the first shipments for the season from the Cuyuna Range. Shipments from shaft pocket will be made at the rate of about fourteen cars per day during April and loading of the winter's stockpile will also be started. It is stated that the company plans to complete the shipment of four cargoes before May 1 if possible.

Trommald—Diamond drilling has been started on the NE¼ of SW¼ of Sect. 32, 46-29—the old Joan No. 4 mine property—by the Adbar Development Co., which now has this forty under option. The Joan mine, formerly operated by the Marcus Fay interests, was closed down early in 1919 after the shipment of 40,000 tons of high-grade manganiferous ore, and the lease on the property was subsequently surrendered.

Mesabi Range

Hibbing—The Stevenson mine of the McKinney Steel Co. has the distinction of being the first shipper from the Mesabi Range, as its stock pile of 8,000 tons was shipped to the Allouez docks of the Great Northern R.R. whence it was taken by steamer to a lower lake port.

Chisholm—Stripping in the Hartley pit, the Oliver company was delayed by the flooding of a portion of the pit through the breaking of a ditch into the pit. It is expected that work will resume soon. Stripping at the Frazer pit, a new property of the same company, was stopped for a week to permit the track system to be re-aligned and ballasted.

MICHIGAN

Gogebic Range

Oglebay-Norton Co.'s Mines Cease Production — Oliver Iron To Start Shipments From Ashland

Ironwood—All mines of the Oglebay-Norton Co. on the Gogebic Range have received orders to stop production. Operations will be confined to exploratory work, pumping, and necessary timbering. Some single men without dependents have been laid off. As many men as possible will be retained on a half-time basis. Under the new plan 110 men will be employed at the Montreal, 300 at the Ottawa, and 600 at the Eureka, Castile, and Asteroid. Nearly all of the 1920 tonnage shipped from these mines is still unused at the lower lake ports or at the furnaces, and until the furnaces are again in operation there will be practically no demand for further shipments.

On April 12 the Steel & Tube Co. started to ship 1,500 tons of Palms-Anvil ore daily to the company's furnaces at Nayville, Wis.

The Plymouth pit, which has been idle since the early part of January, has resumed stripping operations with one shovel and about 130 men.

Chequamegon Bay, at Ashland, is clear of ice, and it is reported that the Oliver Iron Mining Co., will begin shipping within the next few days.

The Cole-Goudie shovel, which has been tried out at the East Norrie mine for some months past, has been placed on the market and promises to be an important factor in mechanical shoveling.

The booster compressor for the "G" Pabst power plant has arrived and will be installed immediately.

Menominee Range

More Mines Closed at Iron River—Three at Crystal Falls with Full Crews

Iron River—The Bates mine has been closed down for an indefinite period. A few days before the Rogers-Brown Ore Co. had closed its Hiawatha, Rogers and Chicagoan properties. The Homer, Davidson and Dober mines are the only ones in the Iron River field being worked full time. The Baltic, Fogarty, Berkshire and James are being operated part time.

Crystal Falls—The Carpenter, Balkan and Amasa-Porter mines are the only ones in the Crystal Falls district working with full crews. The Odgers, Bristol and Warner are working part time. Shaft sinking only is being carried on at the Bristol and Warner properties. The Judson is employing a few men in development work. There are not more than 1,000 men working in Iron County, which includes the Crystal Falls and Iron River fields, if one figures two men to a day's work on the half time basis.

The Copper Country

Mohawk-Wolverine Wage Cut Represents Cost Reduction of 1 to 1½c.

Calumet — Although the Calumet & Hecla Mining Co. and subsidiaries have ceased all copper production, some men will be kept working at all their properties for watching, pumping and such duties. A 25-per cent reduction in wages and salaries became effective April 16. Retiring directors were re-elected at the annual meeting.

The Seneca Mining Co. has started stoping operations on the north side of the 4th level. The results of this operation will be watched with interest because it is the first stope started on the property, and may give some idea of what to expect from future stoping. Drifts have been started both north and south on the 6th level.

The reduction of wages and salaries which became effective at these properties on April 1 will reduce their cost of producing copper somewhere between 1c. and 1½c. per lb.

OKLAHOMA

Picher—The Eagle-Picher Lead Co. shut down its mines on April 22.

THE MARKET REPORT

Daily Prices of Metals

April	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
14	12.50	28.50	29.75	4.25@4.40	4.20	4.60
15	12.25@12.50	29.00	30.25	4.25@4.30	4.20	4.65
16	12.25@12.50	29.00	30.50	4.25@4.30	4.20	4.65
18	12.25@12.50	29.75	31.00	4.25@4.30	4.20	4.70
19	12.25@12.50	29.50	30.75	4.25@4.30	4.20	4.70@4.75
20	12.25@12.50	29.25	30.75	4.25@4.30	4.20	4.75

*These prices correspond to the following quotations for copper, "delivered": 12.75c. on April 14, and 12.50@12.75c for April 15 to 20 inclusive.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

April	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
14	68⅝	68¾	72	159	162¼	20½	21⅛	25¼	26¼
15	69	69¼	71	160¾	164¼	20½	21⅛	25½	26½
16	...	...	...	....	....	...	...	...	...
18	69¾	70	71	169	171¼	20⅝	21	25⅞	27
19	69¾	70	71	168	169¾	20⅝	21⅜	26	27
20	70⅛	70½	71	166¾	169¼	21	21⅝	26	26⅞

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

April	Sterling Exchange	Silver			Apr.	Sterling Exchange	Silver		
		New York, Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York, Foreign Origin	London
14	390	99½	58¾	34⅛	18	392	99½	61¼	35⅜
15	391	99½	58½	33¾	19	392	99½	60⅛	34⅞
16	391½	99½	59⅞	34½	20	392	99½	60⅝	35

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, April 20, 1921

Sales continue of small volume, with prices varying little from those quoted last week. General business conditions show improvement in certain lines, but there is still no demand of importance for raw materials of any kind. Among consumers of metal, the automobile manufacturers seem to be returning to normal conditions faster than any others. This activity is reflected in a better demand for copper and zinc by Middle-Western brass makers, and in increased requirements for lead by storage-battery manufacturers.

The tariff situation has had some effect on conditions in the metal trade, but the whole subject is still indefinite.

Copper

Business has languished during the last week, and the demand has generally been for small lots from consumers who require the metal for early use. There has been a pronounced disposition to hunt for bargains and to laugh down any producer who quotes 12.75 or 13c. delivered. Coupled with this is the fact that the meager demand has made some interests anxious to dispose of their stocks without waiting longer. Some business has therefore been done as low as 12.50c., delivered, for prompt shipment. Large quantities are not obtainable at this price, however, and there is every likelihood that the leading intersts will soon be able to obtain their asking price of 12.75@13c.; in fact, business was done at the lower figure all during the week. The premium on July delivery would be about 25 points over the prices which we quote.

Export demand has been disappointingly small, and has of course been affected by the disturbed conditions in England. Some small inquiries have been on the market from Japan, but the business is not of sufficient importance to warrant the newspaper comment that has been made upon it. Most of it was done with the understanding that the metal could be resold in this country if desired, although the small amount which was sold through the Export Association must actually be exported.

Lead

The official price of the A. S. & R. continues to be 4.25c., New York and St. Louis. This producer has done practically all of the business in New York, as most other interests are asking premiums up to 4.50c. In St. Louis, however, the A. S. & R. price has been shaded somewhat, and lead is freely offered there at 4.20c. by other producers. The slight weakening in the market was unexpected, and is unlikely to persist, because production is being further curtailed, and consumption, already good compared with other metals, shows signs of increasing. The price in London is also becoming stronger, and at present lead could not be imported direct from England for less than 4.50c., New York. Chemical lead is offered at 4.25@4.40c., St. Louis. Almost no future lead is obtainable except at prohibitive premiums.

Zinc

The market has taken a decided turn upward, advancing a total of 10 points during the week. Sales have not been much larger than usual, but the number of inquiries has increased, particularly from galvanizers, and better demand from this important class of zinc consumers has created a firmer undertone to the market. Whether due primarily to the drop in steel prices it is difficult to say, as steel prices are still high. Some producers feel that zinc has turned the corner and is due for a continued rise, whereas other market followers point to the heavy stocks in the country as a deterrent to any advance. High-grade is still quoted at 6.75c.

Tin

Demand continues dull, but there is no metal pressing for sale, and prices have been firm, in view of the London advance. Some 99 per cent could be obtained for less than our quotations, but the grade is undesirable, although a good delivery on the New York Metal Exchange. The available supplies of tin are not as large as formerly and seem to be closely held. We quote the price of futures the same as for spot Straits.

Arrivals of tin, in long tons: April 12th, China, 15; 14th, Penang, 100; 15th, London, 50.

Silver

The silver market in London declined the early part of the week on China selling, but advanced later on buying for both Indian bazaars and China account. The market is erratic, owing to speculative operations in China exchanges, causing sharp advances when orders are placed to buy at the market in London, with small supplies of silver offering. On the other hand, the market reacts quickly when these speculative orders are withdrawn, as the economic conditions in China do not warrant the high prices paid for China account. There is probably still a large bear account in China exchanges, which accounts for the speculative purchases. Indian bazaars continue to absorb silver, so that the general outlook indicates a continuance of prices around present levels. Supplies of silver from the mines continue only moderate, although there are some indications of a revival of mining activity in Mexico. Domestic demand continues dull.

Mexican Dollars—April 14th, 44⅞; 15th, 44½; 16th, 45⅝; 18th, 46⅞; 19th, 46⅛; 20th, 46½.

Gold

Gold in London: April 14th, 105s. 4d.; 15th, 104s. 11d.; 18th, 104s. 8d.; 19th, 104s. 8d.; 20th, 104s. 8d.

General stock of money in the United States, April 1: Gold coin (including bullion in treasury), $3,001,487,915; standard silver dollars, $272,112,326; subsidiary silver, $271,111,530; United States notes, $346,681,016; Federal Reserve notes, $3,265,571,195; Federal Reserve Bank notes, $192,991,400; National Bank notes, $732,818,484; total, $8,082,773,866.

Foreign Exchange

On Tuesday, April 19, francs were 7.2275c.; lire, 4.785c.; and marks, 1.57c. New York funds in Montreal, 12.68 per cent premium.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 22@23c. per lb.; 22½c. for imports, duty paid.

Antimony—Chinese and Japanese brands, 5¾c.; market dull. W.C.C. brand, 5¾@6c. per lb. Cookson's "C" grade, spot, 9½c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.60 per lb., 500 lb. lots.

Cadmium—Nominal, $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $4 per lb.; black oxide, $3@$3.10 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $250@$300 per oz.

[1]**Molybdenum Metal in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.**

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 38@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—$72@$75 per oz.

Quicksilver—Nominally, $44@$46 per 75-lb. flask. San Francisco wires, $46.

[1]**Rhodium—$200@$225 per troy oz.**

Ruthenium—$175@$200 per troy oz.

[1]**Selenium—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.**

[1]**Thallium Metal—Ingot, 99 per cent pure, $20 per lb.**

[1]**Tungsten Metal—Wire, $35@$60 per kilogram, according to purity and gage.**

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 45@50c. per long ton unit, f.o.b. Atlantic ports.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $7.45; Mesabi bessemer, 55 per cent iron, $7.20; Old Range non-bessemer, 51½ per cent iron, $6.70; Mesabi non-bessemer, 51½ per cent iron, $6.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5.80; old bed concentrates, 63 per cent, $6.70; Harmony, cobbed, 63 per cent, $6.70; new bed low phosphorus, 65 per cent, $9.50.

Manganese Ore—30c. per unit, seaport; chemical ore (MnO_2) $60 per gross ton, lump; $70@$75 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.**

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit **of WO_3, $3@$3.25, f.o.b. Atlantic ports.**

Uranium Ore (Carnotite)—Ore containing 1½ **per cent U_3O_8 and 5 per cent** V_2O_5 sells **for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2** per cent U_3O_8 and 5 **per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively;** higher **U_3O_8 and V_2O_5 content commands proportionately higher prices.**

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite—According to conditions, $70 @$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.**

Zinc and Lead Ore Markets

Joplin, Mo., April 16 — Zinc blende, per ton, high, $24.85; basis 60 per cent zinc, premium and Prime Western, $22.50; fines and slimes, $21@$20; calamine, 40 per cent zinc, $12. Average settling prices: Blende, $22.76; calamine, $10; all zinc ores, $22.68.

Lead, high, $46.30; basis 80 per cent lead, $47.50; average settling prices, all grades of lead, $44 per ton.

Shipments for the week: Blende, 5,153; calamine, 30; lead, 959 tons. Value, all ores the week, $159,790.

Buyers took 1,200 tons less zinc blende in this week's purchase than in each of the last two weeks. Sellers believe the lower offerings were made in an effort to break down the solid front of sellers in refusing to sell for less than $22.50 basis.

Platteville, Wis., April 16—No market for zinc or lead ores. Shipments for the week: Blende, 382 tons. Shipments for the year: Blende, 11,211; lead ore, 550 tons. Shipped during the week to separating plants, 447 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $2,000@ $3,000; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@ $75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7 per long ton, f.o.b. Cartersville, Ga. Small lots as low as $5.

Bauxite—High-grade French bauxite, $8@$10 per ton, Atlantic ports. American quotations the same. Consumers generally well supplied. Prices vary according to grade. Crude, unground, $16.50 per ton; ground, $22; calcined, ground $35; unground, $45, f.o.b. plant.

Chalk—English, extra light, 5@5½c. Domestic light, 4½@5c.; heavy, 4@4½c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@ $10; washed, $10@$12; powdered, **$15@ $20; bags extra, per net ton, f.o.b. mines, Georgia;** powdered clay, **$15@ $20, f.o.b. Virginia points. Domestic** lump, $10@$20; powdered, **$25@$30; imported lump, $15@$25, f.o.b. American ports;** powdered, **$35@$45, f.o.b.** New York.

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar—Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$25 per ton, f.o.b. Illinois mines, and $20@$25, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, $40@$60; lump, $17.50, f.o.b. Heathden, N. M. Ground acid grade, 97 per cent CaF_2, $32, New Mexico. Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pa. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 7½@8c. per lb.; chip, 6@6½c.; dust, 4@4½c. No. 1 flake, 7c.; amorphous crude, ¾c.@2¼c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$2 per net ton; 1½ in., $1.50@$2. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined—Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned—$38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.) High freight rates retarding business. Steamers quoting $8, Pacific to Atlantic ports.

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); all f.o.b. New York.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $7.35; 68 per cent, $6.85; 68@66 per cent, $6.60.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 14c., c.i.f. Atlantic seaport; furnace size, 14c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1½ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Silica—Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Market reported generally dull.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$40, talcum powder grade. Southern talc, powdered, carload lots, $10@$14 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 8@9c. per lb. in carload lots.

Sodium Nitrate—$2.60@$2.75 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; $32@$33 per ton, New York.

Potassium Sulphate—Domestic, $215@$220 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 15c. per lb. of chromium contained; 4 to 6 per cent carbon, 16@17c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $85@$90, f.o.b. furnace; resale, $90, delivered; English, $90@$95, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $32, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $50@$55; 50 per cent, $80@$85; 75 per cent, $145@$150.

Ferrotungsten—Domestic, 70 to 80 per cent W, 50@55c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$5@$6 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 20½@20¾c. per lb.; wire, 15c.

Lead Sheets—Full lead sheets, 7½c.; cut lead sheets, 7¾c. in quantity, mill lots.

Nickel Silver — 33½c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets 18¼c.; sheathing, 17¼c.; rods, ⅝ to 3 in., 15¼c.

Zinc Sheets—$11 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $80 per net ton, shipping point; arches, keys, wedges, $85; splits, soaps, $100.

Fire Brick—First quality, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $45@$50.

Magnesite Brick—9-in. straights, $90@$100 per net ton; 9-in. arches, wedges and keys, $105; soaps and splits, $120.

Silica Brick—9-in., per 1,000: $45@$55 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, April 19, 1921

By various changes in the last week or ten days, steel prices have now been equalized, as between the Steel Corporation and the independents.

Prices now developed are: Billets, $37; slabs, $38; sheet bars, $39; rods, $48; bars, 2.10c.; plates and shapes, 2.20c.; blue annealed sheets, 3.10c.; black sheets, 4c.; galvanized sheets, 5c.; tin plate, $6.25; hoops and hot rolled strip, 2.75c.; wire, 3c.; nails, $3.25; steel pipe, 1 to 3-in., 62½ per cent basing discount; steel boiler tubes, 3¼ to 13-in., 43 per cent discount, in less than carloads. On nails the price is that of the Industrial Board schedule, other prices averaging about $6 a ton below that schedule.

Independents closed some extra business as they withdrew their lowest prices, and the Steel Corporation is likely to receive heavier specifications against its contracts. The independents are operating at about 35 per cent.

Pig Iron—The market remains altogether inactive, prices remaining quotable at $25 for bessemer, foundry, and malleable, and $23 for basic, f.o.b. Valley furnaces, with $1.96 freight to Pittsburgh.

Coke

Connellsville—Furnace, $4@$5; foundry, $5@$6.

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[1] Foote Mineral Co., Philadelphia, Pa.

The New Position of the German Potash Industry

Alsatian Competition Has Destroyed the Empire's Former Monopoly—Sales Increased in 1920, but Production Is Below Pre-War Rate — Possibility of Combination Of Foreign Producers for the Purpose of Price Stabilization

SPECIAL FOREIGN CORRESPONDENCE OF *Engineering and Mining Journal*

NOWHERE do potash salt deposits occur in such abundance as in Germany, where the potash industry, a natural monopoly until the end of the war, is an export business par excellence. Since the beginning of the industry in 1851, annual sales steadily increased and reached a total value of 1,280,000,000 marks in 1919, a marked increase over the preceding year in spite of a decrease in shipments of almost 200,000 metric tons. The important rôle the industry plays in German export trade can hardly be better illustrated than by the fact that out of the total 1919 sales, inland sales amounted to only 250,000,000 marks (200,000,000 in 1918). Shipments to the various countries during 1919 and total shipments during the period 1913-1920 are shown in the following table:

SALES OF GERMAN POTASH
(In Metric Tons)
1919

To—	
Germany (domestic)	637,033
United States	70,129
Scandinavian countries and Denmark	56,011
Holland	30,700
Great Britain	10,279

	Total Sales	Foreign Sales
1913	1,110,370	506,087
1914	903,988	366,180
1915	679,750	112,653
1916	883,976	158,932
1917	1,004,282	132,932
1918	1,001,364	141,648
1919	812,002	174,970
1920	924,168	.....

The year 1920 opened favorably, and brisk business continued up to May, when the effects of the international stagnation began to react upon the industry. Lack of sales—especially export sales—continued throughout the summer, and the situation grew even more unpropitious toward the end of the year, compelling many works to use short shifts and discharge men. Keen disappointment was caused by the failure of the most important market, the United States, to improve, which was all the more surprising as the United States had to do without German potash during the war and the tonnage of substitute potash produced by the American industry is comparatively insignificant, especially when compared with the import of 248.300 tons in 1913. The failure of the American market has given rise to severe criticism on the part of interested German parties and the press, on the price policy of the Potash Syndicate, which is held responsible for the slump in sales to the United States, on account of the exorbitant prices charged. The syndicate, however, strongly resents the charge, contending that no undue profits were made, and that export prices were fixed in accordance with the purchasing power of the different foreign currencies.

In explaining the decrease in sales the Syndicate points to the business depression existing during the last year in America. Negotiations for a resumption of potash shipments to the United States are in progress, and it is generally held that present difficulties are but temporary and will soon be overcome.

Some potash mines had to close down of late, but a revival of export business in the autumn is anticipated. The syndicate recently applied to the Federal Potash Syndicate for an advance of inland prices by [illegible] per cent, but despite its contention that present inland prices represented an increase over pre-war prices of 500 to 600 per cent only, and that inland prices merely covered 60 per cent of cost prices, the application was refused by the vote of the farmers' and workmen's delegates.

Alsatian Competition Important

With the return of Alsace-Lorraine to France, the question of competition from the Alsatian potash industry has had to be faced. The new French industry cannot yet compare in size with the German, as it comprises but eighteen plants and three potassium chloride works, compared with 209 plants and 88 works in Germany; nevertheless great efforts are being made by France to develop the Alsatian potash deposits, and there is no gainsaying the fact that the German pre-war potash monopoly is gone. Alsatian potash production for 1920 amounted to 1,061,197 tons of crude salts, of which 450,000 tons was shipped to France, 327,000 to the United States, 117,000 tons to Belgium, and 92,000 tons to Great-Britain.

German producers, according to a statement by Director Duehrssens of the Potash Syndicate, are however, taking a rather sanguine view of the future of the industry, stressing the fact that high-percentage potash salts, particularly in demand by American farmers, are of rare occurrence in Alsace. It is also pointed out that present production may easily be doubled without sinking new shafts, and that plant extensions on a moderate scale, coupled with an increase in the number of men, would more than treble present output.

The price question, however is causing some apprehension. It is admitted, that Alsatian producers are in a position to underbid German quotations by 15 to 20 per cent, but appropriate measures will be taken in due time with a view of bringing prices in line with Alsatian offers should competition from those quarters assume formidable proportions.

Spanish competition is not considered likely to be pressing for some years to come, owing to the difficulties experienced in sinking Spanish shafts. It is worth pointing out that the German syndicate has shown a marked interest of late in Spanish potash fields, and there are indications that preparations are already well under way for a future cooperation to eliminate competition.

Socialization of the Industry Improbable

The socialization question stands in the background at present and is likely to remain there for some time—if not forever. Investigations made by the Government Socialization Committee are stated to have yielded negative results, the impracticability of applying the principles of socialization to an industry catering first and foremost to the export trade being apparently realized. A notable feature in the development of the industry during the last year has been the marked tendency for concentration and amalgamation of plants. The total capital invested in the industry is estimated at 1,500,000 gold marks. Most of the companies have done well, the average dividend for 1920 working out at 25 per cent.

Regarding the London reparation decisions, it is argued that the Allies are dependent upon German potash and that foreign farmers will have to pay the export tax in form of higher prices. Probably, part of the business will then be lost to Alsatian competition but it is generally held that, for reasons pointed out, elimination of the German potash industry from the world market will prove an impossible task.

COMPANY REPORTS

Phelps Dodge Shows Operating Profit

The report of operations of the Phelps Dodge Corporation for 1920 states that 95,652,508 lb. of copper, 445,215 lb. of lead, 1,372,765 oz. of silver, and 14,357 oz. of gold were produced. In addition, the yield from purchased ores amounted to 3,282,719 lb. copper, 242,417 oz. of silver, and 1,522 oz. of gold. A price of 18.337c. per lb. f.o.b. New York was received from 227,584,468 lb. of copper sold (includes copper received from other sources). Income account:

Income:		
Sales of copper, silver, and gold..	$22.357.915.84	
Sales of coal, coke, and mdse.....	12,974,092.27	
Income from investments and miscellaneous earnings............	598,169.61	$33,930,177.72
Expenses:		
Finished metals on hand at beginning	$16,877,473.28	
Mining, treating, and refining metals	16.966.467.56	
	$33,843,940.84	
Less finished metals on hand at end	16.412.363.95	
	$17,431,576.89	
Cost of coal, coke and mdse. sold	11,704,704.20	
General and administrative expense	1,128,444.68	
Depreciation of plants...........	1,266,095.90	
Depletion of mines...............	3,666,244.54	35,197,066.21
Net income....................................		$733,111.51

Surplus balance Dec. 31, 1919, was $123,794,061.40. Deducting net income for the year, $733,111.51, and dividends of $4,500.000 (10 per cent) gave a surplus on Dec. 31, 1920, of $120,027,172.91.

Inspiration Copper Stocks Increased

The report of operations of the Inspiration Consolidated Copper Co. for 1920 shows that 79,453,740 lb. of copper was produced, at a cost of 14.173c. per lb. (exclusive of depletion and Federal taxes). Income account follows:

Sales of copper		$10,033,706 61
Expenses:		
Mining, including development	$3,701,140 26	
Reduction, including transportation of ore..	4,385,209 68	
Refining and selling, including transportation of metals	2,151,996 21	
Administration and Federal taxes	809,188 91	
Copper on hand at beginning of year	6,118,331 96	
	$17,165,667 02	
Less, copper on hand at end of year........	9,746,476 63	7,419,190 39
		$2,614,516.22
Depreciation of buildings and equipment		648,718.80
		$1,965,797.42
Interest received	$1,769 81	
Income from investments................	326,708 85	328,478 66
Balance, net income for year............		$2,294,276.08

Surplus account Dec. 31, 1919, amounted to $9,879,259.16; net income was $2,294,276.08. Three dividends were paid, totaling $4,136,884.50. Surplus Dec. 31, 1920, $8,036,650.74.

East Butte Has Small Deficit

The annual report of the East Butte Copper Mining Co. for 1920 shows that 18,534,279 lb. of copper, 690,488 oz. of silver, and 867 oz. of gold were produced. Approximately 10,000,000 lb. was in process of manufacture on Dec. 31, 1920, inventoried at 13.90c. Income account follows:

Gross value of metals shipped..............................		$3,241,812.96
Other income		70,746 51
Gross income from operations		$3,312,559 47
Cost of mining, treatment, freight, selling, refining, and cost of custom ore purchased....	$3,047,704.69	
Miscellaneous operations	4,621 52	3,052,326 21
Profit on copper mining operations		$260,233 26
Less depreciation....	$44,397 90	
Ore depletion..........................	7,199.10	51,597.00
		$208,636 26
Less outside exploration..................		276,798 16
Net deficit on all operations.............		$68,161 90

Mohawk Mining Co. Surplus Decreased

A report of operations of the Mohawk Mining Co. for 1920 indicates that 10,269,824 lb. of copper was produced, at a total cost of 17.545c. per lb.; 8,528,024 lb. was sold at 19.08c. per lb., or $1,627,150.14. The net cost of this copper was $1,046,339.82, giving a profit of $580,810.32. Miscellaneous income amounted to $51,951.40, and total net profit, before providing for depreciation, depletion, and taxes, was $632,761.72

Surplus balance on Jan. 1, 1920, was $2,611,940.24; adding profits and appreciation ($279,286.33) gave $3,523,988.29. Depreciation, depletion, dividends ($550,000), reserve for contingencies ($600,000), and miscellaneous charges reduced surplus to $1,859,936.37.

U. S. Smelting Has Profit of $2,909,274

The report of operations of the U. S. Smelting, Refining & Mining Co. for 1920 shows that 77,545,368 lb. of lead, 18,227,889 oz. of silver, 16,852,918 lb. of zinc, 1,391,116 lb. of copper, 123,175 oz. of gold, 1,548,222 tons of coal, and 3,443,778 lb. of byproducts were produced in that year. Profit and loss account follows:

Earnings of all companies, after charging cost of production, selling expenses, repairs and interest, but before providing for depreciation, depletion, and Federal taxes............................		$6,777,000.07
Deduct:		
Reserves for depreciation and depletion	$1,865,223.35	
Reserves to reduce inventories of metals to market prices at Dec. 31, 1920 (including losses on metals sold in December).......	2,002,501.90	3,867,725.25
Profits for year.................................		$2,909,274.82
Undistributed surplus, as per previous balance sheet		$17,330,116.62
Profits for the year, as above....................		2,909,274.82
Amounting to..................................		$20,239,391.44
Applied as follows:		
Dividends on preferred stock of U. S. S., R. & M. Co. at 7 per cent per annum................		1,702,225.00
Dividends on common stock of U. S. S., R. & M. Co. at $5 per share.........................		1,755,575.00
Undistributed surplus		16,781,591.44
		$20,239,391.44

The reserve for Federal taxes provided in the previous year is considered sufficient to cover all Federal taxes accrued up to end of 1920.

Calumet & Arizona Sold Entire Output

A report of operations of the Calumet & Arizona Mining Co. for 1920 states that 45,087,408 lb. of copper, 1,214,049 oz. of silver, and 37,911 oz. of gold were produced. Copper sales for the year totaled 47,770,619 lb., for which an average price of 18.5c. per lb. was received. A statement of income and expenditures follows:

EXPENDITURES	
Operating expenses, depreciation............................	$6,143,520 36
Salaries, office, general expenses	50,382 91
Freight, refining, marketing................................	1,171,977.32
State and Federal taxes....................................	840,522.93
	$8,206,403 02
Less	
Ore depletion	1,362,969 24
Net income	$1,849,201 53
	$11,418,573 89
INCOME	
Total earnings on metals......	$10,527,113 26
Interest	131,380 46
Dividends..	646,745 50
Other income...	113,334 67
Total	$11,418,573 89

Four quarterly dividends were paid, totaling $2,570,084. Surplus account on Dec. 31, 1919, stood at $5,817,069.85; on Dec. 31, 1920, at $5,096,187.38.

MINING STOCKS

Week Ended April 16, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Adventure	Boston	*60	*50	*60	....	
Ahmeek	Boston	50	44	49	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	½	⅜	½	....	
Allouez	Boston	21	18	21	Mar. '19	1.00
Anaconda	New York	38⅞	37	38½	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2⅝	2	2¼	....	
Ariz. Com'l	Boston	8¼	8	8¼	Oct. '18,	.50
Big Ledge	N. Y. Curb	5/16	¼	5/16	....	
Bingham Mines	Boston	8¼	8	8¼	Sept. '19, Q	.25
Calumet & Arizona	Boston	49	45	48½	Mar. '21, Q	50
Calumet & Hecla	Boston	230	220	230	June '20, Q	5.00
Canada Copper	N. Y. Curb	....	....	*13	....	
Centennial	Boston	....	....	8	Dec. '18, SA	1.00
Cerro de Pasco	New York	28	25¼	28	Mar. '21, Q	.50
Chile Copper	New York	11⅝	10¾	11½	....	
Chino	New York	22⅞	21⅝	22¼	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*24½	*22½	*24½	....	
Con. Arizona	N. Y. Curb	....	....	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	...	...	1⅞	....	
Copper Range	Boston	35	32¾	34¾	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*30	*28	*29	....	
Davis-Daly	Boston	6½	5	6⅜	Mar. '20, Q	.25
East Butte	Boston	8⅜	8	8¼	Dec. '19, A	.50
First National	Boston Curb	*75	*65	*70	Feb. '19, SA	.15
Franklin	Boston	2	1⅞	1⅞	....	
Gadsden Copper	N. Y. Curb	....	....	*25	....	
Granby Consol.	New York	20½	19	20½	May '19, Q	1.25
Greene-Cananea	New York	23⅝	22¾	23⅝	Nov. '20, Q	.50
Hancock	Boston	....	....	2¼	....	
Howe Sound	N. Y. Curb	2⅜	2⅛	2¼	Jan. '21, Q	.05
Inspiration Consol.	New York	34	32⅛	33¾	Oct. '20, Q	1.00
Iron Cap	Boston Curb	....	....	6	Sept. '20, K	.25
Isle Royale	Boston	1	17¾	19	Sept. '19, SA	.50
Kennecott	New York	19¼	18⅞	19⅜	Dec. '20, Q	.50
Keweenaw	Boston	1¼	1½	1¼	....	
Lake Copper	Boston	2	2½	2½	....	
La Salle	Boston	1½	1½	1½	....	
Magma Chief	N. Y. Curb	...	...	*21	....	
Magma Copper	N. Y. Curb	20½	19	20	Jan. '19, Q	.50
Majestic	Boston Curb	*8	*5	*8	....	
Mason Valley	Boston	1½	1½	1½	....	
Mass Consolidated	Boston	*90	*70	*80	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	3⅞	3⅜	3⅜	....	
Miami Copper	New York	20¼	18½	20⅜	Feb. '21, Q	.50
Michigan	Boston	3	2¾	3	....	
Mohawk	Boston	50½	48½	50½	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	4½	4⅜	4¼	....	
Nevada Consol.	New York	11½	10⅞	11½	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3	....	
New Cornelia	Boston	14¼	13½	14½	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	.	....	*5	....	
North Butte	Boston	11	9½	11	Oct. '18, Q	.25
North Lake	Boston		.	½	....	
Ohio Copper	N. Y. Curb	....	....	3/16	....	
Old Dominion	Boston	20	18	19	Dec. '18, Q	1.00
Osceola	Boston	26¼	24	25½	June '20, Q	.50
Phelps Dodge	Open Mar.	†160	†130	....	Apr. '21, Q	1.00
Quincy	Boston	38½	37½	38½	Mar. '20, Q	1.00
Ray Consolidated	New York	13	12¼	13	Dec. '20, Q	.25
Ray Hercules	Boston Curb	...	.	*35	....	
St. Mary's Min. Ld.	Boston	36¾	35	36¾	June '20, K	2.00
Seneca Copper	Boston	15	15	15	....	
Shannon	Boston	1	*80	*80	Nov. '17, Q	.25
Shattuck Arizona	New York	6½	5⅜	6	Jan. '20, Q	.25
South Lake	Boston	..	....	1½	....	
Superior Copper	Boston		...	3	Apr. '17,	1.00
Superior & Boston	Boston	1¼	1¼	1¼	....	
Tenn. C. & C. cfs.	New York	8½	7¼	8½	May '18, I	1.00
Tuolumne	Boston	*43	*43	*43	May '13,	10
United Verde Ex.	Boston Curb	28	23½	26	Feb. '21, Q	.50
Utah Consol.	Boston	4	3½	3½	Sept. '18,	.25
Utah Copper	New York	52	49	50½	Mar. '21, Q	1.00
Utah M. & T.	Boston	1¼	1½	1 1/16	Dec. '17,	.30
Victoria	Boston	1	1½	1½	....	
Winona	Boston	*60	*50	*50	....	
Wolverine	Boston	12¼	11¼	12	....	
		NICKEL-COPPER				
Internat. Nickel	New York	15½	14⅞	15½	Mar. '19,	.50
Internat. Nickel, pf.	New York	.	..	81	Feb. '21, Q	1.50
		LEAD				
National Lead	New York	72½	71½	72½	Mar. '21, Q	1.50
National Lead, pfd.	New York	104	104	104	Mar. '21, Q	1.75
St. Joseph Lead	New York	12⅛	11¾	12	Mar. '21, Q	25
Stewart Mining	Boston Curb	.	.	*6	Dec. '15,	05
		ZINC				
Am. Z. L. & S.	New York	8¼	8½	8½	May '20,	1.00
Am. Z. L. & S., pfd.	New York	27	27	27	Nov. '20, Q	1.50
Butte C. & Z.	New York	4¼	4¼	4¼	June '18,	.50
Butte & Superior	New York	12	11½	11½	Sept. '20,	1.25
Callahan Zn-Ld.	New York	5¼	4⅞	5½	Dec. '20, Q	50
New Jersey Zn.	N. Y. Curb	132	126½	126½	Feb. '21, Q	2.00
Success	N. Y. Curb	*3½	*2	*2½	July '16,	.03
Yellow Pine	Los Angeles			1	Sept. '20, Q	03

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

Stock	Exch.	High	Low	Last	Last Div.	
		GOLD				
Alaska Gold	New York	1⅛	1	1	....	
Alaska Juneau	New York	1⅝	1⅜	1½	....	
Carson Hill	N. Y. Curb.	....	....	22¾	....	
Cresson Consol. G.	N. Y. Curb	1⅛	1 1/16	1⅛	June '20, Q	$0.10
Dome Extension	Toronto		.	*60½	....	
Dome Mines	New York	19⅝	17	19¼	Apr. '21, Q	.25
Golden Cycle	Colo. Sprgs.	*66	*64	*66	Dec. '20, Q	.02
Goldfield Consol.	N. Y. Curb	*7	*5	*7	Dec. '19,	.05
Hollinger Consol.	Toronto	6.95	6.91	6.94	Feb. '21, M	.05
Homestake Mining	New York	59	59	59	Sept. '19,	.50
Kirkland Lake	Toronto	*49½	*48	*48	....	
Lake Shore	Toronto	1.14	1.14	1.14	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	1.95	1.91	1.91	Jan. '21, K	.05
Porcupine Crown	Toronto	*21	*21	*21	July '17,	.03
Portland	Colo. Sprgs.	*48	*45	*48	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*4½	*2	*4	May '19,	.05
Silver Pick	N. Y. Curb	*6	*4	*6	....	
Teck Hughes	Toronto	*12	*12	*12	....	
Tom Reed	Los Angeles	1.14	1.11½	1.13	Dec. '19,	.02
United Eastern	N. Y. Curb	2¼	2½	2¼	Apr. '21, Q	.15
Vindicator Consol.	Colo. Sprgs.	*19	*19	*19	Jan. '20 Q	.01
West Dome Consol.	Toronto	*6⅝	*6¼	*6½	....	
White Caps Mining	N. Y. Curb	*7	*6	*7	....	
Yukon Gold	N. Y. Curb	1	¾	1	June '18,	.02½
		SILVER				
Arizona Silver	Boston Curb	*30	*23	*29	Apr. '20, M	.03
Batopilas Mining	New York	.	.	¾	Dec. '07, I	.12½
Beaver Consol.	Toronto	*35	*33½	*33½	May '20, K	.03
Coniagas	Toronto	..	..	1.90	Nov. '20, Q	.12½
Crown Reserve	Toronto	....	....	*16	Jan. '17,	.05
Kerr Lake	Boston	3	3	3	Jan. '21, Q	.12½
La Rose	Toronto	....	...	*23	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	..	.	*17	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.00	0.95	0.95	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	7	6⅜	6⅜	Apr. '21, Q	.15
Ontario Silver	New York	.	.	4	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	1⅝	1¼	1⅝	Jan. '12,	.10
Peterson Lake	Toronto	...	..	*6½	Jan. '17,	.01½
Temiskaming	Toronto	.	.	*24	Jan. '20, K	.04
Trethewey	Toronto	*13¼	*12¾	*12¾	Jan. '19,	.05
		GOLD AND SILVER				
Atlanta	N. Y. Curb	1*	*½	*1	....	
Barnes-King	Butte	‡....	....	1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*67	*63	*64	....	
Cashboy	N. Y. Curb	*7	*5	*6	....	
El Salvador	N. Y. Curb	.	.	½	....	
Jim Butler	N. Y. Curb	*10	*7	*9	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*7	*5	*6	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	½	....	
MacNamara M. & M.	N. Y. Curb	*14	*13	*14	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1¼	1¼	1 7/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1¼	1 1/16	1¼	....	
Tonopah-Extension	N. Y. Curb	1½	1 5/16	1 7/16	Apr. '21, Q	.05
Tonopah Mining	N. Y. Curb	1¼	1⅛	1⅜	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	1	⅞	1	Dec. '19, SA	.05
		SILVER-LEAD				
Caledonia	N.Y. Curb	*11½	*10	*11	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	....	....	1.05	Dec. '20,	.15
Chief Consolidated	Boston Curb	2½	2½	2½	Feb. '21, Q	.05
Consol. M. & S.	Montreal	15¼	15	15	Oct. '20, Q	.62½
Daly Mining	Salt Lake	....	....	2.50	July '20, Q	.10
Daly-West	Boston	....	....	3	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	....	....	2⅛	Apr. '21, K	.05
Electric Point	Spokane	*7	*7	*7	May '20, SA	.03
Federal M. & S.	New York	....	.	6½	Jan. '09,	1.50
Federal M. & S., pfd.	New York	...	.	23	Mar. '21, Q	1.00
Florence Silver	Spokane	*17	*16	*16	Apr. '19,	.01½
Grand Central	Salt Lake	.	.	*37½	June '20, K	.03
Hecla Mining	N. Y. Curb	3¼	3⅛	3⅜	Mar. '21, Q	.15
Iron Blossom	N. Y. Curb	*17	*17	*17	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake		.	3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*6	*5	*6	....	
Prince Consol.	N. Y. Curb	5/16	¼	¼	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*5¼	*5	*5	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*7½	*7	*7½	....	
South Hecla	Salt Lake	*92	*91	*91	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	3/16	3/16	3/16	Oct. '17,	.05
Tamarack-Custer	Spokane	2.00	1.90	1.90	Jan. '21, K	.04
Tintic Standard	Salt Lake	2.60	2.52½	2.60	June '20, Q	.10
Utah Apex	Boston	2½	2[illegible]	2½	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*4	*3	*4	Nov. '17,	.01
		QUICKSILVER				
New Idria	Boston	.		*95	Jan. '19,	.25
		VANADIUM				
Vanadium Corp.	New York	30	28¾	29½	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal	72½	71¼	71¼	Apr. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	...		89½	Apr. '21, Q	1.75
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref.	New York	40¼	36½	40	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf.	New York	76½	73½	76½	Mar. '21, Q	1.75
Am. Sm. pf. A.	New York	65¼	63½	65½	Apr. '21, Q	1.50
U. S. Sm. R. & M.	New York	31½	29	30½	Jan. '21, Q	.50
U. S. Sm. R. & M. pf.	Boston	41½	40½	40½	Apr. '21, Q	.87½

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Education of Mining Engineers

IT WOULD BE DIFFICULT to estimate in specific terms the part played by the college and university graduates in the mining industry. Neverthless, when we examine the progress made in technical lines we find the progressive, well-trained graduate a potent factor. In operating positions, in the laboratory, in the field, and in the professional office he is fulfilling a useful purpose, and his numbers are growing. Like the proverbial cork in the tar barrel, he is getting to the top in spite of the viscosity of the medium selected. When we say this, it is without disparagement to the man who has struggled up from the ranks and who by individual study, experience, and hard work has won recognition. He also is an essential part of the industry, and gets to the top as well.

The graduate in mining does not always obtain prominence and remunerative employment easily. He may enter the industry via the muck-stick route, or he may have to serve in many subordinate positions before he has a chance to win his spurs. Employers are sometimes callous toward him and unsympathetic to the man who proposes to advance by a route different from their own. Many employers overlook the fact that the institutions of technical learning gather the greater proportion of alert, capable men, and that the product from these schools represents a wealth of good material which, if sympathetically handled and properly developed, will measurably enhance the success of their undertakings. More astute employers realize the advantage of securing men from the group that has gone through the process of selection operative in the well-organized institution and are willing to recognize the value of the individual who has a basic knowledge of things acquired by systematic and well-directed study.

There is discernible progress in institutions of technical learning toward meeting the requirements of modern life. Sporadic criticism has been flung at them without much discrimination, and although it lacks specific value, it has had the effect of keeping faculties stirred up and alive to the need for improvement. In another part of this issue we present a brief sketch of changes that have taken place during the last few years in the School of Mines of Columbia University. This remarkable school has a splendid record. From "Daddy" Kemp to Raymond it has consistently provided a strong and well-balanced faculty. Now it has established a new plane, a new ideal. Better graduates in a broad sense are to be turned out. Quantity production has been displaced by quality production. In readjusting its courses and organizing a high-class personnel upon its faculty, Columbia University presents to the able student the opportunity of association with other able students under a consistent plan for well-directed study. If the student co-operates in the same spirit, the graduate product will more nearly approach the ideal, a man thoroughly trained in fundamentals and with an active, open mind.

Some time ago, Professor Robert Peele presented an able paper on the subject of "The Education of the Mining Engineer" to the Mining and Metallurgical Society of America. This represented the result of close study and wide experience with mining educational problems. One of the significant facts brought out by Professor Peele was the excessive number of mining schools in the United States. The total is forty-three, and this is out of all proportion to the needs of the industry. Professor Peele said, "There is great waste of time and energy in such a reduplication of schools. Since there is no common standard of attainment, the degrees conferred at different schools mean very different things. Often they imply no definite amount or kind of training. The situation is made even worse by the inevitable competition for students, which lowers the requirements for entrance, tends to laxity of discipline, and injures the quality of student work."

The answer to this condition, in the absence of systematic effort looking to its control, appears to us to have been given by Columbia and other institutions of like standing. By the maintenance of standards, these schools will turn out a responsible product, acceptable both to employers and to the profession.

An Investigation of the Copper Shutdown

A PRESS NOTICE in the New York daily papers reports a possible Government investigation of the leading copper companies for the purpose of ascertaining whether the recent shutdown was brought about by common agreement, in which event the Attorney General might find cause for acting under the Sherman Law. It is exceedingly doubtful whether such investigation will disclose any infraction of the law, as is evident from the fact that the shutdown is not nearly as complete as is commonly supposed—barely more than 50 per cent of present production. Undoubtedly the Department of Justice knows or will find that the four great porphyry mines acted under common agreement, which is not so strange, considering their joint control and interlocking directorates. Furthermore, the department will no doubt discover that large subsidiary companies of important producers were actuated by the same governing motives. For example, Inspiration followed Anaconda, a parent organization. But many important copper companies, in fact most of these out of the ring of large producing interests—Hayden-Jackling group, Rockefeller-Ryan group, and others—have steered an independent course. Several of them—Miami is an instance—have definitely decided to continue operations and are enabled to do so by their advantageous financial position.

The investigation, to be complete, will have to consider costs of production; and, even granted that the suspending companies are able to produce copper at present prices when running to capacity—a very doubtful question—can the investigators suggest a means of persuading an unreceptive market to absorb the additional copper that would be produced? Or a means of reducing the tremendous surplus stocks in the country?

The action of the copper producers was taken to conserve their industrial existence and not in restraint of trade. Copper can be obtained at prices low enough to satisfy any rationally minded consumer—lower than for years. We would prefer to find out why copper tubing recently cost a silver-mine operator at the rate of one dollar per pound and sheet copper 54c. per pound rather than if the copper shutdown possibly violates an existing statute.

It would have been to the advantage of the industry had a greater number of producers participated in the shutdown; and should present conditions continue, it would not be surprising to see other companies gradually added to the ranks of the closed properties.

How little has actually been accomplished by the Government in aiding industry since the armistice! Two and one-half years after hostilities the greatest political and economic problems that have ever faced a nation remain unsolved. Despite legislative vehicles commendably enacted for the convenience of foreign trade, we find no real progress in holding the export commerce gained during the war. The crudest sort of tariff legislation has been proposed, and Congress is still at sea over protection or free trade for American industry. The political difficulties of a satisfactory peace with Germany still await solution; and meanwhile—industrial depression continues. Yet, regardless of the stupendous problems confronting the country, the suggestion is brought forth that taxpayers' money be used to investigate one of the results rather than the cause of present economic and social disturbances.

How much better it would be to direct attention to intelligent constructive aid for the copper producer, wheat grower, and the manifold agricultural and industrial organizations that are affected by present economic conditions!

Timing the Gears

WITH CHARACTERISTIC CLEARNESS Herbert Hoover, in an address delivered before the Philadelphia Engineers Club, has pointed out the need of reorganization of the Government. The interlocking functions of bureaus, departments, and committees—wheels within wheels—with which the country's administration is at present burdened, only serve as impediments to national enlargement, and not until the business of the nation is freed from complicated entanglements, the slack taken up, and the overlap removed can we hope to attain the proper degree of efficiency in Government organization.

As a people, we take a justifiable pride in our business institutions. They are like well balanced machinery, exact and carefully fashioned and move with precision. Each function that they perform is deliberately arranged; and each part so designed that there is no interference from the other. Were this not so our supremacy as a nation of manufacturers would not exist; we would become second-raters, or fall completely out of the running. True enough, with advancement has come additional detail, but each new unit or function has been carefully separated, and, although related to the main body or machine, there has been the underlying principle of effective concentration.

Mr. Hoover points out that, "In a department [referring to the Department of Commerce] we do not want to either engage in business or to regulate business," which is perfectly true. Nevertheless, the operation of such a department must be conducted along business lines; its functions must be entirely within itself and its duties so defined that the services demanded by industry can be furnished to the fullest extent, and at the most reasonable price, if it is to fulfill—more than in name only—the purposes of a Department of Commerce.

It would seem that the time is particularly auspicious to take cognizance of this condition and cut the Gordian knot of conflicting and overlapping Government activities, which, if permitted to remain, will only lead to endless confusion. An earnest effort is being made, we believe, to disentangle the mess, to get down to fundamentals, and definitely to place the boundaries of each department. The evidence already gathered shows inefficient working of different departments in the past —in particular the Department of Commerce—and is sufficient to convince that there is a need for change and that a change should be made. Already Congress has put the problem up to a Congressional joint committee. But more than this is needed; namely, the "full insistent support of the public."

The Tom Reed-United Eastern Apex Litigation

EXTRACTS FROM THE INTERESTING DECISION of Judge Bollinger, of the Superior Court of Arizona, recently handed down in the Tom Reed-United Eastern issue, are published on page 747 of this number. The Tom Reed mine claimed ownership of the vein in the United Eastern. The Tom Reed was the original location, and the Tom Reed vein was followed down till it was cut off by a fault. We believe it is a matter of history, although it is not recorded in the decision, that the Tom Reed searched for the vein on the other side of the fault, but could not locate it; and that employees of the Tom Reed formed the theory that the vein had been thrown out of the company's ground, and located the United Eastern property, on that geological theory, which subsequently proved to be correct, the downward extension of the vein being found, terminating, of course, upward against the fault. This upward termination the United Eastern claimed as an apex, and the court so ruled, although the fact that the vein is identical on both sides of the fault was proved to its satisfaction.

There seem to be two essential elements in the judge's decision: first that the amount of faulting as measured on a vertical plane at right angles to the vein (over four hundred feet) must be regarded as breaking the continuity of the vein, although not disturbing its original identity; second, that the horizontal element of faulting was much greater than the vertical, and probably amounted to several thousand feet, so that the ore in the United Eastern is not that broken off in the Tom Reed. Thus there appears in apex litigation a recognition of the legal aspect of the horizontal movement in faults, which has only been fully realized as a geological phenomenon for a few decades or so.

Looking at the matter from a casual and extra-legal point of view, there are evidently two sides to the question, but in general we have to grant the common sense arguments of the judge, which are grounded largely on his perception of geological facts. Yet he has, it is plainly evident from the decision, small thanks for the geologist:

"There were a number of eminent geologists and mining engineers who testified in this case, many of them not only with national but international reputations. A few practical miners also testified and furnished the court with very valuable information, *because the problems involved in this case are largely practical ones.*"[1]

Further on he observes: "This case must be decided from a practical viewpoint as the miners find conditions in the ground today, or it must be decided upon the theories and testimony of geologists, in accordance with conditions as they existed many thousands or millions of years ago. If the decision be based upon the theory and testimony of the geologists, it seems to me that no mining location in the Oatman district could be secure or valid."

The judge accordingly decided with the practical men, and against the geologists. The "geologists," witnesses for the Tom Reed, we note, include Andrew C. Lawson, Albert Burch, Walter H. Wiley, and Oscar H. Hershey; and the "practical men," witnesses for the United Eastern, include Horace V. Winchell, William H. Emmons, John A. Burgess, and Fred Searls. The court has accordingly ruled that the latter are not geologists. This is a part of the decision which we would question, however. A legal precedent seems to have been established, which we have noted in previous cases, for the judge to characterize the witnesses for the side that he decides against "geologists," and those for whom he decides "practical men." If the judge would make the definition more concise, it would doubtless be "A geologist in the apex sense is a witness for that litigating party which is in the wrong." As many of our court geologists regard a legal decision as clinching geological points, they would doubtless feel that they could loyally accept this also.

Another legal definition in the decision will also be entered in their notebooks, "A fault is merely a vein which is not mineralized." This definition will doubtless be cited by judges and apex geologists yet unborn. The legal corollaries of this, we suppose, would be thus expressed: "A vein is merely a vein which is mineralized," and also, "A vein is merely a fault which is mineralized."

The judge, whose horse sense, we repeat, pierces the fogs of law and geology, describes with interest geological processes as he learned them during the trial, but there is little trace of collusion with a geologist in his verbiage. Recognizing the interest of the wonders of nature, he is inclined, when it comes to dollars and cents, to get down to hard facts.

"We are reliably informed by geologists," he observes, "that this northwest section of Arizona, including the San Francisco mining district and Oatman, *experienced at some time in the past a great upheaval and sank about six thousand feet. With this in mind,* the court is compelled to view this case from a practical standpoint and adopt the views of the practical miners, and view the conditions as they are today and as they were when the rights of all parties herein were acquired."

Minor Trouble With Pittman Act Machinery

THE REPURCHASES OF SILVER under the Pittman Act have in general been made smoothly and satisfactorily. The major difficulties which were first encountered in the administration of the repurchase provisions were easily ironed out through exemplary co-operation between the domestic silver producer and the Government. The form of affidavits to be used, the satisfaction of the Government as to the authentic domestic origin of the silver, and other matters which at one time threatened to disturb the machinery of the Pittman Act were cleared with commendable celerity. Now, however, we find that a detail has been apparently overlooked which, according to an article on page 746 of this issue, is a hardship on a smaller silver producer.

It appears that although the full dollar per ounce is being paid at the mints of the country for domestic silver purchased by the Government, the minor assay offices are permitted to pay only the New York price for foreign silver, which is now quoted but little over half the dollar rate. The minor assay offices are of course in the habit of receiving gold bullion from local mining companies, and, as the article points out, the silver in the bullion is settled for only on the foreign silver price basis. Manifestly, this is not within the spirit of the Pittman Act, which was put upon the statutes not for the especial benefit of the large and more prosperous silver producer but for all domestic silver producers alike. This undesirable feature of administration can and should be easily eliminated, thereby making the act equitable to all classes of silver miners and removing what might be termed a little "knock" in the operating cylinders of the Pittman Act.

International Adjustments

GOLD IS POURING into this country from all over the world; from England, France, Canada, Sweden, and Holland; from Asia and South America. Almost two hundred million dollars' worth has been received so far this year. During the war, all nations conserved their gold as much as possible: the future was indefinite and ocean transportation was perilous. But now the blackest days are past, and foreign commercial interests think it better to take steps to improve adverse exchange rates than to keep a large gold reserve. Those nations with a surplus of certain commodities are endeavoring to bring about the same result by exporting to the United States, but foreign countries have, in general, been drained so dry that it is more convenient to ship gold.

The United States has taken England's place as the creditor nation of the world, for the time being at least; and, to be paid, we must receive manufactured goods as well as gold. At present, raw materials are generally at or near pre-war prices in this country, whereas manufactured goods are roughly twice what they formerly were. This is not a healthy condition. Importations of high-priced commodities will not only help to lower prices here, but will provide resources which foreign nations may employ in buying our cheap raw materials, thereby increasing the prices. This will have the tendency of bringing our price levels more in accord.

The proposed tariff wall should not be too high to jump over; particularly for those commodities which, because of superior natural advantages of production, and not because of a lower standard of living, can be produced more efficiently in other countries.

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[1] The italics here and later on are ours.—EDITOR.

WHAT OTHERS THINK

Converting Mixed High-Grade Matte and Copper

Referring to a correspondent's inquiry published in *Engineering and Mining Journal* of Jan. 29, and C. D. Demond's reply thereto published on March 26, under the caption "Blowing White Metal to Blister," I think Mr. Demond makes his answer too strong. The data are too few to make a generalized statement that the thing can or cannot be done, but I am sure that under some circumstances, with the conditions as given, the material could be successfully and economically converted.

In 1906 I was smelter superintendent at the plant of the Shannon Copper Co. at Clifton, Ariz., and we installed a converter plant to treat the mattes there, which did not differ materially from the matte mentioned in the correspondent's inquiry. There was a shortage of sulphur, and the matte ran from 55 to 77 per cent of copper, with the average for some months as high as 65 per cent. The furnaces, it is true, were blast furnaces, but the temperature of melted matte does not differ on account of its origin. Under the conditions referred to, the furnaces made a little black copper from time to time, and this tended to accumulate in the crucible, which was unusually deep, and also appeared as buttons in the bottom of the matte pots. Before the converters were installed it appeared in the molds and pots. The buttons were collected, and occasional black copper runs were made for the purpose of putting it into merchantable form. After the converters were installed it went directly into them.

The matte was successfully converted without serious difficulty. It was before the day of basic linings, and the acid lining would stand many charges, as many as twenty or more per lining, I believe. Practically all the corrosion was just above the tuyères.

The presence of black copper does not necessarily mean white metal for the accompanying matte. A black copper charge (and I am not referring to one in which metallic copper is added to the charge) frequently produces black copper containing 97 per cent copper and matte containing 60 or 65 per cent copper, though at times the matte may be 75 per cent or more. The latter is usually indicative of unsatisfactory furnace conditions.

In the case in question the inquirer states that the copper in his tests was in the form of shot in the matte, as a mixed mass. It seems to me that the test must have been of short duration. Copper separates readily and quickly from hot matte unless there are conditions not mentioned by him. If the matte was so cold that the copper could not separate or was itself solidified, I do not see how it was possible to tap the furnace. If it was hot enough to be readily tapped from the furnace it seems to me that there are possibilities for converting. The data are too few to make it possible to state positively.

Mr. Demond seems skeptical about the small amount of copper in the slag, and I must say that I agree with him in that, but I will not violate the principle noted and say it cannot be done. Electric smelting with a high-lime slag might do it. It is an unusual case, however, and I am afraid my skeptical nature will make me think there has been some mistake unless I am informed as to the conditions which permitted such favorable results to be obtained. C. A. GRABILL.

San Francisco, Cal.

[We hope that we may have more information from our original inquirer.—EDITOR.]

Engineer of Mines vs. Mining Engineer

This letter is, in a way, only confirmatory of much that has been published on the above subject in *Engineering and Mining Journal.*

It seems to me that the editor's note, appended to "Engineering vs. Surgery," published on March 26, however, is not quite to the point. Though we certainly should not call in a physician who had taken only a correspondence course in medicine and surgery—that is, under ordinary circumstances—if a "regular" was not available, we should much prefer a "correspondence" man to one without even such training. The value of such a one is tacitly admitted when in mining and other accidents one who has been trained in "first aid" is preferable to the rank and file. Analogously, in an important mining problem, would a "recent graduate" from even the highest technical school be preferred to a "correspondence man of long and successful experience"?

It appears to me that any one excepting a chronic, hidebound "regular" would gladly listen to one, correspondence man or not, if his past work showed him to be a master in his line.

This brings one face to face with the root of the whole discussion—"What is an engineer?" Consult the Century Dictionary, and you will find that an engineer is defined as "A person skilled in the principles and practice of any department of engineering." A second and more general definition is "One who carries through any scheme or enterprise by skill or artful contrivance; a manager."

I cannot quote exactly the person or circumstances of the following: As I recall it, the engineer of the Tay bridge was asked by the correspondent of a London daily to define "engineering." His reply was "engineering is applied common sense."

In 1902, while in Kingston, Ont., I asked the professor of chemistry in Queens College if one not a graduate of a technical school had a right to call himself an engineer, to solicit, or practice, engineering work; specifically, to consider himself a mining engineer. His reply was direct and explicit, and given with no indecision: "Such a man has no right to sign himself 'E. M.' That is a technical degree conferred in virtue of having fulfilled a prescribed course of study. He has a perfect right to call himself a mining engineer. In each case the ultimate right, skill in practice, depends wholly upon the individual."

In 1882 to 1888 I was instructor in mathematics in the Rensselaer Polytechnic Institute, in Troy, N. Y.

David Greene at that time was the "director." It often happened that after faculty meetings the director and myself had informal discussions, mainly to do with the work of the students. On one occasion the director spoke very feelingly on the subject of degrees. "We give our graduates the degree of 'C. E.' This is wrong. They are not civil engineers. They are not engineers at all. We teach them how to become engineers; they make engineers of themselves after they get out—if they have it in them."

I take it that the above quoted opinions are not simply "instances" or one-sided examples, but are sober expressions as to what really constitutes an engineer. I conclude that it is performance—doing—that constitutes an engineer, not at all the degree conferred.

There is absolutely no doubt in my mind that an engineering course is highly desirable, and is eminently helpful; there is equally no doubt that lack of a liberal education gained in a formal course is no bar to the making of an engineer. A polished bit of glass is only glass, after all; it can never be anything else. A rough diamond is something that glass can never be—a diamond—but the diamond can acquire the polish as well as the glass. The sole shibboleth is not "where did you get your degree" but "what can you do?"

This is all *ex parte* evidence, and is to be valued accordingly. I own only an "A. M." from an ordinary college. Yet for nineteen years I have signed myself "geologist and mining engineer." This was on advice of professors in one or two of the highest engineering schools in the country. Perhaps it was intended "to let the inquirer down easy." It is possible that if the professors consulted had expressed their unvarnished opinion they would have advised me to classify myself with "practical horseshoers" or "practical barbers," even if they had not advised me to be consistent and classify myself specifically with "practical mule shoers" or "practical dog trimmers," since, as a mining engineer, I have confined myself to the restricted field of "ore finder," instead of indulging in general practice.

West Haven, Conn. FRANK L. NASON.

The Mackenzie River Oil Field

In *Engineering and Mining Journal* of March 26 appeared an article on the Mackenzie River oil field, which in most respects is timely and much to the point, and I heartily concur with all that is said regarding the exercise of caution with reference to reports from that quarter. Nevertheless, I desire to take exception to it on one point. In the discussion of the geology of the region, one is led to infer that there is little else but Devonian or older formations between the "tar sands" of the lower Athabaska and the delta of the Mackenzie.

In a recent publication of the Geological Survey of Canada with accompanying map (Charles Camsell and Wyatt Malcolm, Geological Survey, Canada, Memoir 108, "The Mackenzie River Basin," 1919), it is shown that post-Devonian rocks have a considerable distribution in the Mackenzie region. Immediately southeast of Norman there is an area of Tertiary beds thirty to forty miles long by twenty to thirty miles wide; to the south these are succeeded by Cretaceous rocks which extend along the Mackenzie River on both banks for fifty miles, and nearly the whole course of the Great Bear River (east of Norman), together with the western and northwestern shores of Great Bear Lake, are underlain by rocks of this age. There are also two more areas of Cretaceous sediments of considerable extent along the Mackenzie between Norman and the delta.

It is not stated in the memoir to which reference was made that these later strata are oil bearing. They may have served, however, to prevent the escape of oil from the underlying rocks, so that the geological possibilities of the region are probably somewhat greater than would be inferred from reading the article in *Engineering and Mining Journal*. J. A. REID.

Cobalt, Ont.

Increased Living Costs and Higher Wages

From Mr. Lee's excellent article in *Engineering and Mining Journal* of April 2 on the driving costs of the Spiro Tunnel from 1916 to 1920 inclusive, it is shown that the labor cost in 1920 per foot advance was 148.8 per cent greater than in 1916, of which 49.27 per cent was due to increased wages and the remainder, or 99.53 per cent, to a slackening of effort, or labor inefficiency. Comparing the cost of materials per foot for the same years, there was an increase of 128.5 per cent. No doubt this 128.5 per cent was largely higher wages and labor inefficiency passed on and on from the producer of the raw materials to the manufacturer, and from him to the consumer.

The average workingman would bitterly resent being told that he profiteered during and since the war and would cite the fact that while his wages had been advanced in this particular case, 49.27 per cent of his cost of living had increased 100 per cent or even more; forgetting that he did 50 per cent of work for 150 per cent of pay of former years, and also that his increased living cost was largely another working man's higher wages and inefficiency passed on to him.

Park City, Utah. P. H. HUNT.

Bacillus Scientarum Popularis

The newly discovered germ, *Bacillus scientarum popularis* (correctness of Latin form not vouched for), seems to be spreading rapidly, possibly because of the unusually early spring. Fortunately, it is a beneficent germ, capable, indeed, of inducing extraordinary symptoms, but not likely to work any lasting harm to the constitution, even of the most hide-bound professor.

I have before me the current numbers of *Engineering and Mining Journal* and *Science*. The leading editorial in the former is on "Popularizing Science"; the first paper in the latter is entitled "A New Agency for the Popularization of Science." Is this collusion, coincidence, thought transference, or simultaneous inoculation with the above-named germ?

Whatever started this thing going, let us hope that the good work will continue until the scientist is willing to acknowledge the right of the layman to exist, and the layman is able to learn what the scientist is driving at.

Augusta, Me. FREEMAN F. BURR.

Costs at Las Dos Estrellas Mill

In the comparative costs at Las Dos Estrellas mill published in *Engineering and Mining Journal* of April 2, the cost of tube milling in 1920 is erroneously given as \$0.2829, whereas the correct figure is \$0.5829. The correction is made through the kindness of T. Skewes Saunders, Mineral de Dos Estrellas, Michoacán, Mexico.

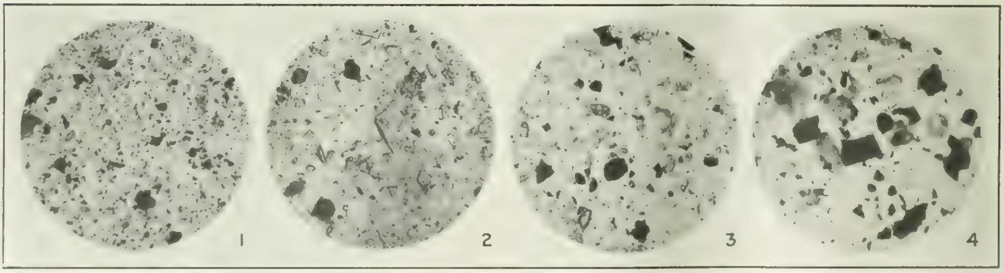
Dust Control and Ventilation in Metal Mines

Co-operative Public Health Service and Bureau of Mines Investigations of Great Importance to the Mining Industry—Increase in Labor Efficiency, and Operations in Workings of High Rock and Water Temperatures, Made Practicable by Comparatively Small Outlay to Allay Dust and Assure Pure Air

BY D. HARRINGTON*

Written for *Engineering and Mining Journal*

ALTHOUGH lack of adequate ventilation and prevalence of dust in coal mines have long been regarded as dangerous, dust occurrence and lack of moving air currents have not, until recent years, been considered particularly disadvantageous by metal-mining men in general, especially in the United States. England, South Africa, and Australia attacked the problem of dust some years ago, and the necessity of adequate ventilation was also considered, though in a somewhat less degree. South African investigation and practice in dust control was and is of much importance, and some exhaustive and interesting reports have been published.



PHOTOMICROGRAPHS OF METAL-MINE DUST

(1) Through 280 mesh and magnified about 60 diameters. This material had very little free quartz, being largely copper ore in hematite. Note comparatively few sharp-pointed or cutting edges. This dust would be comparatively harmless. (2) Through 280 mesh and magnified about 60 diameters. From hard granite with about 20 per cent quartz. Particles mainly sharp and splintery, making a very dangerous dust, as the quartz present seems unusually hard and brittle, breaking into particles with cutting edges. (3) Through 280 mesh and magnified about 60 diameters. About 15 per cent quartz, remainder more or less disintegrated feldspar and hornblende. Chiefly rounded particles with a few sharp cutting edges, these generally being quartz. (4) Through 280 mesh and magnified about 60 diameters. Practically no quartz, chiefly copper sulphide ore (chalcocite). Round-edge dust predominates.

G. S. Rice, chief mining engineer of the U. S. Bureau of Mines, became actively interested in matters pertaining to dust and ventilation in metal mines several years before much, if any, actual work was done on these subjects in the United States, and chiefly through his initiative, in 1915, the Bureau of Mines and the United States Public Health Service entered upon a study of dust in the mines of the Joplin, Mo., region, the field investigators being Edwin Higgins, mining engineer of the Bureau of Mines, and Dr. A. J. Lanza, of the Public Health Service. Reports of this work were published by both the Bureau of Mines and Public Health Service.

INVESTIGATIONS AT BUTTE PROVED IMPORTANT RESULTS

In 1916, the dust study was extended by these two bureaus to the mines of the Butte, Mont., region, and the investigators, Dr. A. J. Lanza, of the Public Health Service, and D. Harrington, mining engineer of the Bureau of Mines, soon became convinced that the health problem, though largely one of dust, was complicated by important contributory factors such as high air temperatures, high humidities, and lack of air movement. The Butte study was extended through 1918, and reports of this investigation are in the press and will probably be issued soon.

In 1919, the study was continued in the mines of the Globe-Miami district of Arizona, the investigators being D. Harrington and G. E. McElroy, of the Bureau of Mines, and Dr. R. A. Koronski, of the Public Health Service. A confidential report was made on each of the mines visited and a composite report on the district for publication will soon be completed. In 1920, it was decided to further expand the work and it was divided into three separate problems, the direction of research and investigation being placed in charge of D. Harrington. The separate problems are: Metal-mine ventilation; rock dust in relation to miners' pulmonary diseases, and high temperatures and humidity as affecting the health of miners.

Mining engineers Pickard, Gardner, McElroy, Ageton, Dyer, and Forbes, of the Bureau of Mines, and Doctors Saunders and Koronski, of the Public Health Service, were assigned to this work, and, with Chief Surgeon Sayers, of the Bureau of Mines, and D. Harrington, they have participated in these investigations in various mining regions of Arizona, Montana, California, and Idaho. Some work of a similar nature has recently been done by Mr. Ageton and Dr. Kindall, of the Public Health Service, in the mines of Michigan. It is probable that the work will be extended to other states should the mining companies desire it.

Dr. R. R. Sayers, chief surgeon, and D. Harrington, mining engineer of the Bureau of Mines, have undertaken the detailed study of the effect on the human body of heat and humidity as influenced by air movement, air vitiation, and other conditions underground, as found

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in metal mines. Some of the data obtained were published in *Engineering and Mining Journal*,[1] and on Jan. 28, 1921, the U. S. Public Health Service published additional data. A more detailed underground study of this phase of the work has recently been made by Messrs. Sayers and Harrington, with especial reference to effect of air movement, and results will soon be published.

RELATION OF INVESTIGATORS TO MINING COMPANIES

Although the co-operation of the mining companies is necessary in carrying out the work, the companies are put to practically no expense other than supplying a guide to accompany the investigators underground, the length of time spent underground generally being a few weeks for a comparatively large mine. Dust and ventilation considerations constitute the main objects of the work, but the engineers and doctors, when underground, naturally become fairly familiar with systems of mining and details (good and bad) of mining practices, and the diversified opportunities of the investigators for observation allow them to assimilate interesting information, much of which is frequently transmitted verbally to the representatives of mining companies, or possibly is given in written form in the report. Hence, the study is one of give-and-take, in which information and data are obtained by the investigator and information is likewise given out to the mine operators.

REPORTS ON MINES HELD STRICTLY CONFIDENTIAL

A separate detailed report is made on each mine studied, embodying data as to flow of air, temperatures, humidities, gases, dust formation and dissemination, analyses of air and dust, microscopic examination of dusts, and other special data, together with conclusions of the investigators and recommendations. Inasmuch as safety and fire prevention are intimately associated with dust-ventilation studies, some attention is given them, and at least a few conclusions and recommendations as to these items are included. These reports of individual mines are held strictly confidential, a copy being given the company officials and other copies being held in the confidential files of the Bureau of Mines and the Public Health Service. After several mines of a mining district or of a state have been reported on individually and confidentially, a composite report is prepared for publication, but so worded as not to identify the individual mines.

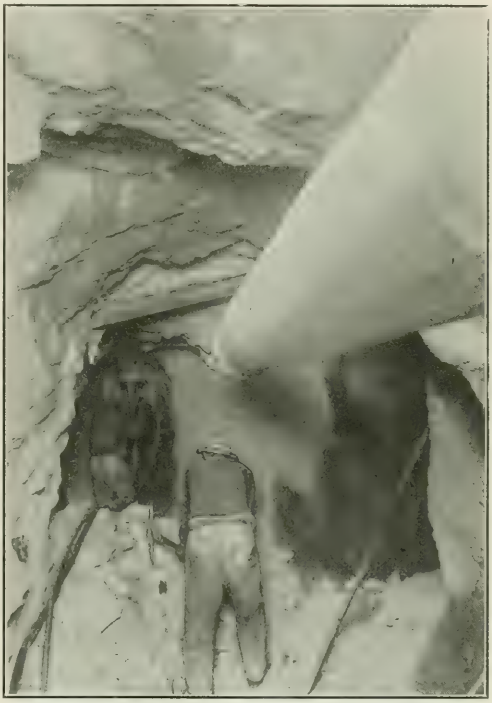
FIELD METHODS AND APPARATUS

Inasmuch as it is desired to correlate a study of one region with all other regions studied, the methods adopted have been made as nearly uniform as possible, subject to change, however, when progressive ideas suggest better methods or when unusual underground conditions demand alteration of existing practice.

Bureau of Mines sling psychrometers are used to obtain air temperatures and humidities at pertinent points, as at the surface at intake openings, at various points underground, such as in intake or return air courses, or in crosscuts, drifts, raises, stopes, or other underground workings. The psychrometer is used also to obtain temperatures of underground water, especially of water dropping through the air, and also rock temperatures, both rock and water temperatures having vital effect on underground air temperatures, especially at working places where the air movement is slight.

VELOCITIES

Air velocities are determined where possible by use of standard mine anemometers of 4 to 6-in. diameter, and readings are taken usually by moving the anemometer through the cross-section of the opening during a period of a minute, taking several such readings and averaging the result. Where greater accuracy is desired, the cross-sectional area of opening is divided into six or nine equal parts, and the anemometer is held stationary for a minute at each part, the average of all such readings being then accepted as the result. Anemometers are sent to Washington, D. C., from time to time to be calibrated, and velocity corrections are made from curves obtained in calibration. Where velocities are less than 100 ft. per minute (frequently the condition in metal mines), they are approximated by observing the inclination of a candle flame (after having seen the effect of various velocities on the flame of a candle), or the velocity is approximated by observing the length of time for smoke from burning fuse to traverse 50, 100 or more feet.



ONE MAN DRILLING AND ONE MAN MUCKING AT FACE OF CROSSCUT IN ROCK WITH NATURAL TEMPERATURE 102 DEG. F.

The moving air from end of canvas ventilating tube allows the men to work practically without evidence of perspiration.

PRESSURES

Standard aneroid barometers are used to obtain barometric pressure on surface as well as in various parts of the mines. In obtaining fan-operating pressures, the readings on the aneroid barometer are checked against a portable water gage consisting essentially of a glass U-tube with several feet of rubber tubing of about ¼-in. diameter.

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[1] "Physiological Effect of High Temperatures and High Humidities in Metal Mines," Vol. 110, No. 9, pp. 401-404.

AIR SAMPLES

Air samples are taken of intake air at the surface, of return air at the surface, and, if possible, from various ventilation splits underground. In general, however, air samples are taken at places where men work, chiefly at faces in crosscuts, drifts, stopes, raises, or other workings. Sampling is done by breaking the tip of evacuated glass tubes of about 250 to 300 c.c. capacity, the tube being broken in the atmosphere to be sampled.

[illegible] IN DUST SAMPLING MINE AIR

After the sample of air has been collected in the tube, the tip is sealed with an especially prepared wax, and the sample forwarded to the Pittsburgh laboratory of the Bureau of Mines for analysis.

DUST SAMPLES

The sugar filter method of obtaining samples of dust from mine air has been used in these studies. In the Joplin investigations, a method of aspirating air through a small tube filled with sugar was devised by Mr. Higgins, and this was used in the Joplin and Butte work. The method by which the air drawn through the sugar tube was breathed by the sampler and the exhaled air taken into a calibrated bag theoretically gave a sample essentially similar to that breathed by the workers. However, in mine air of considerable humidity, the sugar in the tube quickly became partly saturated with moisture, aspirating became labored, and speed of breathing was likewise labored and unnatural. Moreover, it was practicable to breathe only comparatively small quantities of air per sample (about 35 liters in the Joplin and Butte work), and this quantity was so small that the laboratory determinations on the dust samples were subject to much error. Hence, in the later studies in Arizona and Idaho, the South African method of using pumps was adopted, in conjunction with a sugar tube of large diameter and aspirating 15 to 20 cu.ft. of air per sample.

Two kinds of pumps have been devised in the Pittsburgh laboratory of the Bureau of Mines: one, double-acting, somewhat like the best type of South African pump, and the other single-acting and adapted from a pump that formed a part of certain discarded apparatus formerly used by the Bureau of Mines. Though the latter is much cheaper, it is by no means as efficient as the double-acting pump.

In sampling underground the sugar tube through which the mine air passes before entering the pump is held as closely as possible to the head of the mine worker, and the pump is worked by one of the investigators at a rate of about one cubic foot of air taken per minute, or approximately the rate of breathing of a normal man when working. The sugar filters out the dust from the sampled mine air in a manner somewhat similar to removal of dust by the workers' air passages when breathing the dust-laden mine air.

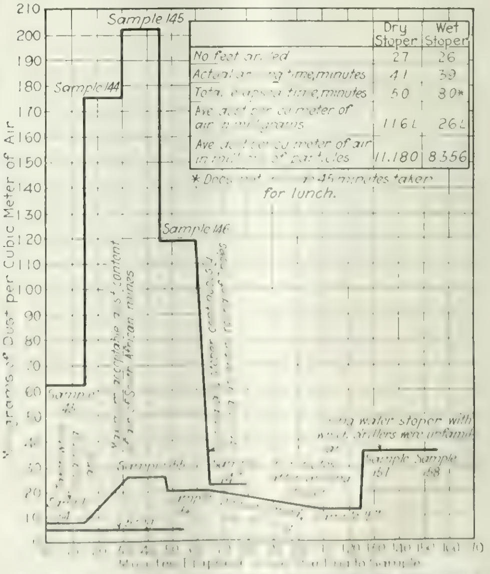


CHART 1. COMPARATIVE DUST CONTENT OF AIR OF AN UNVENTILATED RAISE WHEN DRY DRILLING A ROUND OF HOLES AS AGAINST WET DRILLING THE SAME PLACE

Immediately after sampling, the sugar tubes are sealed by suitable corks, and then sent to the Pittsburgh laboratory of the Bureau of Mines for analytical examination. Before shipment to Pittsburgh, a few drops of formaldehyde are placed in the sugar tube to prevent fermentation, this preparation being especially necessary when the mine air is humid and the surroundings during shipment are excessively warm, as in summer.

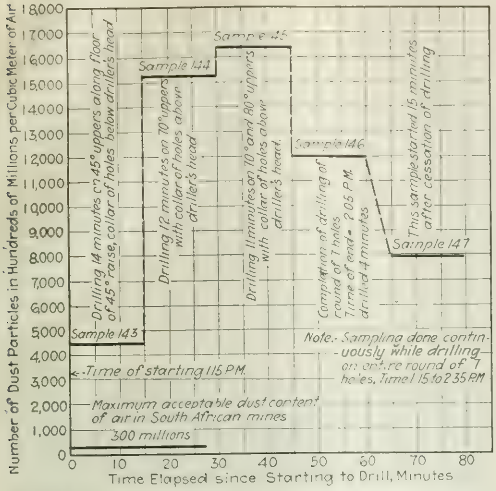


CHART 2. DUST CONTENT OF AIR BY NUMBER OF PARTICLES WHILE DRY DRILLING A ROUND OF HOLES IN A RAISE IN A WESTERN METAL MINE

Also shows how enormously greater is the dust content of this place than the allowable maximum dust content of mine air of South Africa. The material drilled was highly siliceous.

In addition to the before-mentioned samples of dust from mine air (from 10 to as many as 100 samples being taken in a single mine), samples of drill cuttings, of dust settlements along workings, of vein matter, and of country rock are also sent to Pittsburgh for analysis and microscopic examination, these samples each being from two to four pounds in weight and one or two of each (possibly more) being sent from each mine examined. It is also desirable to send a sample of the water used in drilling, and possibly one of the water provided for drinking purposes.

LABORATORY WORK

As has been heretofore indicated, practically all analytical work is done at the Pittsburgh laboratory. Air samples are given standard analysis for oxygen, carbon dioxide, methane, carbon monoxide, and *nitrogen plus other* constituents. If information is desired as to especial gases, such as oxides of nitrogen, or SO_2, or hydrogen or hydrogen sulphide, special request must be made of the chemists at Pittsburgh.

The quantity and nature of the mine-air dust entrapped in the sugar tube are determined by dissolving the sugar in a measured quantity of distilled water and filtering out and rejecting the particles over 280 mesh in size, particles over 280 mesh being known to have practically no harmful effect, as they are too large to enter the air passages at points of danger. The dust in the filtrate is then separated by sedimentation into particles *under* ten microns in size and particles ten to ninety microns (a micron being about 1/25,000 of an inch); a small part of the filtrate is set aside to be placed under the microscope, and a count of particles made and reported in millions of particles per cubic meter of air. The dust is chemically treated to dissolve soluble constituents, and is finally weighed and reported in milligrams per cubic meter of air aspirated, divisions being made as to particles above and below ten microns in size. The division at ten-micron size is made for the reason that investigators in dust work have found that seldom, if ever, are particles over ten microns in size found in lungs of miners who have died of miners' consumption.

Particles of dust from drill cuttings, country rock, vein matter samples, or other sources are also placed under the microscope, and photomicrographs are made. Reports are submitted as to quantity, size, shape, and other characteristics of particles, especially as to sharpness and cutting edges of the small particles. Also, chemical analyses are made of drill cuttings, vein matter, and other underground material incident to mining operations, with especial reference to the presence of known harmful constituents, such as silicates, free silica, or like deleterious substances, and especially free silica or any other insoluble substance breaking into fine particles with sharp edges. These analytical reports and examinations are transmitted to the investigators, who tabulate them and compile the results and interpret them, placing the tables and interpretation, with suitable recommendations, in the reports submitted on the individual mines.

SPECIAL WORK OF THE DOCTOR

In general, the doctor assigned to the work accompanies the engineer into the underground workings and aids in the taking of the data, collecting samples, and in general investigations, and simultaneously obtaining data as to sanitation such as latrine system, drinking water system, and general working conditions. If it is possible to do so, the doctor makes physical examination of miners and other mine employees, with especial reference to chest conditions, including heart, lungs, and other vital organs, simultaneously taking history data

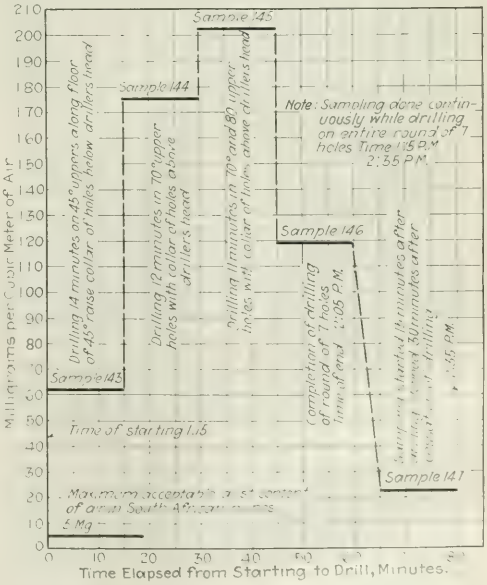


CHART 3. DUST CONTENT OF AIR BY WEIGHT OF PARTICLES WHILE DRY DRILLING A ROUND OF HOLES IN A RAISE IN A WESTERN METAL MINE

Also shows how enormously greater is the dust content of this place than the allowable maximum dust content of mine air in South Africa. The material drilled was highly siliceous.

as to kind of work done, length of time employed in the mine as well as in other mines, and general mining experience and work. However, physical examinations are sometimes difficult to obtain. Either the mining companies or the employees, or both, object, and in such circumstances no examinations can be made. Where temperatures are high, special problems arise, and the doctor obtains data as to blood pressure, pulse, and general physical effects of varying conditions.

RESULTS OF THE DUST VENTILATION WORK OF THE BUREAU OF MINES

Although investigations of the effects of dust and general mining conditions have been carried on for many years in foreign countries and for several years in the United States, and though considerable definite information has been obtained, much remains to be done. In the United States, conditions are complicated by many unusual factors, and the effect of these has not yet been definitely determined, but I offer the following tentative personal conclusions, with full knowledge that future investigations or even some at present in progress may change the conclusions:

DUST

1. Long-continued breathing of underground air heavily laden with any kind of dust is likely to be ultimately harmful to health.

2. Harmfulness of dust is proportional to its fineness, insolubility, and occurrence of sharp cutting edges. Dust particles over one twenty-five hundredth of an inch in size are not considered especially harmful. Particles under one twenty-five hundredth of an inch are invisible to the naked eye unless present in the air in great numbers.

3. Probably the most dangerous dust is that of free silica. Fine dust of combined silicates, though not so harmful as free silica, is also likely to have sharp cutting edges and is insoluble, and consequently is likely to have a harmful effect on lung tissue.

4. It now appears probable that though dust composed largely of free silica is likely to be harmful, there may be conditions under which the usual harmfulness of free silica dust is at least partly neutralized.

(a) Haldane advances a theory that ordinarily harmful siliceous dust may be associated with some other dust which "adsorbs" or envelops the harmful dust, and this prevents the harmful dust from acting.

(b) It also appears that free silica may exist in a state of partial alteration by heat, pressure, or other underground condition such that it is more or less decomposed, and so acts as compared to ordinary silica somewhat as decayed timber would effect solid timber.

5. Considerably over 50 per cent of present-day metal mining is done in siliceous material, and in many of the non-siliceous mines there are other dusts, both soluble and insoluble, which have bad effect on the health of underground workers.

6. Mines working in material composed largely of free silica (quartz, flint and similar rocks) or having other dangerous kind of dust, may, to a large extent, avoid harmful results.

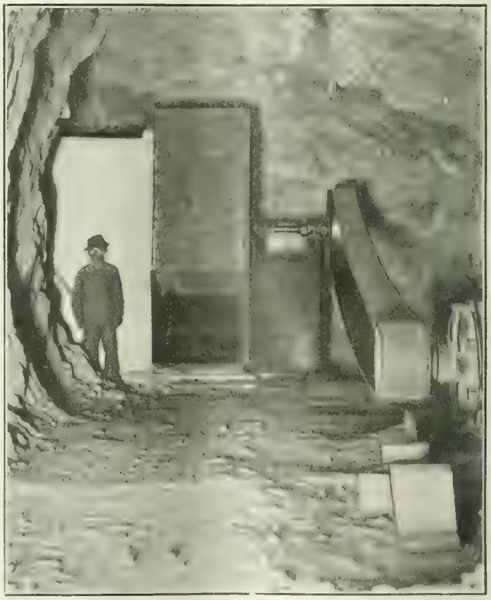
(a) Through lack of formation of dust if the material is wet.

(b) Through prevention of dust formation and its dissemination by use of water drills for all kinds of holes, including stopers, by use of water sprays, by wetting down of rock piles, roadways, chutes and other working places, by sprinkling, and also by adoption of methods of mining resulting in reduction or elimination of upper holes.

(c) By prevention of blasting while men are on shift and adoption of methods of dust allayment after blasting, and before men again come on shift.

(d) By providing ample currents of air to sweep out the dangerous fine dust as soon as it is formed. Compressed air blowers or jets, in general, do not supply sufficient quantity of air to accomplish this. Where the coal-mining method of always having an intake and a return air course is impracticable, the use of efficiently set doors, regulators, brattices, and analogous appliances, and small fans with galvanized iron or canvas tubing, readily supply sufficient currents of air to advancing blind-end faces of drifts, raises, or other workings, to clear them of dangerous dust as well as of smoke.

7. By far the greater part of the excessive unhealthfulness of workers in and around metal mines is due to dust. There is no question that the dust hazard can be eliminated, and at no undue expenditure of time, money, or effort, provided there be whole-hearted co-operation of miner and operator. In general, the metal-mine operator realizes the dust danger, but is handicapped in adoption of commonsense methods and regulations by the fact that the miner only too frequently prefers to "eat" the dust, with full knowledge of ultimate effect, rather than undergo a certain amount (frequently temporarily) of physical discomfort in using dust-prevention or dust-allaying devices. This attitude on the part of the miner has made inoperable practically all the state laws heretofore adopted to assure the elimination of dust in metal mines, and little progress can be made until the miner realizes the necessity of helping to protect his own health.



AN EFFICIENT FAN INSTALLATION 3,000 FT. BELOW THE SURFACE

VENTILATION

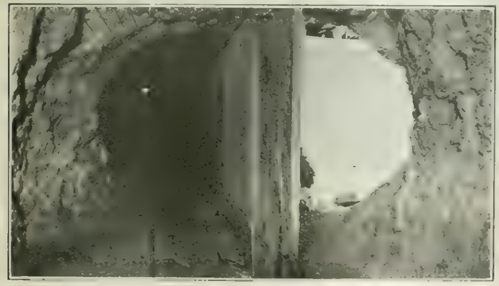
1. Ventilation of metal mines was until recent years considered a "fad" or an impossibility, but widespread, earnest attention is now being given to it.

2. In general, even the better ventilated metal mines of the present day fail utterly to provide really adequate ventilation. Large quantities of air are coursed through the mine, with little or no attention to bringing moving air to the actual working faces, and the worker only too frequently must leave his working place to obtain the benefit of ventilation expenditures. Seldom can moving air be found at as much as 25 per cent of the working faces of a metal mine, and this is true even when considerable money is spent on ventilating equipment.

3. The old-time "hard-boiled" metal-mine foreman or superintendent cannot be relied upon to introduce adequate ventilation methods or systems. He has probably mined many years without ventilation, and therefore sees no need for it. Moreover, he has not the technical knowledge or the special experience to handle the problem, and the work should be intrusted to a young engineer who has had ventilating experience in either a coal or a metal mine and who preferably reports to the higher officials, who want results and are not likely to be governed by prejudices. The old-timer as foreman or superintendent, according to my observation, is likely to try to block progress rather than to facilitate it. There certainly can be no effective ventilation of metal mines until ventilation equipment, methods, upkeep, and direction and control are placed in the hands of some one man who spends practically all of his time in direct touch with the work, and is under instruction to keep moving currents of air at all times at all working places in the mine.

4. All mines should have mechanical ventilating equipment, with main fans placed preferably on the surface in fireproof housing, and with suitable arrangement for prompt reversing of air current if an occasion should develop making that necessary.

I am of the opinion that no mine can be adequately and *safely* ventilated by natural ventilation. Even assuming that there may be no effect on naturally ventilated mines due to change of seasons (and this assumption cannot be borne out by facts), the mine with natural ventilation is likely to be seriously, probably dangerously, handicapped if a mine fire should occur. This is now recognized by many progressive mining companies, and fans are being placed even where it is felt that natural air currents are sufficient for ordinary ventilation.



USE OF BRATTICE IN A METAL MINE

5. Providing efficient ventilation is fully as important to the ultimate financial success of a metal mine as is the adoption of a proper system of mining, or of haulage, or of mill or metallurgical treatment. This may be considered a radical statement, but I have in mind several properties in which the workers simply cannot deliver more than one-fourth to one-third of a decent day's work because of unfavorable (almost unendurable) air conditions. Yet there are near-by mines with essentially as bad natural conditions in which men work at top speed because of good ventilation installation.

I know of mines with abundant ore of better than ordinary grade that have been abandoned because it has not been possible to work them, owing to high rock and water temperatures. On the other hand, other mines with even worse natural conditions are working successfully through maintenance of adequate ventilation, and at a cost of but a few cents per ton of ore produced. Many metal mines that are today getting only 30 to 50 per cent efficiency from their men, because the men are compelled to work in hot, humid, stagnant, or vitiated air, could readily provide decent, healthful working conditions by making a comparatively small outlay for ventilation, and be reimbursed several times over annually in greater efficiency of their men, as well as in compressed air saved, fire protection afforded, and other economies.

Importance of Specifications for Chemical Lime

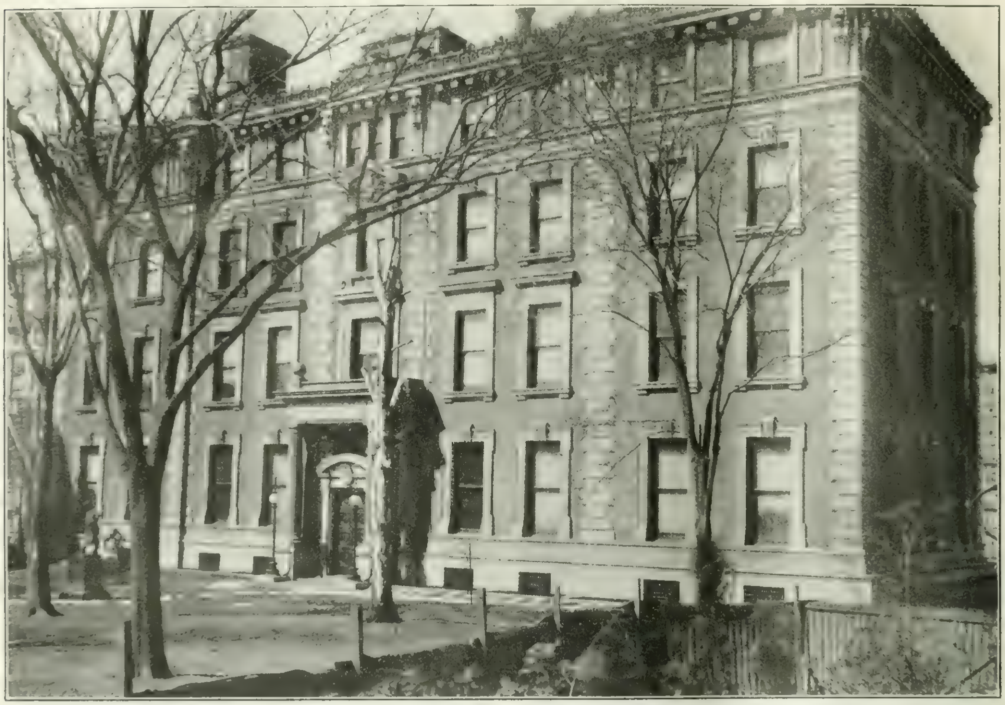
Urgent Need for Standardization of Lime for Various Uses—Government Co-operating With Consumer In Recommending Specifications

LIME, hydrated lime, and limestone fill a very important place in the industrial life of the country. It is estimated that approximately 140 different industries use lime in some form. It is becoming more and more apparent that there is great need of improved standardization of the material used for various purposes. The requirements are so diverse that a lime which is satisfactory for one use is found to be entirely inadequate for another. Many firms are using types that are inferior for their purposes, partly through ignorance of plant practice and partly through lack of information as to where material of the proper grade may be obtained.

A better standardization of materials would probably have the effect of establishing better plant operation through the dissemination of knowledge of details of approved practice, and would enable producers to prepare lime better suited to the requirements of the trade. It would also tend to cut down transportation costs, for the user would in many cases be enabled to obtain suitable material from a more convenient source than at present.

The great need for detailed specifications led the Bureau of Standards to call a meeting of representatives of various Government bureaus to discuss the feasibility of working out a standardization of requirements. As a result, an Interdepartmental Conference on Chemical Lime was organized, with representatives from the Bureau of Standards of the Department of Commerce, the Bureau of Chemistry of the Department of Agriculture, the Geological Survey and the Bureau of Mines of the Interior Department, and the Nitrates Division of the War Department. This conference holds meetings at intervals of about a month, at which specialists in the use of lime in various consuming industries present specifications for general discussion. Tentative specifications are then submitted to the industries and to competent organizations for approval or criticisms. When completed, they are published by the Bureau of Standards. One such specification, that recommended for quicklime and hydrated lime for use in cooking rags for the manufacture of paper, has already been issued as Circular No. 96. Several additional specifications are now nearing completion.

It is desirable to emphasize that the work of the Interdepartmental Conference in no way conflicts with or overlaps similar work conducted by the American Society for Testing Materials and the Specifications Committee of the Lime Association. In fact, the approval of the latter organizations for specifications prepared by the Interdepartmental Conference is sought and obtained. The preparation of complete specifications consumes much time, and it is felt that the field is so tremendous, and the need so great, that there is ample opportunity for several groups to work for years without conflict. The conference is careful to select only those industries for which the other organizations are preparing no specifications, thus avoiding duplication of effort.



COLUMBIA UNIVERSITY SCHOOL OF MINES BUILDING

The Columbia School of Mines Idea

Its Principal Tenet Is That the Education of a Mining Engineer Should Include Sound Preliminary General Training—A Six-Year Course Necessitated by This Plan

By George J. Young
Written for Engineering and Mining Journal

SINCE the beginnings of technical education there has been contact with industry, but this contact was more or less casual until technical graduates and employers became increasingly insistent upon the need for a knowledge of the practical or, I might say, "going things" in the industry. The requirement that an engineer should be practical or should temper his judgment with a background of practical experience has been generally accepted, and mining schools have endeavored in various ways to meet this requirement.

Laboratory instruction in tool sharpening and rock drilling, excursions to mining districts, experimental adits, and talks by experienced engineers and mining men, greater amplification of laboratories, with introduction of large-scale appliances such as were used in milling operations, as well as the requirement that students should work in mines and mills during a part of their vacation periods, comprise some of the efforts to develop the practical aspects of a mining education.

Contrasted to this conception of educational requirements is the theory that the cultural development of the engineer has been neglected and that some effort should be made by the schools to broaden the engineer's outlook upon life. A part of the curriculum of mining schools has always been devoted to cultural subjects, but this has been in many institutions a diminishing quantity as an increasing amount of time has been spent in laboratory work.

Along with this latest movement is a related one that I foresee will engage the attention of educators. It is also in line with cultural development. Though difficult to state in simple terms, it comprises the following: A greater appreciation and knowledge of the human element in industry, a conception of the fundamentals of sociology, a knowledge of psychology, fundamental training in hygiene, housing, and living, a broad foundation of the economics of mining and industry as well as of business, and a more extended knowledge of what I might term the civil contact of industry; meaning by this, corporation, business, and regulatory laws, which have developed both in numbers and complexity during the last decade.

As a phase of the endeavor for greater cultural development there is also an insistence for higher quality in the product of the schools. There is, among the advocates of the broader training, the feeling that quality heretofore has often been sacrificed to quantity. Many educators have felt the pressure to increase attendance and have reluctantly trimmed their sails to meet the exigencies of their individual situations. Now, however, the growing need for better quality is meeting some recognition, and the more progressive institutions are going through a process of introspection which will in time raise educational efficiency and result in meeting the needs of the students more specifically.

A curriculum may be well thought out and balanced, and may function like a modern piece of artillery, or it may resemble an old-fashioned stage coach, filled with a heterogeneous mixture of humans, parcels, and trunks, creaking along in top-heavy fashion and somehow getting to its destination, although with a certain degree of misery to its occupants. Most mining schools have workable curricula, which require only additional change as educational ideas advance. The principal function of the curriculum is to serve as a systematic base and equitably to divide the students' time.

With the object of renewing my acquaintance with mining education, I recently visited the School of Mines of Columbia University. Through the kindness of friends there I was enabled in the limited time available to meet almost all members of the faculty and to learn at first hand some of the important developments that have taken place in that school.

THE COLUMBIA PLAN OF GRADUATE SCHOOLS

Columbia University has established in its technical schools a six-year course, the first three years being the basis of a liberal education and the last three being devoted to technical studies. This represents a departure from the conventional four-year university course so commonly found in engineering schools. The motive back of this departure was the desire to afford better preparation for entrance to the technical school. This motive can be traced to the movement to provide a greater cultural background for the technical man.

The segregation of the curriculum into two parts makes possible the service of two objectives specifically. The work in Columbia College has for its objective the training of men in fundamentals such as physics, chemistry and mathematics, languages, and other pertinent subjects. It is designed to be superimposed upon a well-balanced high-school course. Its product becomes the raw material for the technical course. There are no limits to what is loosely termed a general education. There are, however, practical limitations in a college course, such as available time and the students' receptive capacity.

After attempting to work out the intricacies of the college course for School of Mines men, I have the feeling that much can be done in presenting it in a clearer manner than has apparently been considered necessary in the existing catalog. However, as it is, the presentation may contribute to the intellectual development of the student, or perhaps it is a modern intelligence test that may operate to prevent the entrance of the victim unable to fathom it.

The technical course in mining and related subjects at Columbia, in common with the other schools of engineering, is organized under Dean George B. Pegram. He told me that the plan contemplated a working enrolment of 350 in the various technical branches, with an annual output of 100. About half the incoming technical students are expected to come from outside colleges and half from Columbia. Under the previous system the number of technical students totaled 800 as its maximum. The proper care of this number under the present courses would tax the capacity of staff and laboratories beyond their limit. Dean Pegram pointed out his conception of the college course in making it possible for a student to make a wiser selection from the technical courses. Of the technical courses in relation to the college course, he stated that the objective was to train men to be leaders and men of affairs.

The curriculum of the mining school is plainly presented. Three separate courses for the engineer of mines, the mining geologist, and the metallurgical engineer are provided. Each specialized branch is an important one. The courses are sound, and the arrangement is consistent. There is about an even division between classroom and laboratory time, and the total time in any one session is not far from thirty hours. Summer work is provided for at the end of the first and second years. A fair degree of contact with the industry has been provided.

Edward F. Kern took me through the metallurgical laboratories. I formed the impression that pyrometallurgy was the leading subject for the moment and that hydrometallurgy had slipped into second place. The assay laboratories under Professor Hall, placed fortunately at the top of the building, are splendidly equipped for good instruction and rapid work.

I met William Campbell, who handles metallography. Professor Campbell believes that engineering students should know something about the materials they are using. In his judgment, this study of materials is just as important as calculus. He is an authority on his subject, and has turned out some able men.

With Arthur L. Walker, professor of metallurgy, I had an interesting conversation. Professor Walker believes in giving a student an opportunity to think for himself. He requires each student at some time in his courses to prepare three lectures on assigned subjects and present them to the class. Robert M. Raymond, professor of mining methods and mining engineering, who came to his educational work after an extended experience in operating mines, discussed the question of contact of the student with the mining industry. The students are encouraged to get practical work as early as they can, and most of the men comply, using their summer vacations for this purpose. At the end of the second year, a six weeks' excursion is taken under the direction of Professor Raymond, and this excursion brings in contrast a number of mining districts. During the session short trips are taken to near-by iron and coal mines, and the students study at first hand the construction work in the subways of New York. A surprising variety of mining and metallurgical operations is accessible from New York. Robert Peele, professor of mining operations and mine plants, has had a large field experience and has been on the educational staff of the School of Mines for twenty-eight years. He is a mining educator and writer and represents the student and scholar. To finish off an exceedingly interesting day, I dropped in on Professor Charles P. Berkey. In response to my request Professor Berkey initiated me into the mysteries of cultivating geological ability in students.

Columbia University has collected in this School of Mines an able, experienced, and balanced faculty. There appear both the scholastic type and the practical engineer. The individual members are men that one would like to know, and I felt that the ideal which Columbia is endeavoring to meet, in turning out graduates who will be better leaders and who will advance the technical side of industry by reason of their thorough preparation and sincere purpose, is in excellent hands.

We know, of course, that the wisdom of the six-year mining engineer course is an open question, which is far from having been generally accepted. Possibly even some of the faculty at Columbia have their doubts. Naturally, there are adherents of the old order as well as enthusiasts for the new. The new program started under the difficulties imposed by the war, and has not perhaps had a fair trial. There is a surprising scarcity of students. Some believe that six years is too long a time for a technical student to remain in college. But the idea is, at any rate, an interesting experiment, which will doubtless be carried to a logical conclusion, and there should be as definite an accounting of the results as possible.

Back of this experiment there is a record of achievement that has placed Columbia University among the leading universities of the United States. The relatively great expansion of local opportunities for technical education has operated competitively against the long-established and strong institutions. Will the new order change this, and will the flow of first-class material set in toward institutions like Columbia? Or, will Columbia be impelled to change its plans, and adopt for its mining engineers a course of training approximating more nearly that of the Western mining schools which have found this course successful? Or will the Harvard idea of a four-year course, or the Massachusetts Institute of Technology plan, concerning which I hope to write more later, turn out to be the successful compromise?

A Defect in the Pittman Act

Minor Assay Offices Required To Pay Foreign Silver Price for Domestic Silver Purchased—Small Producer at a Disadvantage in Obtaining $1 per Ounce

[illegible] for Engineering and Mining Journal

THE PITTMAN ACT provides that silver of domestic production presented at the Assay Office in New York or at one of the coinage mints shall be purchased by the Government at the price of $1 per fine ounce. As a consequence, domestic silver is quoted in the New York market at 99½c. per ounce, whereas foreign silver is 60c.—more or less—depending upon the London price.

The price to be paid for silver contained in gold bullion is fixed from time to time by the Director of the Mint, under authority of U. S. Secs. 3520-3526. Exercising this authority, he has made a standing order that such price shall conform to the New York quotation, but has modified this to the extent that although the New York Assay Office and coinage mints pay $1, in accordance with the act, the minor assay offices must pay, for all silver purchased, even though known to be of domestic origin, the New York price quoted for foreign silver.

It is not intended for a moment to question the motives of the Director. It must be assumed that the exclusion of the assay offices was intentional, but it may be contended that they would not have been excluded had conditions been understood. Unquestionably, the Director has authority to pay the New York market price for domestic silver, and a large number of small producers would receive the benefit of the advanced price were payments also made through the assay offices.

As the matter stands, the producer who happens to be operating near Denver or San Francisco can deliver his bullion to the mint and receive $1 per ounce, whereas the producer situated near Seattle or Helena or Boise derives no benefit from his proximity to those assay offices, and must either pay additional transportation on his bullion to sell it at the mint, or accept the lower price which is all the local office is authorized to pay. Thus, the usefulness of these offices is impaired at the very time when the mining industry is most in need of encouragement and support.

Also, the miner who is producing smelting ore may sell his ore to the smelter and receive $1 per ounce for his silver, whereas his neighbor whose rock is free-milling deposits his bullion at the assay office and receives only the foreign price.

Unfortunately, it is the small operator who suffers from these inequalities, as in many cases he cannot wait for returns from a distant mint, but must sell his product to the nearest assay office; and there are instances where consequently considerable losses have been sustained; in fact, every one depositing bullion of domestic origin at a minor assay office must pocket this variable loss of from 40 to 45c. per ounce.

It is not known why the minor assay offices were excluded from the provisions of the Pittman Act, but it has been suggested that because of the danger of our being swamped with foreign silver disguised as native, the act was confined to the mints and the New York office, with the view that thus only four places would require watching. If this is the reason it is without merit, because the amount of silver contained in the gold deposits purchased at these offices is negligible when compared with the total amount of silver purchased by the Government; and the officers at these offices know practically all of their customers and the sources from which this bullion is derived, so that any unusually large deposits would at once excite suspicion and inquiry.

The obvious remedy is for the Director of the Mint to authorize the minor assay offices to pay for silver in gold deposits of known domestic origin, the New York price for domestic silver; or to amend the Pittman Act so as to make the minor assay offices pay for silver contained in gold deposits of domestic origin the same price as the mints pay under this act for silver purchased for coinage.

Oil Reserve Distinctions

Present output and future reserves of petroleum must not be confused in the study of mineral statistics, warns the U. S. Geological Survey. In the main, present national rank is indicated by production, but the fact that mineral resources are not replaceable is always a qualifying factor. This distinction between present and future is especially important when such a topic as national domination in oil is under discussion: that North America contributes 85 per cent of the world's supply of petroleum is no proof that Persia and Mesopotamia may not contain half as much oil as the United States and Mexico, even though those countries of the Near East are now yielding only 2 per cent of the world's output. Indeed, in the matter of mineral wealth, the nation that is a spendthrift today is so much the less likely to possess "independent means" tomorrow.

The Tom Reed-United Eastern Decision

Case Involved Novel Question of Apex Mining Law, According To Judge Bollinger—Mallery Fault Responsible—Many Eminent Geologists and Practical Men Testify at Trial—Defendant Wins

A DECISION in favor of the United Eastern Mining Co., of Oatman, Ariz., defendent in the apex suit brought against it by the Tom Reed Gold Mines Co., was handed down on March 28 by Judge Bollinger, of the Mohave County Supreme Court, as already announced in the news columns of *Engineering and Mining Journal.* The attorneys for the plaintiff, Tom Reed, were the late Judge Curtis H. Lindley, William E. Colby, and the firm of Wallace & Lucas. Witnesses for the Tom Reed were: Ely Hilty, Steven Smiley Jones, Herman C. Zulch, Fred W. Crosley, Oscar H. Hershey, W. B. Phelps, manager; Walter H. Wiley, Albert Burch, and Andrew C. Lawson.

Attorneys for the United Eastern were: John T. Gray, R. L. Alderman, and C. W. Herndon. The defendant company's witnesses were: George Keating, Edward L. Haff, W. D. Dower, Fred Searls, Percy G. Harrison, John A. Burgess, William H. Emmons, William S. Winstead, and Horace V. Winchell.

The decision reviews the case from the first. The substance of it is given in the following excerpts:

This is a very interesting and remarkable case. It is not only an unusual case in the history of Arizona jurisprudence, but a case that presents problems of the mining law which have never been adjudicated by any court.

The issues in this case present a suit to quiet title to an underground vein or orebody situated beneath the surface of the Big Jim mining claim, which claim is patented and owned by the defendant. The plaintiff owns the Grey Eagle and Bald Eagle mining claims and they are, also, patented; and said plaintiff is claiming the ore in question by its alleged extralateral right under what is known in mining parlance as "the apex law."

The action of the Mallery fault is the cause of this lawsuit. A fault is merely a vein which is not mineralized. Dr. Lawson, during his testimony, gave a very interesting lecture upon the phenomena of faulting and discussed at some length some of the fundamental principles of such phenomena. The court read with a great deal of interest his views and the views of other high authorities upon this interesting question. It seems that faulting results from strain which accumulates in the rocks of the earth. This strain is sometimes caused by one thing and sometimes by another. Two of the most important causes of this strain are the operation of temperature within the rocks and the moving of weighty material from one place to another on the surface.

Therefore we have established in the Oatman district two fissure systems: the older system which was mineralized, as exemplified by the Tom Reed vein which traverses the Grey Eagle and Bald Eagle claims of the plaintiff, and the later system which is not mineralized, as exemplified by the Mallery fault. The mineralization which occurred in the earlier fissure and produced the Tom Reed vein was an interesting process. That fissure contained moving underground hot water. Because this water was hot and came in contact with sulphur and thereby formed a chemical solution, which solution was capable of mineralizing a fissure by circulating and depositing elements contained in this solution throughout the fissure, therefore we conclude that a fault in geology is nothing more nor less than a break in the continuity of the body of rock, which break is attended by a movement on one side or the other of the break so that what were once parts of one continuous rock stratum or vein are now separated. This movement which separates the stratum may be in more than one direction; that is, there may be both a downward displacement and a horizontal heave, as is found in the Mallery fault. The amount of displacement in each movement may be a few inches or thousands of feet.

The vein which traverses the Grey Eagle and Bald Eagle claims lengthwise, and what the plaintiff has called the "first segment" of the Tom Reed vein, has its apex within the surface lines of those claims. Since the first of the year 1916 the plaintiff has mined the ore from this vein to a depth of 600 ft., and at that depth the vein stops abruptly against what is known as the "Mallery fault." At the bottom of the vein the ore is bent upward on the hanging wall of the Mallery fault. At a distance of about 430 ft. from the 600 level of the Grey Eagle the orebody which the defendant terms the "Big Jim vein," and which the plaintiff terms the "third segment" of the Tom Reed vein, stops against the foot wall side of the Mallery fault. The ore in this vein is bent downward. The top of this orebody is about 200 ft. beneath the surface of the Big Jim claim. In order to reach the main orebody within the Big Jim the plaintiff would either have to travel up the Mallery fault a distance of 430 ft. from the 600-ft. level of the Grey Eagle, or crosscut through country rock, mostly beneath the surface of the Big Jim for about the same distance.

There were a number of eminent geologists and mining engineers who testified in this case, many of them not only with national but international reputations. A few practical miners also testified and furnished the court with very valuable information, because the problems involved in this case are largely practical ones. After listening to the testimony of the geologists, and after reading and rereading the same, the court is of the unqualified opinion that at some time in the dim and distant past, the orebodies beneath the Tom Reed property and the orebodies beneath the United Eastern property were once connected as a part and parcel of the same general fissure and vein system, but this court has no information as to just how many thousands or how many millions of years have elapsed since that condition existed, but that it at some time in the past did exist seems to be the opinion of all the expert witnesses on both sides. But when the faulting occurred as the result of the formation of the Mallery fault there was not only a downward displacement of approximately 430 ft., but there was a horizontal movement along the strike of the vein, the extent of which is not known, and the best proof which could be introduced as to the size of the horizontal component would be nothing more reliable than a wild guess. For instance, there is nothing before this court that any part of the vein along the 600 level within either the Grey Eagle or Bald Eagle claims was ever attached to any part of the top of the vein as found at the 200 level within the surface of the Big Jim claim. About the only testimony on this point was to the effect that the horizontal movement was greater than the downward displacement.

This case involves nothing more than a novel question of the apex mining law. During the course of the trial there was not much dispute or serious conflict between the expert witnesses on both sides. The essential facts relating to existing conditions as found in the premises were practically admitted.

Every man is required to keep his hands off of any and every thing within the surface lines of a claim belonging to another, which surface lines extend vertically downward, until he sustains the heavy burden of proof that he is working upon and following the vein which has its apex within the surface lines of his claim. This apex right only accrues and attaches to the vein of any claim when said vein may be identified on its downward course and when it is a continuation of the same vein outside of the lines of his claim that it is within the lines of his claim; in other words, in order to assert this right of apex the vein outside must be identified with and a continuation of the vein inside of the lines. . . . If veins are separated permanently and cannot be followed as the same vein, and if it is necessary to pass through great distances of country rock in order to connect them, in which distances there are neither mineralized walls nor seams, such veins must be deemed separate and distinct ones and cannot be identified as one and the same.

This case must be decided from a practical viewpoint as the miners find conditions in the ground today, or it must be decided upon the theories and testimony of geologists in accordance with conditions as they existed many thousands or millions of years ago. If the decision be based upon the theory and testimony of the geologists it seems to me that no mining location in the Oatman district could be secure or valid. The fundamental purpose of the apex law was to give the miner what he found.

We are reliably informed by geologists that this northwest section of Arizona, including the San Francisco mining district and Oatman, experienced at some time in the past a great upheaval and sank about 6,000 ft. With this in mind the court is compelled to view this case from a practical standpoint and adopt the views of the practical miners, and view the conditions as they are today and as they were when the rights of all parties herein were acquired.

As stated before, the three essential conditions to be established in this case are, *identity*, *continuity* and *continuity of right*. . . . The plaintiff introduced a great deal of convincing testimony as to identity. Among other things it proved that the ore is abruptly cut off and exists on opposite sides of the Mallery fault, that the strike and dip of the various orebodies are very similar, that the vein-filling is virtually the same, that the wall rocks are similar, and that on the hanging-wall side of the Mallery fault the ore is bent upward while on the foot-wall side of this fault it is bent downward. But the plaintiff did not identify the ore which is located beneath the surface of the Big Jim claim as the continuation of its vein known as the Tom Reed vein which stops abruptly against the Mallery fault on the 600-ft. level of the Grey Eagle and Bald Eagle claims. This identity and continuity of the Tom Reed vein within the plaintiff's ground into the ground of the defendant was not proven and could not be proven if, for no other reason, than because it would be impossible to ascertain the extent of the horizontal movement at the time of the formation of the Mallery fault. When a locator locates a mining claim his claim is limited to 1,500 ft., and his apex or extralateral rights are also limited on that claim to the same distance. These rights may be limited to a much shorter distance.

The testimony of all the geologists who testified in this case shows that the continuation of the Tom Reed vein on the foot-wall side of the Mallery fault is at least over 400 ft. from where it was once connected and attached to the Tom Reed vein, and probably several thousand feet from either the Grey Eagle or Bald Eagle claims. . . . A fault which causes a downward displacement of over 400 ft. and a horizontal component of that much displacement or a great deal more, destroys the identity and continuity of the vein and deprives the apex owner of his continuity of right to follow that vein under such conditions into the land of an adjoining owner. . . .

The court finds that within the premises in question there exist at this time three separate and distinct veins or ore bodies; namely, the Tom Reed vein, the Sideline vein and the Big Jim vein. These veins are permanently separated, have been so separated for many centuries and each of them possesses an individuality of its own. The only physical connection that they ever had in past ages was that each of these veins or orebodies at some time in the distant past constituted a part of one main fissure or vein system which was disrupted by the Mallery fault. So far as the testimony in this case shows, it would be impossible for any geologist, either by positive knowledge or through the agency of geological projections to locate the actual physical continuation of the Tom Reed vein. The same condition exists as to the Big Jim vein with reference to the ore which at one time constituted the upward extension of this vein. The Tom Reed or Grey Eagle vein is wholly within the ground of the plaintiff, has its apex within the ground of the plaintiff and is owned by the plaintiff. The Big Jim vein is wholly within the ground of the defendant, has its apex within the ground of the defendant and is owned by the defendant.

Suppose that this court should adopt the view and theory that this case should be decided from the standpoint of origin, at the time when these veins, lodes, ledges, faults and apices were formed, would it not be just as reasonable and legal to go beyond the Mallery fault period to other times and other ages and have the geologists read the story of the rocks back to the time of creation? There were no doubt prehistoric times when the premises in question presented very different conditions from those portrayed at the time of the formation of the Mallery fault or immediately preceding that time. . . . In other words, if this case should be decided upon the theory of origin, the plaintiff would not own the Tom Reed vein as found within the Bald Eagle and Grey Eagle claims, but that property might be successfully claimed by some owner of barren ground a few thousand feet away.

Record Production of Borax in 1920

The quantity of borax produced and sold in the United States in 1920 was 35,280 short tons, valued at $5,674,000, according to R. C. Wells, of the U. S. Geological Survey. This is a record production and value, exceeding even those of last year—28,518 tons and $4,351,891—which were higher than those of any previous year.

For many years borax has been manufactured in the United States from the mineral colemanite, a calcium borate, which is mined in California, but for the last two years some borax also has been obtained from the water of Searles Lake, Cal., as it is one of the salts that the brine yields by a certain method of treatment. This method of treatment marks a departure in the borax industry and recalls the old days in the 60's when borax was made by recrystallizing the crude salt found in the mud of Borax Lake.

The total quantity of crude borates produced in the United States in 1920 amounted to 120,320 tons, valued at $2,173,000. This is a record in quantity, though not in value, on account of the lower grade of the ores.

Borax, called in chemistry sodium tetraborate, is used in large quantities in making the enameled coating for cast-iron and steel ware used in plumbing fixtures, chemical equipment, and kitchen utensils. It is also a constituent of borosilicate glasses, such as are employed in making lamp chimneys, baking dishes, and laboratory glassware. Considerable borax is also used in the laundry and kitchen, in making soap and starch, in paper sizing, and in tanning and welding.

In the United States a considerable quantity of boric acid is made from borax as well as from colemanite. Boric acid is an antiseptic, and is used in cosmetics. It is also employed to preserve meats under conditions permitted by the Food and Drugs Act.

The price of borax in 1920 as quoted in the New York market, for crystals in bags, in car lots, averaged about 9½c. a pound. The price in 1919 was about 8½c. a pound.

Borax was produced in the United States in 1920 by the American Trona Corporation, 233 Broadway, New York City; the Pacific Coast Borax Co., 100 William St., New York City; Chas. Pfizer & Co., 81 Maiden Lane, New York City, and Thorkildsen, Mather & Co., 111 West Monroe St., Chicago, Ill.

The West End Chemical Co., at Searles Lake, expects to begin marketing borax in the near future.

CHROME ORE CARAVAN IN ASIA MINOR

Mining Chrome Ore in Turkey

American Operators in Macri District Planning an Output of 100,000 Tons Annually Of Mineral Running From 40 to 45 Per Cent Chromic Oxide and From 6 to 8 Per Cent Silica—Methods of Mining, Transportation, and Loading Primitive but Cheap

BY RUFUS W. LANE
Written for *Engineering and Mining Journal*

MACRI, on the coast of Asia Minor, opposite the Isle of Rhodes, is mentioned in history a thousand years before Christ. It has a beautiful harbor, almost completely surrounded by high mountains. Across the entrance to the harbor is a small island, which leaves a narrow passage, but one sufficient to permit the entrance of the largest ships, and where the water is sixty fathoms deep.

A town of 6,000 inhabitants, divided into one-third each of Turks, Jews, and Greeks, nestles at the foot of the mountains. On the cliffs back of the town one sees caverns, tombs, and shrines cut into the rock many centuries ago. This little city lives from agriculture and chrome mining, the latter being the chief source of revenue. There are many chrome mines in this district, but only five of them are near enough to the sea to make their operation profitable.

The three largest chrome mines in the neighborhood are worked by an American corporation, Lane, Reggio & Co., Inc., with headquarters at Smyrna. Of the output about twenty thousand tons is shipped to America yearly, the remainder going to Europe. The mineral is about 80 per cent lump and runs 40 to 45 per cent chromic oxide, with 6 to 8 per cent silica. The mines are operated on long lease and are all open workings, and under present conditions produce roughly 25,000 tons a year.

The present operators expect to increase this output to 100,000 tons when political conditions become such that plans already drawn up for installing an endless cable can be executed without fear of government interference. The quality is much liked by American metal works, and commands a good price. Modern docking and loading facilities are absent, and all ore is lightered out to the ship and dumped into the hold in baskets. Operating six lighters and three winches, a ship can take on 400 to 500 tons per day. Facilities for weighing are also lacking, as the "way bridge" of the company was seized by the Turkish government during the war, and present political conditions are such that the installation of a new one would invite a similar fate.

An estimation of weights approximately within 10 per cent correct is the best that can be expected. The Turkish government collects a royalty on all minerals exported, and its functionaries control the quantity by using a "steel-yard." They weigh out, say, twenty tons of ore in sacks and put it on board a lighter; then they make a mark at the water line. Each lighter is then loaded to its water mark and the number of loads made by each lighter is noted.

LOADING SHIP A FAMILY EXCURSION

The water marks of the ship then control the day's work. While loading is going on the ship's officers amuse themselves on shore, where game is abundant. A bag of twenty red-leg partridges is not unusual, and in winter there are large numbers of woodcock. Wild boar abound at all seasons. As the actual port of shipment is some miles north of Macri, the stevedores and passers are usually embarked at the town, to the number of 200 or 250, and transported by the steamer to the loading port. The laborers frequently take their entire families with them, and all camp on the shore while the ship is being loaded.

The women are occupied in mending sacks and the children hold the sacks open while they are being filled. The mineral is transported to the lighter in these sacks, lightered out to the ship, and then emptied into the slings.

The arrival of a steamer, which happens about every month, is a festive occasion, and the whole business of loading is made a kind of picnic. The Turkish government functionaries always accompany the steamer to the port of loading, and like our American darkies, delight in showing authority. They do not, however, treat the people badly, and in this region, at least, they are far from being the bloodthirsty killers one reads about in the American papers.

Workmen are recruited from the neighboring villages, and the supply is ample. A day's wage for a good miner is about $1.10. Before the war it was much less. There are practically no labor troubles. Formerly many annoyances were caused by the government. In recent months, however, the operating company has been able to work without difficulty and on the best of terms with government officials.

LAND TRANSPORTATION BY CAMEL TRAIN

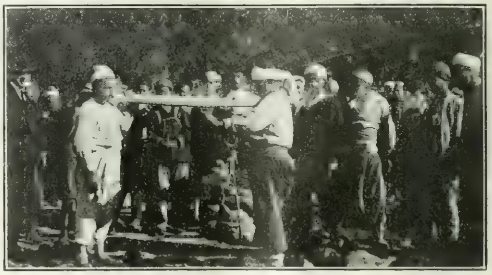
The country being without railways, and much broken, all transport from the mines to the sea is by camel. This is not as expensive as it would appear, for the camels get most of their food from the leaves of the abundant undergrowth with which the mountains are covered. Each camel train in the caravan comprises about seven camels, a donkey to lead and a Turk as driver. A camel carries from 500 to 600 lb. of ore in sacks, tied to a cumbersome but comfortable pack saddle. The leading camel is usually a large male, and on festive occasions he is decorated with showy harness and ornamental trappings, in which bright red cloth is always a prominent feature.

LOADING CHROME ORE AT MACRI FOR SHIPMENT TO AMERICA

The driver sits on the donkey at the head of the train and smokes half of the time, sleeping when he is not smoking. The leading camel thus acquires a taste for tobacco, and I have seen a camel inhale tobacco smoke with every sign of pleasure when a lighted pipe was held to his nostril. The camel at the end of the train always has a bunch of bells hanging to his saddle. Their constant jingle serves to soothe the slumber of the driver, and the cessation of the music never fails to rouse him, as this is a warning that there is a break in the line behind. Each camel is led by a light cord attached to his halter and also to the saddle of the next ahead. When a break occurs the camel whose halter cord has snapped always stops, and thus brings all those behind him to a standstill.

DRIVERS MUST 'WARE THE "ADAMJILI"

The camels are usually docile, and respond to gentle treatment, but they are stupid and stubborn. After experiencing abusive treatment a camel will carry a grudge for a long time and wait his chance to get revenge. Camels have often killed an unkind driver with a blow from the long, powerful hind leg or by crushing his head with a single bite. Such camels are always thereafter muzzled, and are known as "Adamjili," or man killers. The value of a full-grown female is about $500 and the duration of life from fifty to sixty years.



TURKISH GOVERNMENT OFFICIALS CONTROLLING THE WEIGHT OF CHROME ORE BEING SHIPPED FROM MACRI TO PHILADELPHIA

On Fridays, this day being the Turkish Sabbath, a fight between camel bulls of rival drivers is the chief diversion of the people, and bets are freely made. The fighting is really wrestling, as the beasts are always muzzled to prevent serious injury to each other. Danger cannot, however, always be avoided, as the camels try with unexpected intelligence to get a strangle hold, and often succeed. When this happens pandemonium breaks loose, the owners in great excitement endeavoring to separate the fighters, as would a referee in a boxing match. A broken neck or leg has sometimes been the result, but the contest usually ends with one of the fighters taking flight and being chased by the victor, amid the hoots of the villagers.

Causes of Alaskan Mining Depression

The very marked decline of the mining industry in Alaska has been noted with concern by many who are interested in the territory, and has been especially unwelcome to the general public because it came at a time when the Government was expending large sums of money on a railroad that is intended primarily to open up the mineral resources of the interior. This decline is not due primarily to local causes, however; it is largely the result of the world-wide industrial conditions brought on both by the war and by the readjustments that have followed it, according to the U. S. Geological Survey.

Aside from the improvement in general and world-wide economic conditions, the chief need of the Alaska mining industry is cheaper and better transportation, including not only a reduction of the rates on existing lines but the extension of land and water routes.

BY THE WAY

Handy Knowledge

At the O'Sullivan mine, in Delaware, the following device has been successfully used to avert the sad results that customarily attend the falling of a cage. The circular shaft is 50 ft. deeper than the lowest level. A steel cylinder 20 ft. long has been built in the sump, its diameter being the same as that of the shaft. This is provided with a piston, the rod of which, projecting above the cylinder, carries a platform of the shaft diameter. A high-pressure air line carried down the shaft from the level above connects with the bottom of the cylinder by means of a plate valve. The flow of air into the cylinder is controlled by a valve in the line, just below the station above, the handle of the valve projecting out into the hoisting compartment. A falling cage on passing below the station automatically turns on the air, thus raising the piston and platform below to cushion the shock. This device was thoroughly tested by F. X. O'Shaugnessy, the master mechanic, who had such faith in his invention that he deliberately cut the rope upon the occasion when Mrs. O'Shaugnessy's mother was making her maiden trip underground. Another advantage attendant upon its use is that cheaper hoisting ropes may be used. A falling cage is now regarded merely as a passing incident at the O'Sullivan mine.

A carrot of symmetrical shape and sufficient weight makes an excellent plumb bob. If too light for use on windy days or in strong drafts underground this may be remedied by melting down some of the spare pieces of the laboratory platinum and inserting the metal as a weight in the carrot. A pin in the end will permit accurate centering. Where mules are used for underground haulage, it will be well to soak the bob in a strong solution of formaldehyde. The bob may then safely be left hanging from station plugs in the back as long as may be necessary. This same precaution should be taken at properties where there are no mules but where Cousin Jacks instead are employed.

Mineral collectors will be interested to note in the *Commercial Gazette*, of Calcutta, that olivine may be obtained for half the price of *ghee*, and is used in cooking in all the leading hotels in that city.

Frames covered with stout chicken wire are useful for placing over the top of winzes or other airways so situated as to be a source of danger. It was only luck that kept one shifter from plunging 100 ft. to the level below on more than one occasion when he was a bit under the weather.

After years of experiments the Krupp laboratories have succeeded in producing a non-corrosive steel alloy, containing over 70 per cent iron, also chromium and nickel. Among the many purposes for which it may be used is that of making false teeth for people troubled with acid mouth. A neat coat of enamel, as in the manufacture of bath tubs, gives the proper finish. The Standard Sanitary Manufacturing Co. may undertake to turn out a line of this sort of stuff. An effort to standardize sizes may also be undertaken and metric measurements used. People so equipped will require merely the services of a painter instead of a dentist when repairs are necessary.

The Chemical Show

"The Rôle of the Chemist in Relation to the Future of Our Supplies of Liquid Fuel" was a subject that received much attention at the American Chemical Society's meeting at Rochester last week. Incidentally, the large number of raids by the New York police has made it necessary to add several hootch analysts to the city's laboratory staff. The rôle of the chemist is thus fairly well defined in the metropolis.

The analysis of an unfermented Jerusalem artichoke was discussed by A. T. Shohl. Under the law, every Jewish family is allowed several gallons of wine per month for sacramental purposes, a fact that stuck out during the discussion.

R. H. Carr told the audience what it is that puts the pop in popcorn. The paper was disappointing to many, who had come expecting to take a new recipe home with them.

Other interesting papers were, one on "Blue Eyes," by W. D. Bancroft, and one on "Bleaching," by J. Merritt Mathews. The pips received due attention from Messrs. Whitby and Walker, who discussed "The Influence of Piperidine-piperidyl-dithiocarbamate." After this the congregation went home. The next meeting will be held in Milwaukee, in the Pabst Auditorium.

A Technical Error

"A backsight is better than a foresight," said Lot's wife as she surveyed Sodom and Gomorrah. Thus she earned her salt.

Interesting Facts

The three great nickel districts of the world are the Sudbury district, in Ontario; the Subway district, in New York; and New Caledonia. The production of the second is expected to increase soon.

A course in public speaking for mule skinners should be added to the Phelps Dodge Educational Course. Classes might be conducted every Sunday during the slack period.

Sufficient Unto the Day

"W'ile I did take a good drop o' beer, m'son, h'in tha days w'en 'er wuz to be ad, an' a noggin' o' good whiskey naow an' then," said Cap'n Dick, "still I can't h'abide this 'ere 'ome-raised stuff that some folks be drinkin'. 'Pears to me poor Tom Davey would 'ave been h'able to satisfy 'is curiosity 'ad 'e h'only lived a few years longer. Tom did dearly love 'is beer—fac' is, 'e 'ad tha drinkin' 'abit an' 'ad un bad. One evenin' 'e came 'long tha street baout 'alf maudlin' an' staggerin' a bit w'ile Jim Treloar an' me stood talkin' front o' a h'Italian saloon. 'Com'es 'long do, thee chaps, an' 'ave drop o' beer,' sez Tom, startin' for tha door. ''Old fas' a bit, Tommy,' sez Jim, 'This 'ere Dago keeps poor beer. Le's we go foorth to 'Arry James place.' 'Poor beer, is un?' sez Tom. 'Com'es on, then, you, w'ile I try un. I've 'ad gallons 'pon 'ogs'eads o' beer in my time, but never ad no poor beer.' "

New Talc-Grinding Capacity in the United States*

Question Is Raised Whether More Grinding Plants Are Advisable, in View of a Narrow Market For Talc Products—Stimulation of The Industry Suggested

By Raymond B. Ladoo
Mineral Technologist, Bureau of Mines

THE TALC-MILLING CAPACITY in this country is being expanded so rapidly that it becomes important to inquire into the probable effect that the additional production to be expected from this increased capacity may have on the industry. From information now available it appears that at least nine companies have recently built, are now building, or are considering building increased talc-grinding capacity to the extent of about 500 tons per day, or 150,000 tons per year. Of this new capacity, 235 tons per day is already built, though no production resulted from it in 1920; 85 tons is now under construction and nearing completion, and 180 tons is under consideration. In addition to the tonnages definitely accounted for, several other companies are considering expansion and several have recently been incorporated.

The estimated total consumption of our maximum year, 1920, was about 237,000 tons, or 790 tons per day. Of this total, about 24,000 tons was imported, reducing the domestic production to about 213,000 tons, or about 710 tons per day. Unless a high protective tariff on talc is enacted, imports will increase rather than decrease. Thus, the maximum consuming capacity for domestic talc to date may be taken at about 700 tons per day. However, it cannot be assumed that 1920 conditions will be repeated in the immediate future. The new capacity of 320 tons per day which may be expected to be in operation this year would add to our peak production more than 45 per cent, and, with the prospective 180 tons, more than 70 per cent. The increases over the previous maximum production of about 198,600 tons in 1917 would be respectively 55.5 per cent and 83 per cent.

The erection of some of the new mills may be justified by the fact that through improved milling methods their product will not be forced to find new markets, but will merely replace that from older but less efficient mills. Also, some addition to grinding capacity is undoubtedly justified by the normal increase in demand and by the abnormal increase of the last few years. However, after making due allowance for these considerations, it is evident that the great increase cannot be absorbed through our present channels of consumption, and additional construction seems unwise at this time unless definite new markets are first established. Instead of increasing the plant capacity, a better policy would be to spend available capital in improving mines and mills to produce a better product at a lower cost, to consolidate small inefficient companies into larger and more efficient units, and to pay for research, investigation, and publicity which would develop new markets and uses and expand older ones. Regardless of further additions to capacity, it is not probable that present plants can run to capacity unless new uses and markets are developed. Despite the record demand for 1920, several long-established mills were unable to run at anywhere near their capacity, on account of power shortage and ore shortage. Although it is impossible to run all mills at their theoretical capacity, it is evident that present mills when run at even average efficiency would produce far more talc than present markets can absorb. Running mills at a small fraction of capacity is wasteful and expensive.

The difficulty noted is not found in the talc industry alone, as is evidenced by the condition of the zinc, asbestos, and other industries. The zinc producers, through the American Zinc Institute, have adopted an aggressive campaign of research and publicity to expand their market. The asbestos interests have recently formed an association of companies engaged in the mining, jobbing, manufacturing, and finishing of asbestos and asbestos goods, known as the Asbestos Industries. The purpose of this organization is to expand the markets and uses of asbestos through investigation, research and large-scale educational publicity. The Talc and Soapstone Producers' Association can do much to remedy the condition of the industry if it has the proper backing and support, but so far this support seems to have been lacking.

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*Reports of Investigations, Bureau of Mines.

Graphite Production Increased in 1920

The quantity of domestic flake and amorphous graphite sold by producers in the United States in 1920 amounted to 9,510 short tons, an increase of 28 per cent over the quantity sold in 1919, and with a value of about $626,201, as compared with $778,857 in 1919, according to the U. S. Geological Survey. Operators in Colorado, Nevada, and Rhode Island reported sales of 4,694 short tons of amorphous graphite in 1920, at an average price of $10.60 a ton. This was $3.52 per ton less than the average price in 1919. The sales of crystalline graphite in 1920 amounted to 9,632,360 lb., valued at $576,443, as compared with 8,086,191 lb., valued at $731,141, in 1919. The average price per pound in 1920 was 5.9c.; in 1919 it was 9c. Alabama led in the production of crystalline graphite, the sales in 1920 amounting to 4,894,648 lb., or 51 per cent of the total quantity sold in the United States. The sales reported from New York and Pennsylvania amounted to 3,552,687 lb., or 37 per cent of the total in the United States, and the remaining 13 per cent was reported from California, Montana, and Texas.

The Acheson Graphite Co. reported the sales of 7,399,749 lb. of artificial graphite, which it manufactured at its plant at Niagara Falls, N. Y., compared with 8,163,177 lb. in 1919, 9,182,272 lb. in 1918, and 10,474,649 lb. in 1917.

DOMESTIC GRAPHITE SOLD IN 1915-1920
(Short Tons)

	Amorphous		Crystalline		Total	
Year	Quantity	Value	Quantity	Value	Quantity	Value
1915	1,181	$12,358	3,537	$417,273	4,718	$429,631
1916	2,622	20,723	5,466	914,748	8,088	935,471
1917	8,301	73,481	5,292	1,094,398	13,593	1,167,879
1918	6,560	69,455	6,431	1,454,799	12,991	1,524,254
1919	3,379	47,716	4,043	731,141	7,422	778,857
1920	4,694	49,758	4,816	576,443	9,510	626,201

GRAPHITE IMPORTED INTO THE UNITED STATES IN 1920(a)

Country of Origin	Quantity (Short Tons)	Value
Ceylon	9,204	$1,077,290
Madagascar	4,710	286,383
Canada	2,170	157,015
Mexico	3,659	131,832
[illegible]	810	29,936
[illegible]	137	5,072
[illegible]	58	1,195
[illegible]	30	2,502
Other countries	317	20,087
Totals	21,095	$1,711,312

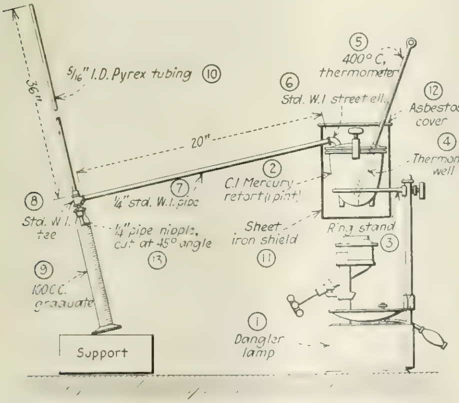
(a) [illegible]

HANDY KNOWLEDGE

Retort for Assaying Oil Shales

A retort for assaying oil shales for oil yield has been devised by the U. S. Bureau of Mines and is described by L. C. Karrick in one of the Bureau's *Reports of Investigations* for March. It is recommended for field and labaratory use where rapid assays are desired with duplicates agreeing within 1 per cent. The retort comprises the following essential parts.

1. Dangler lamp, one-gallon capacity, or a Fisher or Meker gas burner.
2. One-pint capacity cast-iron retort (commonly known as an amalgam retort).
3. 3-in. ring support.
4. ¼ x 3½-in. pipe, sealed by welding at one end (to be screwed into lid for thermometer well; is convenient but not necessary).
5. Mercury thermometer; range 0 to 400 deg. C.
6. ¼-in. street ell; screwed into lid.
7. 20-in. length of ¼-in. galvanized pipe.
8. Tee, ⅜ x ¼ x ¼ in. galvanized; the ⅜-in. opening up.
9. Graduated glass cylinder of 100 cc. capacity, with glass stopper.
10. 36-in. length of ⅜ to 5/16 in. glass tubing, with a one-hole cork to fit ⅜-in. opening of tee (8).



RETORT FOR ASSAYING OIL SHALES

11. Sheet-iron jacket.
12. Asbestos jacket covered with 1-in. hole at center.
13. ¼ x 3-in. galvanized pipe nipple, cut at 45 deg. angle on plain end, and provided with a one-hole cork, to fit on nipple and into graduate.

All pipe threads should be turned up tightly with a mixture of pulverized litharge and glycerin. The top and bottom connections of the tee (8) with the reflux condenser (10) and with the graduate (9) should also be well sealed with the same cement.

The preparation of the retort, its operation and the measurement of the oil accumulated are described in the report in part as follows:

Extreme care should be exercised in the preparation and maintenance of the contact surfaces of the lid and base of the retort. The surfaces will not form a gas-tight fit when new, and this defect must be remedied by grinding the two parts together by hand, using emery dust, as in grinding cylinder valves. The grinding is facilitated by clamping the lid in inverted position on a table and pressing down forcibly on the base while rotating it. After grinding, clean the parts thoroughly with gasoline or other light solvent, clamp the lid in place, then test the improved contact by immersing the retort in water and forcing air into the delivery tube with the lungs. If small air bubbles appear, the leakage must be repaired. Try readjusting the lid, and if this does not stop the leakage, repeat the grinding. The first preparation of the contact surfaces may require one-half hour to an hour's time, but once an air-tight contact is produced, a slight grinding before each run will keep the surfaces in perfect condition. The improved surfaces will form a gas-tight contact if kept perfectly clean and aligned while tightening down the clamp.

It is important to use a sheet-metal jacket around the retort while heating, leaving about ¼-in. clearance at the sides and enough to clear the clamp screw on top. Notches are cut in the jacket for ring support and delivery tube. A cover of asbestos board is necessary to reflect heat down against the retort lid; otherwise oil will condense on the inner side of the lid, and drip down onto the shale in the retort, thus causing losses by secondary distillation.

OPERATION OF THE RETORT

Crush the shale to pass a ¼-in. screen, and weigh out just enough to fill the retort (2) level full. Tamping the charge into the retort is permissible, and will not affect the results; this, however, is seldom necessary, and experience has demonstrated that it is better to permit the charge to rest loosely in the retort, as some rich shales intumesce or coke together, and removal of the residue in such cases is extremely difficult. After the lid is fastened carefully in place and tested for leakage as directed above, place the retort in ring support (3), adjust jacket (11) and cover (12), start the burner (1), then fasten the graduated cylinder (9) and reflux condenser (10) tightly in place. Use a small flame at first, so that no oil will appear within forty-five minutes after starting. Forty-five minutes is about the minimum time in which the shale charge can be brought up to the initial distillation temperature and yet possess a fairly even temperature throughout. Some shales begin to yield vapors at approximately 250 deg. C., whereas others show no signs of oil vapors until 375 deg. C. is reached. Before distillation makes any considerable progress, the interior or coolest shale should be at least as hot as the vaporizing temperature of the oil evolved; otherwise, vapors will migrate to the central or coolest part and condense there, causing losses of oil by cracking on redistillation of the condensed oil.

When two or three cubic centimeters of oil have accumulated, the flame should be increased, as it is imperative to distill rapidly, once oil vapors start to evolve. If the flame has been of such size that oil first appears in about forty-five minutes, it will then be safe to double the size of the flame and thereafter every twenty to forty minutes increase the heat by an equal amount. The oil should accumulate in the graduate at a uniform rate.

It should be remembered that the quantity of oil recovered will vary for the same shale sample if the rate of retorting varies, the greater quantity being obtained with rapid retorting, and, conversely, a much less amount with a long distillation period. With the average oil shale, the recovery, when the actual oil-producing period is approximately two hours, will be 5 per cent greater than when distillation lasts for six hours. When distillation is completed in less than two hours, there is danger of inaccuracy from exceeding the condenser capacity, and, undoubtedly, from decomposition of oil vapors by excessive temperatures. . . . If oil droplets appear dangerously near the top of the reflux condenser (10), the rate of heating must be retarded slightly.

THE PETROLEUM INDUSTRY

Oil Possibilities in Montana

By L. S. Ropes

Written for *Engineering and Mining Journal*

DEVELOPMENT of natural resources, in any locality, depends upon a number of factors. Until an emergency arises, or until a sufficient number of these factors have attained a value which makes for economic importance, the resources lie unrecognized, or at least unconsidered from a commercial point of view. Market, transportation, and environment, which affect labor and living conditions; fuel and power—each has its weight in the final analysis. Thus it has been with prospecting for oil in the northwest.

Sporadic efforts at prospecting for oil at widely separated points have been made in Montana over a period of several years. Oil seeps and gas domes, here and there, have been known, gas wells have been brought in, but conditions were not ripe. Oil was at a low price in the markets of the country; and locally the demand was too limited for extensive production and refining. Transportation facilities were lacking, and there was an ample supply from the mid-west oil fields.

Prior to the war, an era of railroad building made large sections of the state accessible. The war and the extended use of crude-oil products in traction and transportation have increased the demand, the price has risen, and alarmists point to the "early" exhaustion of producing sections. Also, the state has been more generally settled, affording labor and transportation facilities.

FAVORABLE OIL FORMATIONS NOTED IN SEARCHING FOR COAL FIELDS

During the period from 1908 to 1910 I was engaged in making examinations for the General Land Office, with particular reference to occurrences of coal. At the time the work of the U. S. Geological Survey had not been extended over the state, and it was necessary to correlate formations and trace out some of the coal fields so as to be able to make intelligent recommendations. In the course of examinations along the north border of the Bull Mountain coal field, and during the construction of the Chicago, Milwaukee & St. Paul Ry., I noted the structural conditions and pointed out the possibilities for oil in the country to the north of the Musselshell River from west of Roundup to east of Melstone. This is the area of the Cat Creek, Flat Willow, Devil's Basin, and other anticlines and of the first and most actively producing and exploited oil field of the state. In 1911 the geology of this area was reported in Bulletin 541-H, Bowen, U. S. Geological Survey, and the anticlines were noted, with maps. The report, though referring to coal resources, will be found interesting to investigators of oil geology.

Broadly, the geology of the plains region of Montana is that of the Gulf States and the Mississippi Valley. The same oil formations extend to the Continental Divide and, along this, northwesterly into Canada. Before the mountain uplifts the Carboniferous and Cretaceous formations extended farther west. Isolated areas of these formations are found beyond the mountains and in areas between ranges.

AREA OF THE FIELD

Present rough limitations of the formations mentioned follow a line from the Wyoming oil fields along the northeast slopes of the Bear Tooth Mountains, south of the Yellowstone River, along the East Gallatin on the headwaters of the Missouri and with its waters to the foot slopes of the Rocky Mountains, west of Great Falls, and thence along this range into Canada.

The continuity of this boundary is broken by the Bridger Mountains, north from Livingston, from the bend of the Yellowstone, and beyond by the Big Belt and Little Belt Mountains extending along east of the Missouri River to forty miles south of Great Falls. There are some favorable areas of Cretaceous between these mountains and the main range. The western shore of the post-Cretaceous sea followed the above lines.

Off shore, and of post-Cretaceous development, are a number of uplifts throughout the Great Plains region, most of them of volcanic origin. Erosion has exposed igneous rocks, and these have been notable as centers of metal mining. North of Lewistown, in the center of the state, are the Judith Mountains, with a number of important gold and silver-lead producers. To the west are the Moccasin and South Moccasin Mountains, both of volcanic origin and prominent because of the Kendal gold deposits. The Little Rockies lie to the north of these and of the Missouri River.

GOLD MINING FORMERLY PRINCIPAL INDUSTRY OF REGION

Interest in the region has centered in the large deposits of low-grade gold ores, open quarry mining, and leaching after coarse crushing, as well as in narrow, high-grade gold veins. Northwest of the Little Rockies the Bearpaws rise above the plains, also of eruptive origin and containing metalliferous deposits. Beyond the Bearpaws and close to the international border are the Sweet Grass Hills. Returning to Lewistown, the Big Snowy Mountains are observed just to the south, an uplift without apparent volcanic associations, but, rather, related to the uplift of the Little Belts on the west. Between these and the Yellowstone River, comprising some of the highest peaks in the state, the Crazy Mountains stand out by themselves, masses of igneous rocks and uplifted sediments, the latter intersected by numerous dikes. The Bull Mountains, south of the Musselshell River, with other similar eminences, are the result of broad folding and erosion. The Big Horn Mountains complete the border line in the southeastern part of the state, extending into

Wyoming and Dakota and leaving a broad area of Cretaceous to the west.

The significance of these island-mountain features is noted in the folding and faulting of the sediments in their neighborhood. The Bull Mountain syncline and its converse on the north of the Musselshell, within which are included the Cat Creek, Flat Willow, and other superimposed anticlines, are attributable to the mountain-forming agencies responsible for the Judith and Big Snowy Mountains; the Havre oil and gas field anticlines to the Bearpaws; Chouteau, Stillwater, and others to folding and faulting, with the upheaval of the main mountain ranges mentioned. Aside from these, broad anticlines have been noted and traced far afield from immediate mountain-building influences, though they may be attributed to the same general disturbances, the effects of which must have been extensive. These structural features have produced ideal conditions for the accumulation and confinement of oil and gas.

CRETACEOUS FAVORABLE TO OIL RETENTION

The mountain ranges mentioned, the isolated volcanic uplifts and erosion, have afforded exceptional opportunity, over a vast expanse of country, for the study of the extent and continuity of the Carboniferous and Cretaceous formations. The Carboniferous is generally found to be prolific in fossils; the Cretaceous, the oil-bearing formation, with its sands and shales, especially favorable to the storage of oil and gas.

From the Musselshell at Melstone, westerly the Kootenai sands lie at from a few hundred feet to 3,000 ft. below the surface, the surface varying from an elevation of 3,000 ft. above sea level to 5,000 ft. In the eastern and southern sections, except bordering the mountains and isolated uplifts, there is a heavy overburden of younger formations, but a general lowering of surface elevations, with the drainage in an easterly direction, elevations ranging from 2,000 to 3,000 ft. above sea level. Under the more favorably situated anticlines in this part of the state, the sands probably lie at depths of from 2,000 to 3,500 ft.

It is but natural that attention should first be attracted to the shallower occurrences, because of oil seeps and gas domes, surface indications of the presence of oil formations. That deep-seated formations have been generating oil and gas through the ages, and throughout the extent of these formations, has been demonstrated at widely separated "structures" from the extreme southeast to and beyond the Canadian border.

Three essential factors in relation to petroliferous deposits have been established: the presence of formations favorable to the derivation of oil and gas has been confirmed throughout the Great Plains region; mechanical conditions essential to the formation of favorable structures were extensive, and evidence of the structures is found in the superimposed strata; and oil and gas have been found at widely separated points. The next stage is in its infancy. One field has come into production of oil, another of gas, and a veritable army of derricks is being delivered or erected throughout the entire area discussed.

A feeling of confidence has been established in the shallower fields, and deeper drilling is being undertaken in other districts. It is in the deeper-lying sands, under broadly sloping anticlines, that search will be made for the larger, more productive and longer-lived oil and gas fields of the state. In some of these the oil will be confined below sea level, and, backed by the long, gentle slopes of the formations, the water pressure should insure a natural flow of oil over a long period of productivity.

The epidemic of irresponsible wildcatting is passing, and legitimate undertakings, amply financed, as well as large operators from eastern and mid-west fields, are undertaking serious prospecting. The coming season promises to be one of exceptional activity in these fields, and another natural resource has attained its opportunity.

Recent Oil Litigations

SPECIAL CORRESPONDENCE

Two suits over oil lands, in which damages claimed amount to millions of dollars, have been filed recently. The Texas Exploration Co., of Houston, Tex., has filed suit in the Federal Court to recover $1,000,000 damages. The defendants named are the Sinclair Consolidated Oil Corporation, the Sinclair Consolidated Oil & Gas Co., the Sinclair Oil & Gas Co., the Sinclair Gulf Oil Co., and the Sinclair Refining Co. It is alleged by the plaintiff that it entered into a contract with the defendants in 1918 by the terms of which it was to receive one-sixth the value of all oil produced from certain land in the Damon Mound oil field of Brazoria County, Tex., after a certain debt had been paid.

At Homer, La., suit was filed on April 15 in the State Judicial Court by Frank M. Walker, of Tarrant County, Tex., against the Standard Oil Co. of Louisiana, and the Gilliland Oil Co. of Oklahoma for the possession of certain lands in the Homer oil field estimated to be worth $4,000,000. The land at present is in the possession of the two oil companies named.

Oil Development in Arkansas

SPECIAL CORRESPONDENCE

The Cave City Leasing Co., which has been holding a block of 35,000 acres in the vicinity of Cave City, Ark., has negotiated a drilling contract with the Big Six Drilling Co., of Little Rock. The consideration was acreage, the leasing company turning over all but 5,000 acres. The latter company will also retain a one-half interest in the well. Drilling will start as soon as a rig can be built and the tools shipped in. The contract calls for a test hole 2,000 ft. deep.

Work is progressing on Adams No. 1, which is being drilled three miles east of Bateville by Fulk and Riffle, of Little Rock. Another outfit has been shipped to sink another hole on this company's acreage.

There is keen interest in oil development all over the state. About fifty counties have operations under way or in immediate prospect. It is estimated that a total of 175 rigs are in operation in Arkansas at this time. The Eldorado field, in Union County, now has thirty-three producing wells.

Oil Drilling in Washington

SPECIAL CORRESPONDENCE

Interest is being taken in local oil possibilities to the extent of active drilling operations at Clayton and Wild Rose Prairie, a few miles distant from Spokane, Wash. Drilling for oil is still being continued by the Colville Valley Oil Co. at Chewelah, sixty miles north of Spokane.

Book Reviews

World Atlas of Commercial Geology. Part I: Distribution of Mineral Production. Paper; 13½ x 10½; pp. 72; maps, 72. U. S. Geological Survey, Washington, 1921. Price of Part I, $2.

This atlas, of which Part I has just been issued, is the latest published expression of the work begun in December, 1917, by the U. S. Geological Survey, as part of the task of keeping American industries supplied with raw materials. The base maps of the present publication show the pre-war boundaries; but three special outline maps indicate by red over-print the erased and the new boundaries in Europe, Asia, and Africa. A fourth map shows world ocean trade routes and the fuel-oil stations established by the U. S. Shipping Board.

The seventy-two pages of text discuss the production, consumption, distribution, and statistics, for the world, of coal, petroleum, oil shale, natural gas, iron, manganese, chromium, nickel, tungsten, vanadium, molybdenum, copper, lead, zinc, platinum, gold, silver, phosphate, potash, nitrates, sulphur and pyrites, mercury, tin, antimony, arsenic, aluminum, graphite, magnesite, and mica, in the order given. The statistics tabulated and discussed in the text are translated into more impressive charts of the world, of each continent, and of the United States. On these charts each country's production of each mineral is shown by colored symbols placed over the respective countries. The production figures all relate to 1913, and express the percentage contribution by countries, to the world's mineral production. Special charts, however, give the results for 1918 in the United States, expressed as proportions of the total production of the United States. By comparing the North American chart for any mineral with the corresponding United States chart, one may get some idea of the change that took place during the intervening five years.

One of the distinctive features of the world maps is the parallel presentation of each country's consumption and production of minerals. This makes such charts striking summaries of each country's needs, and an index of the relative demands on each by the world. This atlas is an important aid in following and understanding the shifting [illegible] in the world and indispensable to the [illegible] of [illegible] and international [illegible]. For, in the last analysis, a nation's foreign policy is determined by its basic needs, and these are controlled in very large part by the resources of minerals, fuels, and power. When the economic geology parts of this atlas are [illegible], the whole will form an excellent graphic supplement to "Political and Commercial Geology," published in this country last year. C. A.

Mineral Resources of the United States, 1917. Part I—Metals. H. D. McCaskey. Cloth; 6 x 9; pp. 980. Published by the U. S. Geological Survey, Washington, D. C., and obtainable upon request.

All of the material in this book has previously been issued in separate form under the names of the various metals discussed, and most of these pamphlets have been noted on this page as they have appeared. These annual volumes are valuable only for reference, as they are too long delayed in publication to have any news interest; the information contained in this book, for example, is three or four years old. Even the separate papers were generally delayed two or three years.

Petroleum Annual, 1921. Handbook of the Petroleum Industry. Cloth; pp. 430; 9½ x 11¾. Published by the Independent Oil Men's Association, Chicago, Ill.

The issue contains lists of active and associate members of the organization, jobbers, refineries, and foreign dealers; traffic and transportation information; temperature, specific gravity, and tank capacity tables, and general information in the petroleum field. In addition, several papers read at the twelfth national convention of the Independent Oil Men's Association at Denver are presented. The book serves as a valuable guide to those interested in the commercial aspect of the petroleum industry, and is doubtless in big demand.

Technical Papers

Antimonial Gold Ore—Details of the treatment of antimonial gold ore at the Globe & Phoenix Gold Mine, in southern Rhodesia, are given in a three-page article in the *Journal* of the Chemical, Metallurgical and Mining Society of South Africa for January, 1921 (price 3s. 6d. from the Society at Johannesburg, South Africa). The ore contains about 76 per cent of silica and 0.73 per cent of antimony. After breaking and sorting, the ore is wet-crushed by stamps and passes over amalgamating plates to grinding pans. It then flows over canvas strakes to a classifier, which separates sand from slime. The sand is discharged to a dump; the slime to dams. Both products are allowed to oxidize by weathering, after which the sand is ground in tube mills in cyanide solution and treated by counter-current continuous decantation, while the slime is treated by the ordinary decantation method.

Explosives—Bulletin 198, forty-five pages, of the U. S. Bureau of Mines, is entitled "Regulation of Explosives in the United States," and deals especially with the administration of the explosives act of Oct. 6, 1917. It may be obtained free from the Bureau for a time, or for 10c. from the Superintendent of Documents, Washington, D. C.

Deep Mining—The *Bulletin* of the Institution of Mining and Metallurgy for February (No. 1 Finsbury Circus, London, E.C. 2, England) contains an article of nineteen pages outlining the scheme for working the City Deep Mine, in South Africa, at a depth of 7,000 ft. (Price of the paper, 1s. 6d.) The difficulties of mining at great depths are mentioned; particulars of shaft sinking at the City Deep are described, and the theory of ventilating deep and hot mines is discussed. Thirty-two pages of discussion of the paper are printed in the March issue of the *Bulletin*, which presumably may be obtained at the same price.

Assaying—U. S. Bureau of Mines *Reports of Investigations* No. 2,228, (obtainable upon request to the Bureau at Washington, D. C.), discusses the estimation of small quantities of gold, silver, and the platinum metals in ores and other material comparatively high in copper. The paper is supplementary to Technical Paper 270, issued by the Bureau, and deals with the application of the combination, or wet-and-dry, method.

War Industries—The War Industries Board, Bernard M. Baruch, chairman, has issued a report of 421 pages entitled "American Industry in the War," wherein are briefly described the industries over which the Government exercised control and the steps that were taken to regulate production and prices. Our readers will be particularly interested in pages 130 to 204, which are devoted to minerals, metals and chemical products, although much of general interest to the technical man is found throughout the book. The publication is obtainable on request to the War Industries Board, Washington, D. C.

Platinum—"The Detection and Estimation of Platinum in Ores" has just been issued as Technical Paper No. 270 by the U. S. Bureau of Mines, Washington, D. C., twenty-seven pages. It may be obtained on request to the Bureau for a limited time, or from the Superintendent of Documents, Washington, D. C., for 5c. The information given will be of value to all those who have occasion to assay for platinum. A bibliography of selected references on the subject is included.

Electrical Safety Code—The U. S. Bureau of Standards, Washington, D. C., has published a third edition of the "National Electrical Safety Code," 366 pages, obtainable on request. This booklet should be in the hands of all those interested in the design, erection, and operation of electrical machinery or wiring. Cloth bound copies may be obtained from the Superintendent of Documents, Washington, D. C., for 40c.

Mineralogy—"The Future of Mineralogy in America" is the topic of a paper by E. H. Kraus, published in *Science*, March 11, 1921. (Garrison-on-Hudson, New York; price, 15c.) The development of the science is carefully traced.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

American Engineering Standards Committee Report

At the last meeting of the American Mining Congress, P. G. Agnew, Secretary of the American Engineering Standards Committee, said:

During or since the war, national engineering standardizing bodies have been formed in Austria, Belgium, Canada, France, Germany, Holland, Italy, Sweden, Switzerland, and the United States, and one is in process of formation in Japan. All of these are similar in form of organization and method of operation to the British Engineering Standards Association, which, organized in 1901, has been a most significant factor in the development of British industry.

Our own organization—the American Engineering Standards Committee—was organized in October, 1918, and has been actively at work for about 12 months. At the time the committee was organized there were more than a hundred American organizations actively engaged in standardization work, but there were no systematic, unified methods of co-operation.

Prior to Dec. 31, 1920, there had been approved by the committee "Tentative American Standard Specifications and Tests for Portland Cement," "Tentative American Standard Specifications for Fire Tests of Materials and Construction," and "American Standard Pipe Threads." Moreover, there had been submitted for approval by the committee the "National Electrical Code" as an "American Standard," and "Standard Test for Toughness of Rock," "Standard Method of Distillation of Bituminous Materials for Road Treatment," and "Standard Method of Sampling Coal," as "Tentative American Standards," with the "Safety Code for Head and Eye Protection" submitted for approval as "Recommended American Practice."

The committee itself is composed of forty-seven members representing seventeen bodies or groups of bodies, including six national engineering societies, five Government departments and thirteen national industrial associations. Its function is merely to see that each body or group concerned in a standard shall have opportunity to participate in its formulation, which is in the hands of a working committee, technically called a "sectional committee." Each sectional committee is organized by, and under the leadership of, one or more of the principal bodies interested, such bodies being known as "sponsors."

At a conference on Dec. 8, 1920, it was unanimously voted that a comprehensive program of safety codes should be undertaken, to be carried out under the auspices of the American Engineering Standards Committee. Active work is now in progress on twenty-four such codes. As is true of all work under the auspices of the American Engineering Standards Committee, such of the bodies as are interested in the particular code in question are represented.

Concerning standardization in the mining industry the report says:

At an informal conference held in Chicago on Aug. 30, 1920, of representatives of leading organizations interested in the standardization of mining equipment and practice, it was unanimously voted to recommend to the American Engineering Standards Committee that there should be organized a General Correlating Committee for Mining Standardization; that this committee should be made up of representatives of organizations which are now engaged in standardization work, or which might be expected to engage in it. In accordance with this recommendation such a committee has been formed with a nucleus of two representatives each from the American Mining Congress, the American Institute of Mining and Metallurgical Engineers, the U. S. Bureau of Mines, the Mining and Metallurgical Society of America, and the National Safety Council. It has held one meeting. Included in the work of the committee will be such matters as delimiting specific projects which might be most advantageously handled as units, and deciding the order in which the various projects should be taken up.

International standardization of zinc and zinc ores, including methods of sampling and analysis, had been proposed to the American Engineering Standards Committee by the Belgian Standardization Association. It was decided to co-operate with the Belgians in this work, and as the first step the Standards Committee invited the American Society for Testing Materials and the American Zinc Institute to be joint sponsors for American standardization. The American Society for Testing Materials specifications and methods of analysis for zinc, which are generally accepted throughout the industry, will form the starting point of further standardization, which will include standards for sheet zinc, etc. A "sectional committee" of fifteen members, five each representing producers, consumers and general interests (the latter including three Government representatives), will be organized in April.

Foreign Mining Committee Named

A committee on foreign mining has been formed by the Mining and Metallurgical Society of America as follows: C. K. Leith, chairman; Van. H. Manning, George Otis Smith, H. Foster Bain, Pope Yeatman, Sydney H. Ball, and A. C. Veatch.

Great Living American Engineers Picked by American Schools

The American Association of Engineers has been conducting an investigation to ascertain just who are the most highly esteemed engineers in the various branches of the profession. From questionnaires submitted to the deans of various engineering and scientific schools, the association's *Engineering News* leaflet No. 87, published at Chicago, Ill., on April 4, 1921, presents the following results. Only the names of those men receiving more than one vote are listed:

Civil Engineers	Votes	Mechanical Engineers	Votes	Electrical Engineers	Votes	Mining Engineers	Votes	Chemical Engineers	Votes
George W. Goethals	27	John A. Brashear	24	Charles P. Steinmetz	39	Herbert C. Hoover	32	Leo H. Baekeland	22
George P. Swain	23	Orville Wright	18	Elihu Thomson	29	John H. Hammond	29	W. R. Whitney	22
John R. Freeman	21	Ambrose Swazey	18	Thomas A. Edison	28	J. E. Spurr	24	F. G. Cottrell	19
J. A. L. Waddell	19	W. F. Goss	17	Alexander Graham Bell	24	J. Parke Channing	18	E. G. Acheson	15
Daniel W. Mead	15	Ira N. Hollis	15	B. G. Lemme	15	Daniel C. Jackling	9	William H. Nichols	14
John F. Stevens	15	M. E. Cooley	15	Frank J. Sprague	13	Pope Yeatman	6	A. D. Little	8
Allen Hazen	10	William F. Durand	13	Bion J. Arnold	11	L. D. Ricketts	5	William H. Walker	6
Rudolph Herring	10	D. S. Jacobus	12	John J. Carty	9	Robert Peele	5	M. C. Whitaker	4
Gen. W. M. Black	9	R. W. Hunt	11	A. E. Kennelly	6	Horace V. Winchell	3	C. F. Chandler	4
W. B. Parsons	9	Julian Kennedy	10	Charles F. Scott	4	S. J. Jennings	2	G. A. Burrell	3
F. V. Turneaure	9	James Hartness	7						
Clemens Herschel	8	Charles T. Main	6						
Gustav Lindenthal	8	G. Russ Richards	3						
John F. Wallace	8	George A. Orrok	3						
Ralph Modjeski	7								
Frederick H. Newell	6								
J. Waldo Smith	6								
W. H. Mulholland	5								
A. P. Davis	2								
	217		169		178		133		117

America's Greatest Engineers

MEN YOU SHOULD KNOW ABOUT

James McEvoy, mining engineer of Toronto, is examining mineral properties in Mexico.

Kirby Thomas was examining gold properties in the Kirkland Lake district of Ontario last week.

Herbert H. Hodgson, of Morenci, Ariz., has been appointed a member of the Arizona State Industrial Commission.

Horace V. Winchell was in San Francisco, Cal., recently, when he spoke informally at a weekly lunch of the resident A. I. M. E. members.

Edwin James Collins, consulting mining engineer, of Duluth, Minn., has gone to Colorado and Wyoming on professional business.

Charles F. Sturtevant, mining engineer, of Salt Lake City, Utah, is examining mining property in Arizona on behalf of eastern interests.

H. O. Davidson, efficiency engineer for the Oliver Iron Mining Co., Gogebic district of Michigan, is visiting Pittsburgh, Pa., and other Eastern points.

A. W. Newberry, of 2 Rector St., New York City, is in Cleveland, Ohio, on professional business. He will return to New York about May 9.

James Hopkins, mining engineer, who has been working in the diamond fields of the Belgian Congo, was in New York City this week. His address is Ramey, Pa.

R. S. Archibald, engineer and geologist, of Negaunee, Mich., is in charge of explorations for the Palms-Book Land Co., in the Crystal Falls, Mich., district.

Charles N. Bell, **Walter L. Reid**, **Robert McF. Doble**, and **Frederick H. Dakin** have been appointed on the engineering staff of the Metals Exploration Co.

C. Herbert Poirier, mining engineer, of 63 Broadway, New York City, is at Porcupine, Ont., in connection with the transfer of the Bewick Moreing holdings to the Goldale Mining Co.

Edmund A. Guggenheim, of Guggenheim Bros., New York City, has returned from a three-months' trip through Peru, Bolivia, and Chile, in the interest of the American Smelting & Refining Co.

S. H. Dolbear, who returned to San Francisco, Cal., recently, has gone to Ontario on professional business which will occupy several months. Mr. Dolbear also is establishing an office in New York City.

Hon. **Key Pittman**, U. S. Senator from Nevada, spoke before the New York Section of Mining and Metallurgical Society of America on April [illegible]. He discussed the general silver situation, referring specially to conditions in the United States.

H. Foster Bain, acting director of U. S. Bureau of Mines, addressed the graduating class of the Michigan College of Mines, Houghton, Mich., at the class day exercises in the college gymnasium on April 14. He spoke on "Mining as a Business."

E. P. Mathewson, consulting metallurgist, of New York City, who has been in England on professional business for some weeks, went to Paris and Brussels on April 16. He returned to London on the 23d and will spend a few weeks there.

Frank Billings, of Cleveland, Ohio, president of the Tod-Stambaugh Co., has returned from his winter sojourn in the Bermudas. He visited some of the company's Lake Superior mines recently in the company of **J. S. Lutes**, manager of the mining department.

H. C. Cooke, of the Geological Survey of Canada, will act for **Dr. J. Austin Bancroft** at McGill University, Montreal, Que., next year. Prof. Bancroft has been granted a year's leave to serve as assistant general manager of the Granby Consolidated company's mines, Anyox, B. C.

George C. Martin, geologist with the division of Alaskan Mineral Resources, writes that he is still with the U. S. Geological Survey. The report that he had resigned is incorrect. **J. C. Martin**, of the section of foreign mineral resources, of the Survey, resigned on Jan. 31, last, to accept a position with the Standard Oil Co. of New Jersey.

Karl Baumgarten, mining engineer, of San Diego, Cal., who has served as examiner on the staff of the War Minerals Relief Commission at Washington, D. C., during the last year and a half, has been appointed a mining engineer on the staff of the U. S. Bureau of Mines. Mr. Baumgarten will be attached to the Mississippi Valley station of the bureau at St. Louis, Mo. He has fourteen years' experience in mining operations and examinations in the United States and in Mexico.

Mining and metallurgical engineers visiting New York City during the last two weeks also included: **L. D. Cooper**, Minneapolis, Minn.; **Juan Felix Brandes**, Boston, Mass.; **Roy H. Allen**, Parral, Mexico, and Cambridge, N. Y.; **Edwin Shapley**, San Francisco, Cal.; **F. J. Stannard**, M. I. M. M., 65 London Wall, London, England; **G. C. Burnham**, Boulder, Col.; **T. C. Merriman**, Hamden, Conn.; **W. Bjorkstedt**, Bayonne, N. J.; **Glenn V. B. Levings**, American Tripoli Co., Seneca, Mo.; **A. H. Wethy**, Paris, France; **Solomon Le Fevre**, Forest Glen, N. Y.; **Thomas F. Donnelly**, the Suffern Co., Valparaiso, Chile; **C. Leonard Ball**, Pulucayo, Bolivia; **Prof. Heinrich Ries**, Ithaca, N. Y.; **S. A. Taylor**, Pittsburgh, Pa.; **Guy R. Johnson**, Tamaqua, Pa.; **S. J. Gormly**, La Fundicion de Guayacan, Coquimbo, Chile; **Henry C. Carlisle**, Tonopah, Nev.; **J. Ward Williams**, formerly of Ojuela, Durango, Mexico; **Walter Hovey Hill**, Boise, Idaho.

OBITUARY

William Huggard, mining engineer, recently employed in mining operations in Montana, is reported to have committed suicide in a hotel at Tacoma, Wash., last week. He is survived by two brothers, A. M. Huggard, of Goldfield, Nev., and Edward Huggard, of Wexford, Ireland.

Lester Gray French, of White Plains, N. Y., assistant secretary of the American Society of Mechanical Engineers and the editor and manager of *Mechanical Engineering*, died at the French Hospital, New York City, on April 19, after an operation. Mr. French was a native of Keene, N. H., and was graduated in 1891 by the Massachusetts Institute of Technology. Six year later he became editor-in-chief of *Machinery*, and in 1908 assumed his last editorial position. He was among the earliest American writers on the steam turbine.

Edwin Jacobs died at Morenci, Ariz., on April 9, 1921, at the age of sixty-eight. He was a native of Australia, but had been in America for many years, and at the time of his death was employed in the stores accounting division at No. 6 concentrator of the Arizona Copper Co., Ltd., at Morenci. Mr. Jacobs was for several years editor of the *British Columbia Mining Record*, and was at one time secretary of the western branch of what was then the Canadian Mining Institute. During the years he lived in Australia he was engaged in the newspaper business, and also in banking and accounting. In British Columbia Mr. Jacobs had held various positions of trust and responsibility, and for a number of years was a correspondent of the *Engineering and Mining Journal* for that province.

George Frederick Wright, geologist, educator, and theist, died at Oberlin, Ohio, on April 20, in his eighty-third year. Professor Wright was born in Whitehall, N. Y., but early moved with his parents and other emigrants to what was then called the Northwestern Reserve, where they settled permanently. He was graduated by Oberlin College in 1859, and by Oberlin Theological Seminary in 1862. As an avocation, Professor Wright studied the geology of the glacial period so well illustrated in Ohio. His writings on this subject, notably "The Ice Age in North America" and "Man and the Glacial Period," were among the authorities of their day. He served as an assistant geologist on the staff of the U. S. Geological Survey under Powell from 1884 to 1892, and on the Pennsylvania State Geological Survey during 1881-82.

THE MINING NEWS

LEADING EVENTS

Tax Levies by Minnesota Cities and Villages Limited

Legislature's Action Follows Recent Defeat of Bill Providing Tax on Iron Ore Royalties

Taxing of iron-ore lands or profits accruing from them in Minnesota has received more than its share of attention at the present session of the State Legislature. As stated in the last issue the Occupational Tax Bill has become a law. On April 18 a bill to place a 5 per cent tax of royalties from iron ore was defeated in the Senate by a vote of 34 to 28. On the same date a bill to put a per-capita limitation on tax levies in Minnesota cities and villages was passed in the House by a vote of 80 to 44. On its introduction in the Senate, several days later, it passed by a vote of 42 to 17, and it is assured that the Governor will sign it.

The per-capita law will have a direct and vital bearing on the iron-ore companies in the state, as it limits the amount of taxation that can be collected by each separate city or village. The bill as finally passed allows $100 per capita for local purposes and $60 per capita for school purposes. These figures are in contrast to average figures from seventy-seven cities and villages, of $19.20 for local purposes and $12.69 for school purposes. As an example of how the limitation will work, the case of a small village might be cited where a sum of $557 per capita was expended last year.

American Dredging Company Gets Mexican Concession

Covers Nineteen-Year Period—Dredges Must Be Installed Within Nine Years

The American Gold Dredging Co. has secured from the Mexican government, through President Obregon, an exploration and exploitation concession giving the right to develop gold-placer deposits on the west coast of Mexico. The concession was secured by Ralph L. van der Naillen, and covers placer ground on the Yaqui, Fuerte, Mayo, and the Sinaloa rivers in the States of Sinaloa and Sonora. The concession is for a period of nineteen years. Three months are allowed for preliminary prospecting, one year is allowed in which to begin drilling, and four years are allowed to complete prospecting by drilling. The concession allows nine years to complete installation of dredges. Two parties for reconnaissance work have been organized and sent to Mexico. Placer operations in the region covered by the concession have been of a primitive nature.

WEEKLY RÉSUMÉ

The strike situation at Tonopah and Divide is unchanged from last week. A discovery of placer gold in the Johnnie district, four miles from the old Johnnie mine, has created much excitement locally. It is reported from San Francisco that the American Gold Dredging Co. has secured a nineteen-year concession from the Mexican government covering gold placer ground in Sinaloa and Sonora. At Salt Lake City it is reported that the Silver King Coalition has let a contract for a new steel mill building to replace the one recently lost by fire. At Denver the Radium Company of America has absorbed the Carnotite Products Co. of Boulder, Bulkeley Wells being president of the new consolidation. At Butte the Butte & Superior has cut copper ore in the 2,050 level of the Black Rock (zinc) mine. In Louisiana the Union Sulphur Co., in compromising its suit, has paid back taxes with interest amounting in all to $787,307 to Calcasieu Parish and the state. In Minnesota a bill providing a 5½ per cent tax on iron ore royalties was defeated on April 18, since when a bill has been passed limiting the per-capita tax that may be levied by cities and villages in the state. In the Birmingham district of Alabama, iron ore production is at the lowest ebb in years. Calumet & Arizona has suspended copper production. New Cornelia has curtailed to 1,200,000 lb. of copper per month.

In Washington bills have been introduced proposing that a Division of Mines and Geology be created and that the annual assessment work on mining claims be suspended for the years 1921 and 1922. The mining committees of both House and Senate are ready. It is urged that the need for aiding development of Alaska is imperative to provide tonnage for the new Government railroad.

To Open Salt Mine in Texas at Raymondville

A salt mine will be opened on the King estate, west of Raymondville, in Cameron County, Texas. The salt deposit here covers many acres and is covered by only a light overburden of sand. The salt has been used locally for cattle for many years, but no attempt has been made before to market it. The salt forms the core of a coastal salt-dome formation.

Copper Companies Move Offices

Offices of the Inspiration Consolidated Copper Co., Greene Cananea Copper Co., Zonia Copper Co. and the Arizona Oil Co. will be situated at 25 Broadway (Cunard Building), New York, on and after May 1, 1921.

Radium Co. of Colorado Absorbs Carnotite Products Co.

Bulkeley Wells Heads Consolidation—Plants at Boulder and Denver Will Both Be Operated

A merger has been effected whereby the Carnotite Products Co., of Boulder, has been consolidated with the Radium Co. of Colorado, Ltd., whose plant and offices are situated at Denver. Operations will be continued under the name of the latter, as it has well-established trade relations with domestic as well as foreign radium markets. The officers of the new company are: Bulkeley Wells, president, and Warren F. Bleeker, vice-president, who, with K. L. Kithil, W. H. Schlesinger, R. W. Thorne, L. C. Schultz, H. C. Morgan, and A. H. Bunker, form the directorate.

By virtue of the consolidation the new company will rank as one of the largest producer of ores and radium products in the world. In addition to the production of radium the new corporation will manufacture ferro-alloys of vanadium, uranium, tungsten, and molybdenum, and its research laboratories will be constantly employed in the development of new rare-metal products. Operations, for a time at least, will be continued at both the Boulder and the Denver plants. The consolidated company is a large holder of vanadium and carnotite properties in western Colorado and eastern Utah.

The main offices of the Colorado Radium Co. are in Denver. The two upper floors of the plant contain completely equipped and modern laboratories for the manufacture of radium salts, and for all manner of research work in connection therewith. A testing laboratory equipped to make complete concentration tests, including fire and wet analysis, on practically any ore has been installed in the basement. The general offices are on the first floor. The main mine office of the company is at Naturita, Col., and sales offices are maintained in Chicago, New York, London, and Paris.

Although the greater part of the radium supply of the world is produced from Colorado ores the demand for radium is not by any means confined to the United States, as shipments of the element are made from Denver to Central America, South America, and all parts of Europe.

The Radium Company of Colorado, Inc., has been operating in Colorado for six years and has enjoyed a continuous and rapid growth. In taking over the Carnotite Products Co. it now becomes the largest manufacturer of radium salts in Colorado, if not in the world. The company employs more than 300 men and has a combined monthly payroll of more than $60,000.

Several other radium companies are operating in the Colorado carnotite fields, and as there is a vast acreage of undeveloped carnotite territory the radium industry promises to hereafter figure largely in the mineral output of the state.

Southwestern Engineers Meet in Phoenix

L. M. Lawson, of El Paso, Elected President of Southwest District of A. A. E.

The second annual convention of the Southwest District of the American Association of Engineers was held in Phoenix, Ariz., April 15 and 16. The program consisted of business meetings, a banquet, and a smoker. The papers presented were: "The Engineer, Past, Present, and Future," by Dean R. W. Goddard, State College of New Mexico; "Some Comments on the Arizona Engineers Registration Bill," by Dean G. M. Butler, president of the Southwest District, A. A. E.; "Initial Wear and Adjustment," by W. O. Witherspoon, of Bisbee; "Accomplishment and Plans of A. A. E.," by C. E. Drayer, National Secretary, A. A. E., Chicago; "Public Service the A. A. E. Can and Should Render," by C. J. Rofelty, Globe, and "Irrigation Development in the Southwest," by L. M. Lawson, El Paso.

The following officers were elected: L. M. Lawson, El Paso, president; Dean R. W. Goddard, A. and M. College, New Mexico, first vice-president; L. B. Hitchcock, city engineer of Phoenix, second vice-president; E. P. Rankin, Jr., El Paso, third vice-president; Dean D. S. Robbins, A. and M. College, New Mexico, treasurer. Other directors elected were: J. C. Gilbert, of Globe; H. F. Robinson, of New Mexico, and C. W. Bagley, of Texas.

Attempt To Secure Control of Hecla Company Fails

Unusual interest attached to the annual meeting of the Hecla mining company, owner of the famous lead-silver mine in the Cœur d'Alene district, which was held in Spokane on April 12, due to the fact that it was known that an attempt would be made to control the meeting in the interest of the Days and elect E. R. Day, manager of the Hercules, president. It appears that Mrs. Sarah E. Smith, of Chicago, widow of the late James R. Smith, who was president of Hecla at the time of his death, joined with Mr. Day in an effort to get control. Although a great effort was made to secure proxies, when the show-down came it was disclosed that the combination controlled only 160,000 votes out of a total of 1,000,000. Of this number Mrs. Smith, who is the largest individual stockholder in the company, owned 93,000 shares and Mr. Day 20,000, leaving only 47,000 votes as the net result of the campaign for proxies. The old board of directors was re-elected.

Tonopah and Divide Strike Situation Unchanged

Many Employees Would Have Accepted 50-Cent Cut, It Is Reported; 75-Cent Reduction Thought Too Much

The strike situation at Tonopah and Divide is unchanged. The only companies operating normally in the Tonopah district are the West End, Halifax, and Cash Boy. In Divide several small companies have resumed operations paying the old wage scale or contracting. Neither side appears to be seeking a settlement.

The sentiment among some of the workmen is that a 50c. reduction would have been acceptable to a majority of the employees, and in fact has been expected since Feb. 8, the date of expiration of the last agreement between operators and employees. The principal objection appears to be over the extra 25c. and over the manner in which the reduction was announced—by simply posting notices only five days in advance, with no opportunity for conference between operators and men. Comparing the wages in this district with those in other districts would lead one to the conclusion that the reduction is likely to be sustained.

Up to April 16 all mines and mills in the districts were operating to capacity, development and production being normal, with no new discoveries of importance reported. West End profits for March are reported as $56,839.67, from 5,824 tons of West End mine ore and 531 tons of Jim Butler lease ore.

The visit of an engineer representing eastern controlling interests in the Buckeye Belmont mine in Tonopah has given rise to rumors that this property is to be reopened in the near future. The property is advantageously situated, adjoining the Belmont, Rescue, and Halifax mines. Development to date consists of a 1,200-ft. vertical shaft, with about 3,000 ft. of laterals on the 900 and 1,200 levels.

Cut Pay of Workers on Ore Docks On Lake Superior

A meeting of representatives of the International Longshoremen's Union and the railroad companies owning ore docks on Lake Superior was held recently at Ashland, Wis., and the wage scale for 1921 adjusted. The men accepted a reduction in rate of pay under formal protest, which will be carried up to the wage board for a final decision. If the wage board decides that the reduction was unwarranted the workers will get the rate as fixed by the board. The new scale calls for 55½c. an hour for both the day and night shifts. Last year's rate was 55c. for day labor and 66c. for night work. The office force will accept a reduction of 10 per cent in pay. The meeting was harmonious, and it is not believed that there will be any labor troubles on the docks this year. The carriers represented at the meeting were: Chicago Northwestern, Soo Line, Lake Superior & Ishpeming, and C. M. & St. P.

Chestatee Company Reorganized As Piedmont Corporation

New Owners Talk of Building Sulphuric Acid Plant

It is reported that the property of the Chestatee Pyrite & Chemical Corporation, at Chestatee, Ga., has been reorganized under the name of the Piedmont Corporation. No bonds have been issued. It is planned to build a sulphuric acid plant at the mine, with a capacity of 100,000 tons of acid per year; also a stone-crushing plant of 1,000 tons daily capacity, for supplying stone to the state highway. It is said that the Piedmont Corporation has purchased the property outright.

Silver King Coalition Contracts for New Steel Mill Building

Will Replace One Lost by Fire—To Pay 15c. Dividend From Money Saved for Possible Damages

A contract for the erection of a steel mill building for the Silver King Coalition Mines Co., at Park City, Utah, to take the place of that recently destroyed by fire, has been awarded to James Burk & Co., of Salt Lake City. The cost is to be between $45,000 and $50,000, and work will be started upon the arrival of the material, which is expected in about forty days. The mill building is to have a length of 300 ft. along the slope of the hill; the upper half, which will house the crusher plant, will be 40 ft. wide, and the lower half 80 ft.

A separate building is to be erected at the lower end of the mill for the boiler plant and the concentrates dewatering equipment. This will be 125 x 18 ft. There will be two ore bins at the upper end of a combined capacity of 3,000 to 4,000 tons; the larger one, 100 ft. long x 20 ft. wide x 20 ft. high, will hold the coarse ore, and a smaller one, 40 ft. long x 20 ft. wide x 20 ft. high, will be used for the crushed ore. There are said to be excellent opportunities for obtaining slightly used mill machinery suitable for the new plant, and these will be investigated while the mill building is in process of construction. It is thought that it will be possible to build the mill at a considerably lower cost than could have been done a year ago. Concentration and flotation will be used.

The company will pay a dividend of 15c. a share, or $182,415, on May 1 from money accumulated to meet the possible contingency of losing in the litigation with the adjoining Conkling Mining Co. and having to pay damages. The Coalition won the suit.

Union Sulphur Co. Pays Back Taxes

The Union Sulphur Co., operating at Sulphur Calcasieu Parish, La., has paid back taxes and interest due amounting to $783,307. Of this amount the parish will receive $632,212 and the state the remainder. This does not include $36,000 in fees due the attorneys of the parish.

NEWS FROM WASHINGTON

By **PAUL WOOTON**
Special Correspondent

McFadden Gold Bonus Bill Revised

Period Reduced From Five to Three Years—Exporters of Articles Containing Gold Exempt

In a revised gold bonus bill, Representative McFadden, the chairman of the House Banking and Currency Committee, reduced the period covered from five to three years. The Secretary of the Treasury is empowered to terminate the act at any time on three months' notice in the event economic conditions return to normal. Exporters of articles containing gold are exempt from the premium of 50c. per pennyweight.

"The bill provides revenue," said Mr. McFadden, "from an excise of 50c. per pennyweight of fine gold contained in manufactured articles, to be collected at the time of sale, and for a premium of 50c. per pennyweight to be paid to the producers of newly mined gold in the United States and its possessions. The Government is fully protected under the provisions of the bill from the presentation of other than newly mined gold to receive the premium. The bill differs from H.R. 13,201 introduced by me in the last Congress, in that the period has been lessened from five to three years, and that the Secretary of the Treasury is granted full authority to terminate entirely the provisions of the act on three months' notice in the event of a return to normal economic conditions prior to the expiration of the same. Exporters of articles containing gold have been exempted, as they were from the payment of the luxury tax, in order not to interfere with foreign competition. Revenue will be derived on all gold articles of foreign manufacture sold in this country."

In reviewing the history of this legislation Mr. McFadden stated:

"Extensive hearings were conducted in the last Congress on this bill, and it was reported favorably by the subcommittee of the Ways and Means Committee before adjournment. Increases in freight and power rates have more than offset any declines in wages and materials consumed in gold mining. Because of the emergency confronting the gold mining industry, the enactment of this bill should be expedited."

Division of Mines and Geology Again Proposed

Senator Pittman, of Nevada, has reintroduced the bill proposed at the last Congress by Senator Henderson, which provides for the creation of a division of mines and geology in the Department of the Interior. The idea is to fuse into one super-bureau, to be known as a division of the department, all of the activities now centering in the Geological Survey and the Bureau of Mines.

Suspension of Assessment Work Proposed for 1921, 1922

New Mexico Senator Introduces Bill—Chance of Passage Held To Be Poor

Senator Holm O. Bursum, the new Senator from New Mexico, has introduced a resolution providing for the suspension of annual assessment work on mining claims during the calendar years of 1921 and 1922.

When the time for completing the 1920 assessment work was extended until July, 1921, it was predicted that an effort would be made to enact legislation to cancel entirely the obligation of that and subsequent years. It is evident that the prediction will be fulfilled, as Senator Bursum intends to push his bill, in which action he will have the support of a number of members of the Senate and of the House of Representatives. The chance for the success of the measure is not regarded as particularly good.

War Mineral Awards

Awards totaling $47,901.77 were recommended by the War Minerals Relief Commission during the week ended April 9. The Blue Mountain Chrome Co. was awarded $16,296.43. This is 51 per cent of the amount claimed. In the chrome claim of the Bellefonte Lime & Stone Co., an award of $20,048.77 was recommended. This was 47 per cent of the amount claimed. Additional evidence made possible awards in the following cases: E. A. Garrison, $470.25; Powderhorn Mines Co., $1,498.64; I. Lanski & Son, $7,440.44. A further award of $272.74 was made in the claim of William A. Blanton, who previously had received an award of $400. An additional award of $1,874.50 was made to the Morgan-Leitcher Co. A previous award of $5,060.35 to the Morgan-Leitcher Co. had been made.

Recovery of Vanadium Oxide Object of Study Proposed for Government

Research looking to the recovery of vanadium oxide (V_3O_5) from Western phosphates and from coal, hydrocarbon shales, and natural asphalts has been suggested as a proper activity for the Federal Government. This material, which is used in such great quantities in the making of steel, occurs extensively in the United States. It is believed that its economical recovery presents no obstacle greater than many that have been surmounted by American scientists. Vanadium oxide occurs in the ashes of many coals. In certain coals, it is stated, it forms as high as 38 per cent of the ash.

Mining Committees of House And Senate Ready

Nearly All New Members of Former Familiar With Mining Conditions

After some delay in organization, the committees of the Senate and of the House of Representatives are now ready to function. The majority members of the Committee on Mines and Mining of the Senate are as follows: Poindexter, Washington (chairman); Sutherland, West Virginia; Newberry, Michigan; Oddie, Nevada; Nicholson, Colorado, and Norbeck, South Dakota. The minority members are Walsh, Montana; Ashurst, Arizona, and Pittman, Nevada.

The majority members of the House Committee on Mines and Mining are: Rhodes, Missouri (chairman); Echols, West Virginia; Robsion, Kentucky; Brooks, Illinois; Luhring, Indiana; Connell, Pennsylvania; Arentz, Nevada; Williamson, South Dakota; Colton, Utah, and Sutherland, Alaska. The minority members of the committee are: Wingo, Arkansas; Rainey, Alabama; Favrot, Louisiana; Swank, Oklahoma, and Meyer London, of New York.

The personnel of each of the committees has been changed decidedly. Senators Poindexter, Sutherland, Newberry, Walsh, and Ashurst saw service on the Senate committee at the last session. The additions to the committee, however, are all men with an intimate knowledge of the mining industry.

The only members of the new House committee who saw service during the last Congress are Rhodes, Echols, Robsion, Brooks, Luhring, and Wingo. Nearly all the new members bring to it an intimate knowledge of the mining industry. Nevada, South Dakota, Utah, Alaska, and Pennsylvania, political subdivisions in which mining is an important industry, now have representation on the committee. Alabama, with its important coal, iron, and graphite industries, is represented; also Louisiana, with its sulphur, salt, and other nonmetallic mineral industries. The petroleum industry is recognized by the appointment to the committee of Swank, of Oklahoma.

Government's Silver Purchases

Purchases of silver under the Pittman Act during the week ended April 23 totaled 1,040,651 fine ounces. This brings the total purchases under the Pittman law to 48,922,107 fine ounces.

Sale of 25,550 tons of steel billets is to be undertaken by the War Department. Bids were received until 10 a.m. April 29.

Need for Aiding Alaska Urgent, Says Senator New

Must Abandon Conservation Policy, Says Willis—Tonnage Needed for Government Railroad

That something immediate and certain to be effective must be done to stimulate the development of Alaska is the opinion of Senator Harry S. New, of Indiana, the chairman of the Committee on Territories. Several members of the committee expect to make a trip to Alaska this summer, if business before the Senate will permit, so as to bring back a report from the legislators' standpoint as to what the territory needs to stimulate its development.

Senator New says that no new country can be developed rapidly in the face of numerous restrictions. In Alaska, where there are unusual obstacles as compared with more favorably situated areas, Senator New is convinced that unusual opportunities must be offered to those who pioneer the country. He says that it is obvious that they will not endure the hardships and the risks when they know in advance that their chances are no better than in the settled communities.

Senator Willis, of Ohio, another member of the committee, declares that we must abandon the conservation policy which permits the resources of Alaska to be looked at, but does not allow the prospective developer to go much further. He wants to see the coal, metal, and water-power resources of Alaska turned loose, so that the territory may thrive. Restrictions which may be entirely reasonable and proper in the United States itself are not necessarily best for Alaska, he declares.

That Alaska is giving the Administration some concern may be judged from the fact that the President himself is so anxious to make a trip to that territory. Mr. Harding, during his service in the Senate, was an active member of the Committee on Territories, and is fully conversant with Alaska's problems. With the Alaska Railroad nearing completion, it is recognized that it is the duty of the Federal Government, as its owner, to do all in its power to stimulate Alaskan enterprises, so that the operation of the railroad will not be a heavy item of expense. Had a private corporation undertaken the construction of this railroad, it is pointed out that a considerable percentage of the capital would have been employed for tonnage-getting purposes from the initiation of the project. For the last year there has been much talk of special activities looking to the securing of tonnage for the railroad, but no systematized effort has as yet been undertaken.

The U. S. Geological Survey is of the opinion that the most potent influence to draw capital to Alaska would be the establishment of the fact that it has formations favorable to the occurrence of oil. For that reason, the emphasis of the Survey's work there this summer will be placed on oil geology.

The principal work will be done on the west shore of Cook Inlet and in the Cold Bay region. Geological research in the metalliferous areas will not be discontinued, however. Practically all of the work will be done in territory tributary to the railroad. The regions to be examined geologically include the Forty-mile Tanana section between the Tanana River and the Canadian boundary, the Koyukuk gold placer region, and the silver lodes near Ruby.

NEWS BY MINING DISTRICTS

CANADA

O'Brien Denied Injunction Against British America Nickel Corporation—Hollinger Running at Full Capacity

Ontario

Sudbury—The application by M. J. O'Brien for an injunction restraining the British America Nickel Corporation from carrying into effect the proposed scheme for financial reorganization has been dismissed by the court at Toronto. Judge Middleton, in pronouncing judgment, stated that if the corporation carried out its plans it would do so at its own peril, as if Mr. O'Brien, as a minority bondholder, sustained any injury as a result of such action he would be able to seek redress in the courts.

Porcupine — The Hollinger Consolidated is working at full capacity. The last battery of stamps went into operation on April 19 and the plant is treating [illegible] tons of ore every twenty-four hours, employing approximately [illegible] men and eighty-two machines.

The Crown Trust Co., of Montreal, has taken up $100,000 in mortgage bonds of the North Crown, which has placed the company in funds for the resumption of operations about May 1.

The Goldale Mining Co., which recently took over the Bewick Moreing group of claims on the east side of Pearl Lake, has a small crew of men at work.

Port Arthur — Active preparations are being made for the resumption of work at the old Silver Islet mine. A gang of men are at work repairing the buildings and the work of pumping out the mine will be begun soon.

Cobalt—A temporary headframe has been erected at the Meyer's shaft of the Nipissing to take the place of the one destroyed by fire and will be ready for use in a day or two.

Yukon Territory

Dawson—A news dispatch from Dawson announces that a rich strike of silver ore has been made at Keno Hill, 160 miles east of Dawson. The strike is reported to have been made in the No. 9 tunnel on the Rico claim, owned by the Yukon Gold Mining Co. The ore is high-grade argentiferous galena. The company has 2,500 tons of ore at Mayo ready for shipment on the first steamers. A number of claims in the vicinity have been optioned recently.

ALASKA

Willow Creek Gold Mine Resumes

Seattle—Milo Kelly, general manager of the Willow Creek Alaska Gold Mining Co., who has been spending the winter in Seattle assembling supplies and making plans for the coming season, sailed recently to begin work at the property. Last season a cyanide mill was built and the company intends to enlarge this so that it will have a capacity of 200 tons. Power plant machinery will be installed.

ARIZONA

United Verde Extension May Take Over Jerome Verde Holdings

Jerome—Jerome is nearly at a standstill, with little more than an upkeep force left in its main mines and with the U. V. smelter, at Clarkdale, and the Extension smelter, at Clemenceau, merely cleaning up the ore bins. The latter has a large quantity of ore on hand, but will operate only until the reverberatory roof caves in. United Verde will retain 240 men in the mine and 160 at Clarkdale. Extension recently has had a force of 450 and is expected to retain not over 100. None but married men are being retained, the American Legion specifically waiving any priorities its members may have acquired by war service.

At 110 ft. below the 320-ft. tunnel level, the Shea has a 4-ft. ore shoot sampling $18 in silver and $4 gold, with some copper.

Stockholders of the Jerome Verde Copper Co. will meet in Phoenix May 5 to pass upon an offer of sale of the company's property to the Jerome Verde Development Co. to be a subsidiary of the United Verde Extension Co. The new corporation is to be organized under the laws of New Jersey, with capital stock of $1,500,000, in 50c. shares. It is proposed to buy the property and assets of the Jerome Verde for $420,000, in cash or for exchange for the new company's stock on the basis of ten shares for one. The

United Verde Extension Co. will take an option to purchase 628,078 shares of the new stock for $454,039. Jerome Verde has 5,230,000 shares outstanding. An offer of $500,000 in bonds has failed to find purchasers, and there is now outstanding a mortgage note of $72,000, given to pay personal injury judgments of $27,000 and taxes and running expense. Though recent reports as to operations on the Columbia 1,100 level appear encouraging, most of the stockholders favor the exchange. The transaction would give the Extension an immensely increased acreage.

Globe—The International Smelting Co.'s works at Miami are cleaning up for total suspension of operations, and the Old Dominion smelter has made its last bar. The Miami concentrator at Miami is still being operated, the only copper mill still active in Arizona, but there is speculation whether it will long continue to pile concentrates. Superior & Boston announced a cut of 40 per cent in the number of employees.

It is hoped locally that enough silver ore can be produced to warrant operation of a lead-silver stack in the El Paso smelter, where such smelting was stopped March 19 for lack of ore. To do this it is believed freight rates will have to be reduced to pre-war figures. Prospecting has become active in the McMillen, Richmond Basin, upper Miami and other sections that were silver producers many years ago.

A serious condition of drought prevents better development of much Ariona placer ground on which at least wages could be made by hundreds of miners now idle. A brisk demand is noted for dry washers.

A committee of residents of Gila County, headed by the county engineer, Julius Milton, recently waited on Governor Campbell, urging employment on state roads in the county for miners who are out of work in the district. Greenlee County will make a similar appeal through the Clifton Chamber of Commerce in behalf of those out of work in the Clifton-Morenci districts.

Ajo—Owing to the difficulty of marketing securities, there is no prospect of early construction of the railroad planned from Ajo to the Gulf of California. The projected route was inspected lately by officials of the El Paso & Southwestern system, including Arthur James, Walter Douglas, and President T. M. Schumacher, escorted by J. C. Greenway, general manager of the Calumet & Arizona and New Cornelia mining companies. At present active efforts are being made to develop water along the 100-mile length of the proposed road. A well bored several miles from the sea coast was found salty. A harbor will have to be created at the terminus, Rocky Point, with the provision of at least one 1,500-ft. breakwater. As indicated by the name, rock for the breakwater is at hand, a great advantage, for the coast generally is low and sandy.

Douglas—The present stoppage of operations by the Copper Queen branch of the Phelps Dodge Corporation is stated to be the first for forty years, save for brief periods for needed repairs. There still remain in employment of the company about 1,100 men in the Warren district and several hundred here, though G. H. Dowell, general manager, states that there is to be further reduction within a few weeks. Men laid off are to be given full seniority and pension rights when reinstated, provided return is within thirty days from time of notification. Financial assistance will be given men who remain or to their families and a liberal policy will be in effect covering payments on homes.

Calumet & Arizona will retain 575 men in its mines below Bisbee and will mine and stock about 15,000 tons of ore a month. At the Douglas smelter the boiler and power plants will be continued in operation till the ore beds have been filled with crushed material. Much repair work will be done at the smelter. In the mines, the Junction and Campbell shafts are to be completed and exploration work is to be prosecuted from the No. 3 Cole shaft. At Ajo, the New Cornelia force will be reduced to 300 men, from the present strength of 522.

Closing of the local smelting plants has been a serious matter to small shipping mines in Arizona and Sonora. Such properties as the Stargo, at Morenci, and El Tigre, south of Douglas, hope for continuance of operation of at least one silver stack at El Paso. Efforts are being made to secure, mainly from Globe, silver ore enough for running the small smelter at Benson, though a new stack might have to be added if the present copper handling equipment could not be satisfactorily modified. Facilities for concentrating silver ores are lacking in Globe.

Tombstone—The National Metals Recovery Co. expects to start its mill soon. J. W. Stockham will be in charge.

Patagonia—On the bottom level from the new vertical shaft of the Hardshell Mining Co. the crosscut has intersected a prominent vein 200 ft. from the shaft. The vein is 30 ft. wide, and is believed to be the eastern extension of the Hardshell vein. Streaks of shipping ore assay 4 oz. silver, 37 per cent lead and 1.8 per cent copper. At a distance of 230 ft. the crosscut encountered a heavy flow of water, estimated at 1,000 gal. per minute, which was more than the present steam pumping equipment could handle, so development work has been temporarily discontinued, pending the installation of electric pumping equipment designed to handle the flow. It is estimated that the new electrical equipment under consideration will cost about $20,000. The company's Bender properties are being developed under lease. The main tunnel has opened a mineralized zone containing stringers and irregular bunches of silver-lead ore. The veins vary in width from 1 in. to 2 ft. Much of the material will average about 30 oz. silver per ton, and sorted ore assays as high as 5 oz. gold, 1,000 oz. silver, and 64 per cent lead. A trial shipment of five tons of high-grade ore has been made. The strike is creating considerable excitement in the district, and may develop into a shoot of more than ordinary interest. Howard K. Welch is general manager and Murray L. Sanders is consulting engineer.

COLORADO

Buffalo Sulphur Co. Operating Steadily at Creede—Royal Tiger Mill Almost 60 Per Cent Complete

Aspen—Development work in the tunnel of the Hope Mining & Milling Co. confirms the promise of a rich discovery of silver ore recently made. The operators are composed principally of Aspen people, who leased a long-abandoned tunnel, which they extended several hundred feet to connect with a vein, famous in early days for a surface product of extremely rich silver ores. The company states that "the lower portion of the vein averages 1 ft. in width and the upper section from 6 to 12 in. A cross section assay of the lower portion of the vein gives 174 oz. in silver and the upper portion gives .047 oz. These assays are fairly an average of the vein." Drifting on the ore shoot has progressed about 25 ft. Owing to the heavy snows in the Aspen district and the impassable roads at this season shipments will not start until about May 15.

Creede—This old silver producing district is rapidly coming to the fore in sulphur output. For a year or more the Buffalo Sulphur Co. has been developing its property on Sulphur Creek, about 20 miles southwest of Creede. In addition to equipping the mine the company constructed an extraction plant at the mine which converts the ore (a combination of aluminum silica and sulphur) into a crude product, which is shipped to the refining plant at Creede to be converted into commercial sulphur.

Operations at the mine in the last year disclosed a blanket vein from which the overburden was removed, showing a 100-ft. face of sulphur combined with aluminum silica, averaging approximately 60 per cent sulphur. Exploration work with a diamond drill further back on the mountain side indicates extensive deposits of the mineral, insuring many years' supply for the plant. Diamond drilling will be continued, together with an extensive plan of development.

The extraction plant at the mine has a capacity of approximately 125 tons of ore every twenty-four hours, with a crude sulphur output of from fifty to seventy tons. The crude sulphur is conveyed to the refinery at Creede by a Holt tractor train and is then converted into rubber sulphur, brimstone, ground sulphur, flour sulphur, and other products. The sulphur is said to be of the highest grade, and entirely free from arsenic, selenium, or other deleterious elements.

Breckenridge — The Royal Tiger Mines Co., which has been operating in this district for the last two years, is carrying on an extensive plan of development. This company has increased its holdings to upward of 2,000 acres, most of which is highly mineralized.

Operations were first carried on on the Tiger group, near which the town of Tiger sprung up, and, as the operations of the company expanded, a post office and school district were established. In connection with development work carried on by this company a pilot mill was constructed, in which was worked out the problem of ore treatment. A new 400-ton mill is almost 60 per cent completed. A 100-ton unit will be ready to treat ore about June 1. Development work this year includes the sinking of a 1,000-ft. shaft on the South Tiger properties, sinking from the 850 level of the Tiger group to 1,000 ft. and the extension of the I.X.L. tunnel 700 ft. to the Cashier group.

UTAH

New Shipping Ore Opened in Tintic Standard—Tintic Milling Shipping Silver Bullion Direct to Mint

Eureka—A strike of interest is reported at the Tintic Standard, where a face of shipping ore has been opened in a drift from the No. 1 shaft, which is further to the south than any other workings, ore having first been opened 1,500 ft. north of this shaft. The face of the new strike is out 800 ft. to the northeast of the shaft, and the drift is cutting across the ore channel diagonally. The No. 1 shaft is 1,700 ft. southwest of the No. 2 shaft, which is at present producing most of the ore. A shipment of 10,000 oz. of silver bullion was made from the new mill to the United States mint at Denver the week ended April 16.

Silver City—The Tintic Milling is shipping silver bullion to the mint direct and separating the copper and silver bullion at its mill. Shipments in a period of a few weeks will amount to about 77,000 oz. of silver bullion. There was shipped 22,000 oz. the week ended April 16, 35,000 oz. the week preceding, and 20,000 oz. is going out soon. The company is preparing to reopen the Swansea, which has a considerable tonnage of mill ore at or near the 500 level. This mine produced high-grade ore in the past, and operations were halted by the coming in of water. This does not affect the concentrating ore, which is found above water level.

Oakley (in Idaho)—The Vipont Silver Mining Co. in Utah near the Idaho line has [illegible] a power line from Oakley, Idaho, [illegible] miles away. The mill has been [illegible] by electricity for about two weeks, and it is expected to have power at the mine very shortly. This will mean a considerable economy in operation, as the company has had to haul oil for the Diesel engines over bad roads and steep grades. Both mine and mill have been operating throughout most of the winter.

IDAHO

Bunker Hill Smelter and Hecla Mine To Cut Wages

Wallace—Several months ago the wages of miners in the Cœur d'Alene district were reduced from the wartime rate of $5.75 per day to $4.75, and muckers, who had been receiving the same pay as miners, were cut $1.25 to $4.50 per day. Corresponding reductions were made at the Bunker Hill smelter. A further reduction in wages is now necessary, according to announcements recently made by Frank M. Smith, director of the Bunker Hill smelter, and James F. McCarthy, president of the Hecla Mining Co. Mr. Smith described the position of the smelter thus: "In selling our lead in the East in competition with the Montana lead smelters, we are at a decided disadvantage owing to the much lower wage scales paid by those smelters. To keep running at the Bunker Hill and successfully compete with these other plants, it will undoubtedly be necessary to make a reduction in wages in the near future. I have no doubt that our employees would much prefer to accept lower wages rather than to see the plant shut down. Ample notice will be given later as to what policy we will pursue."

In a statement mailed to stockholders Ben L. Collins, manager of the Western Union Mining Co., states that from Nov. 19, when the first shipment was made from the property, to March 11 the lessees have shipped eleven carloads of ore, aggregating 872,099 lb., for which the net smelter returns were $26,103.83. Since the last date four cars have been shipped, for which returns had not been received. The company receives a royalty of 25 per cent, and assumes no expense whatever. The lease expires in August, when operations will be taken over by the company. The average mineral content of Western Union ore as shipped was 43.58 oz. of silver to the ton and 52.58 per cent lead.

As a result of the litigation between the Star Mining Co. and the Federal Mining & Smelting Co., which resulted in favor of the former, the Federal company is required to pay the Star for all ore removed from the ground of the latter through the operation of the Morning mine. Fixing the amount of the claim is a complicated task, and has now occupied the attention of Rush J. White, chief engineer for the Star, for several months. He is now receiving assistance from W. J. Hall, formerly assistant general manager of the Federal, and Fred W. Calloway, of San Francisco, a mining engineer formerly connected with the Bunker Hill & Sullivan. It is understood that the records of the Federal have been placed at the disposal of the Star, and it is expected that an agreement on the amount of the claim will be reached without further action in court.

Mullan — The Independence Lead Mines Co. is planning to resume development by May 1. The lower tunnel has recently been retimbered. Considerable low-grade ore has been exposed in two upper tunnels, and an effort will be renewed to locate it in the lower. The Independence is favorably situated between the Morning and Hunter mines. The property was one time controlled by the late August Heinze. W. M. Bacon, formerly manager of the Stewart Mining Co., is the chief stockholder. W. E. Cullen, of Spokane, is secretary-treasurer.

Bonners Ferry—Sluicing operations of Idaho Gold & Ruby have been commenced on property owned near Leonia, on line of Great Northern railway. Ten years have elapsed since a commencement was made on operations and large expenditures have been made in that time to bring the property to a producing stage. Outcome of the results of sluicing operations is awaited with much interest.

MONTANA

Butte & Superior Cuts Copper on 2,050 Level in Black Rock Mine

Butte—A body of copper ore has been cut on the 2,050 level of Butte & Superior's Black Rock mine. Whether the new deposit is in the Rainbow vein, the zinc fissure of the Black Rock, or in a so-called "northwester" vein, has not yet been determined, because of the faulted condition of the ground. If it should prove to be the Rainbow it will tend to fulfill predictions made in engineering circles years ago, that the noted zinc bodies of the Black Rock would give way to copper with depth. This copper shoot shows an ore width of 12 ft., with chalcopyrite and copper glance sprinkled through the face. This copper ore is going to the stock pile and will be milled when milling operations are resumed.

Last week the Main Range shaft of the Tuolumne Copper Mining Co. reached a depth of 1,600 ft., the immediate objective, and following the completion of a 25-ft. sump and cutting a station, crosscutting for the Spread Delight vein, estimated to be about 300 ft. south of the shaft, will be started.

The 2,700 level of the Colorado mine of the Davis-Daly company was connected last week with the recently completed air shaft by means of a raise, and a direct air current established, lowering the temperature on this level more than 20 deg. and bringing the working conditions to a point of comfort excelled by none of the deeper mines in the district. The Colorado property now is independent of any of the neighboring companies for ventilation.

Development of Anaconda's phosphate deposits near Soda Springs, Idaho, is continuing, despite the suspension of the production of metal output. The experimental phosphate plant at the Washoe works will continue operations for several months, it was announced, although the rest of the works has been closed.

The [illegible] vein has been cut on the 400 level of the Plutus, showing about

15 ft. of well-mineralized manganese material, with silver ore in evidence. Crosscutting is continuing, as the ore in evidence on the upper levels lies on the wall opposite from the one first cut. A 500-gal. electrically operated pump was installed recently on the 400 level.

Lessees at the Butte-New England are making regular shipments from the Hesperus vein.

Bullion production for March by the Barnes-King was $30,938.32, an increase of $8,453.25 over that for February. The recently reported ore development on the lower level of the Shannon mine failed to hold up, according to the company's monthly statement, which said that after continuing for 30 ft. with the grade good in the 605 drift the values dropped off. From the North Moccasin lessees the company received $1,125 during the month. Shaft sinking at the Black Hawk claim has reached a depth of 103 ft.

Jardine—The Butte-Jardine Metals Mine Co. will continue work at the Champion mine, it is announced. Installation of a filter in the new 150-ton flotation concentrator has been decided upon to facilitate the drying of concentrates. When this is in place, it is expected that regular shipments will be begun. High-grade ore is reported in the main tunnel.

Dillon—Development plans of the Silver Spray provide for driving a tunnel instead of a shaft. High-grade copper ore has been opened near the surface and the ground has been prospected to a depth of 80 ft.

Neihart—The Montana Mining Association has advised that it has been informed of an important silver ore development in properties of the Block P. Company, which is operating the Wright & Edwards and the old Barker group of claims. Ore is being hauled 14 miles by auto truck.

WASHINGTON

Index — The Sunset copper mine, which suspended operations Jan. 1, now has a small crew employed on exploration work.

CALIFORNIA

Mother Lode Companies Cut Wages—Dredge Men Study Operations on Mokelumne and Calaveras Rivers

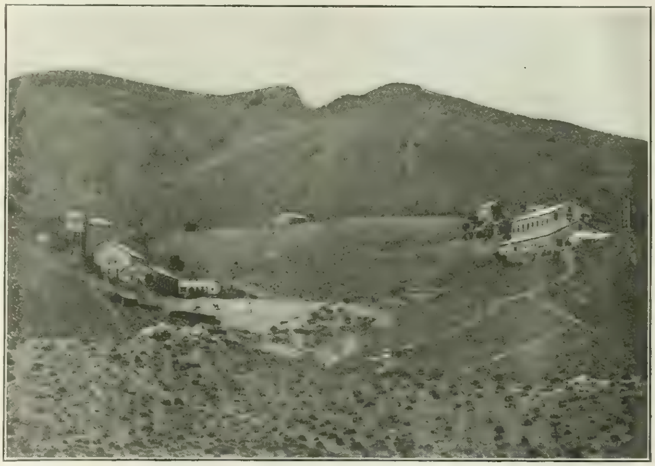
San Francisco—The San Francisco Section of the A. I. M. E. held its regular monthly meeting on April 26, G. B. Rosenblatt presenting a paper on "Mechanical Haulage for Metal Mines of Moderate Size."

Jackson—The Kennedy mine has been unwatered to a point 90 ft. below the 3,600 level. Drifts are being cleaned up and shaft repairs made. The Argonaut is practically unwatered. At both mines preparations to resume production are progressing.

On April 15 Mother Lode mining companies announced a wage cut of 50c. per shift. The principal reason given was that the living costs have declined a little over 20 per cent.

Plymouth—Superintendents of Mother Lode mines held their regular monthly meeting on April at the Plymouth mine. Those present were: W. J. Loring and S. L. Arnot, of the Plymouth Consolidated; W. P. Henry, A. S. Howe, and G. H. Kirsch, of the Central Eureka; Edwin Higgins and B. I. Hoxie, of the Fremont; James Spiers, of the Kennedy; O. D. Rohlfs, of the Amador Mines Co.; R. J. Christenson, of the Bunker Hill; O. McCrany and Byron E. Rowe, of the Belmont-Shawmut, and George J. Young, of the *Engineering and Mining Journal.*

Grass Valley—C. A. Brockington, of the Allison Ranch mine, is reported to have opened up promising ground in the south drift of the 600 level and to be drifting toward this area on the 800 level. The mine was reopened in 1917, but little encouragement up to date has resulted from prospecting work.



MILLS OF YELLOW ASTER MINING & MILLING CO., RANDSBURG, CAL., WITH GLORY HOLE IN BACKGROUND

The North Star has discovered a good shoot of ore, and may be expected to increase its tonnage output. The Idaho-Maryland has unwatered its Canyon Shaft to below the 15th level.

Jenny Lind—Dredge superintendents of the gold dredging companies of California were the guests of F. J. Estep, of the Isabel Dredging Co., and F. P. Hanson, of the American Gold Dredging Co. recently. The operations of the dredges on the Mokelumne and Calaveras rivers were studied.

Randsburg—A 150-hp. hoist will be installed within the next sixty days at the Rand Divide mine.

The Swastika mine (Grady lease) is to install another 50-hp. compressor. The mine is now shipping five cars of ore weekly, an amount nearly equal to the output of the Rand Divide, and of the same character.

The Coyote mine, owned by Blanck & Kelley, will be ready for the installation of electrical power within thirty days.

The Yellow Aster mine recently made a test run, which, if up to expectations, will be followed by a resumption of operations. A lease for working tailings and dumps is reported to have been signed.

Trona—The Slate Range Minerals Co. suspended operations on March 31, owing to the slump in the lead market, and the increase in freight rates.

NEVADA

Placer Gold Discovered in Johnnie District

Johnnie—In the Johnnie district excitement has been caused by the discovery of placer gold. It was first found on the Climax group of Wedekind & Buol, coarse gold, ranging from wheat size to nuggets a half-inch in diameter. So far placer gravel has been found in five different places; also below the Congress group and on the Eureka-Johnnie. There is plenty of water for camp and domestic uses, but dry washers are to be used at the diggings. In the district are free gold veins and many paying quartz mines. The placers occur in clay-like washes, the loose gravel not carrying pay dirt. A syndicate of Tonopah business men has been formed to develop a number of claims and to prospect for the main channel.

Pioche—Ore shipments for the week ended April 14 were nominal, Bristol shipping 465 tons and the Consolidated Nevada-Utah Currency lease 40 tons. Virginia Louise and Prince Consolidated are doing development work only. The Black Metals will not ship until the new rates are in effect.

Virginia City—The United Comstock Mines Co. will probably start construction of a 1,000-ton mill early in May for treating ore developed in its Gold Hill properties. Construction work on a two-mile spur track from the Virginia & Truckee R.R. will also be started soon. The adit being driven is making rapid progress.

At Silver City and Virginia City more than a dozen companies have been formed during the last few months for prospecting and developing areas in the vicinity.

The Consolidated Virginia milled 658 tons of $10.58 ore the week ended April 16. Development and stoping operations were carried on from the 1,650, 2,150 and 2,250 levels. The station on the 2,250 level of the C and C shaft has been reopened for pumping and mining convenience. On the 2,000 level of the Ophir the drift on the Hardy vein shows no improvement, being low grade as a whole.

ALABAMA

Alabama Company Drilling Near Attalla—Ore Production at Lowest Ebb, Independents Producing Nothing

Birmingham—The Alabama Company is drilling near Attalla, Etowah County, Ala. A 4-ft. vein of rich ore is reported to have been discovered at a lower depth than it had been thought good ore would be found. At the company's offices in Birmingham no announcement was obtainable. The report from Gadsden, near Attalla, is to the effect that forty years ago a mining engineer, whose opinion was law throughout the country, made a survey of the Gadsden district and declared that the veins being worked on Shinbone Ridge in Gadsden and in the mountains forming the western boundary of Attalla disappeared at a depth of about 300 ft. This was generally accepted as true until recently. It is said that a large sum has been spent in acquiring ore properties in this section. The deep mining project of the Gulf States Steel Co., at Shannon, is said to have exploded old theories as to the failure of veins at a certain depth below the surface.

It has been many years since iron ore production in the Birmingham district has been at a low ebb as at present. Independent ore companies have suspended all production. The three independent furnace companies that are running are the Sloss-Sheffield Steel & Iron Co., the Woodward Iron Co., and the Alabama Company, each of which has its own ore supply.

The Tennessee Coal, Iron & Railroad Co., the subsidiary of the U. S. Steel Corporation, has seven furnaces in blast, six on basic and foundry iron and one on ferromanganese. The last is using manganese ore from Brazil, and local ores are used in the six other furnaces. The company is running up to 60 per cent of its capacity. All furnace companies of the district have filled bins at furnace plants and have accumulated some ore at the mines so as to be prepared for a rush when the pig-iron market recovers.

MICHIGAN

Menominee Range

Chapin Mine Cuts Force—Iron County's Iron Land To Be Explored

Iron Mountain—The Chapin mine has has reduced its force by ninety men. The stocking space is about filled. This is the first Oliver mine on the Menominee Range to cut its operating force.

Iron Mountain—The West Chapin Mines Co. is negotiating for the purchase of a 100-ton blast furnace, which, if bought, will be moved to the property of the company near Iron Mountain. The Thomas Berry Chemical Co. has become interested in the West Chapin Mines Co., and will handle part of the products to be made at the chemical plant to be operated in connection with the furnace. The company has plenty of ore and of hardwood for charcoal, and it is thought that the manufacture of charcoal pig iron will be started before the close of the year. Several Lake Superior iron concerns are interested in the project.

Crystal Falls—All mining work has been suspended at the Hanna company's Carpenter mine. About 350 men are affected. The Carpenter had been a steady producer since first opened ten years ago. An automatic car dumper was recently installed underground in the property, and gave excellent results for the few days that it was in operation. This installation consists of two single-car pneumatic rotary car dumpers in tandem, each car dumper of a one-car capacity. The dumper was able to handle the ore as fast as brought to the shaft. A similar installation, augmented by an automatic skip-tripping device on the storage bin, will be added to the underground equipment at the Odgers mine.

Crystal Falls — The Palms - Book Land Co., owners of the fee of the Palms and Mikado mines, on the Gogebic Range, are to do extensive exploration work in Iron County, on the Menominee Range. A deal was recently entered into whereby this company has taken an option on lands owned by the Keweenaw Association, the Baldwin Corporation Co., the Menominee River Lumber Co., and the Prickett lands, in Iron County. The lands extend from Crystal Falls to Amasa, covering a strip several miles long, and the prospects of finding iron ore are considered promising. The work of exploring the lands will be in charge of Ralph S. Archibald, of Negaunee, Mich., representative of the Palms-Book Land Co. in the Lake Superior district.

Gogebic Range

Charcoal Iron Co. Cuts Wages Further at Yale Mine

Bessemer—The Charcoal Iron Co. is reported to have announced a second reduction in wages of 15 per cent at its Yale mine, at Bessemer. The first reduction was 20 per cent.

Ironwood—April 15 the Steel & Tube Co. began to operate its Newport and Anvil-Palms mines three days a week. These properties have been working on a four-day-a-week basis. This order will affect about 500 men at the Newport and 310 at the Anvil-Palms mine.

The Oliver Iron Mining Co. will begin laying track to serve "H" shaft, Pabst mine, in the immediate future. About 3,400 ft. of track will be required.

The Wakefield mine suspended operations indefinitely on April 16.

Marenisco—The Charcoal Iron Co. has leased its mill at Marenisco to the William Bonifax Lumber Co. after an idleness of almost four months. The mill is employing about 80 men, and indications are that the force will be increased to 100. It is planned to cut 8,000,000 ft. of logs at the rate of 50,000 ft. every twenty-four hours. Part of the timber is on hand at the mill and the remainder is ready for shipment.

MINNESOTA

Mesabi Range

Accident Floods Lincoln Mine at Virginia—Billings Closed Indefinitely

Hibbing—The Harold mine of the M. A. Hanna company has closed down temporarily. Over 100 men affected will be placed at the North Uno mine, which is to be reopened. Operations later will consist of underground work and some scramming in the pit for final clean-up in certain portions.

The stripping of the Pickands Mather Scranton pit, which is being done by the Winston Dear Co., is to be started soon. All buildings have been removed, and preparations made for handling a large yardage this season.

The first shipments from the stockpile of the Sargent mine, operated by the Wisconsin Steel Co., have gone to Duluth. Regular weekly shipments are anticipated.

Buhl—Stripping at M. A. Hanna Ore Co.'s Wabegon pit is ready to start. A few minor changes were necessary on the No. 300 Marion dragline.

The Woodbridge stockpile, owned by the Fort Henry Mining Co., is being shipped steadily to Duluth.

Chisholm—The Billings mine, operated by the Tod Stambaugh Company, has closed indefinitely. Work of deepening the shaft was in progress when the closing order was received. It is rumored that the pumps are to be pulled. Fifty men are affected.

Virginia—The Lincoln mine, operated by the Interstate Iron Co., is flooded in many parts, owing to an accident. A 14-in. elbow on the discharge line from the pumps broke unexpectedly, and the pump house was flooded, putting all pumps out of commission.

Eveleth—The Oliver company's Fayal mine is shipping ore from its shaft to the D. M. & N. docks at Duluth. This is one of the first mines of the Oliver company to start shipping on the Mesabi Range. It is expected that the movement of ore from the company's large open pits will start in a short time.

THE MARKET REPORT

Daily Prices of Metals

April	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
21	12.25@12.50	29.50	31.00	4.25@4.30	4.25	4.80
22	12.25@12.50	29.50	31.00	4.25@4.30	4.25	4.85@4.90
23	12.25@12.50	30.00	31.50	4.25@4.35	4.25	4.90
25	12.35@12.50	30.50	32.25	4.25@4.40	4.25	4.95
26	12.35@12.50	30.25	32.00	4.25@4.50	4.25@4.35	4.95@5.00
27	12.35@12.50	30.00	31.50	4.35@4.50	4.35	5.00

*These prices correspond to the following quotations for copper, "delivered": 12.50@12.75c. for April 21 to 23; 12.60@12.75c., April 25 to 27.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

April	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
21	69⅜	69¾	71	168¾	171¼	21¼	21¾	26½	27¼
22	69⅞	70⅛	71	168¾	171½	21⅛	21⅝	26¼	27
23	...	..	...	....	....	...	...	..	...
25	70	70⅜	71	174	176¾	20¾	21¼	26	27
26	70¼	70½	72	173¾	176¼	20⅞	21⅜	26¼	26⅞
27	70	70⅛	72	172	174½	20⅞	21⅜	25¾	27

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

April	Sterling Exchange	Silver			Apr.	Sterling Exchange	Silver		
		New York, Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York, Foreign Origin	London
21	392	99½	59¾	34½	25	394½	99¼	60⅜	34⅝
22	391⅞	99½	59⅞	34⅝	26	394	99¼	60⅜	34⅝
23	392½	99¼	60⅝	35	27	393¾	99¼	60¼	34⅝

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, April 27, 1921

Inspired by an increasing demand from consumers and a prospect that the issue between the Allies and Germany may soon be settled, a distinctly better feeling has arisen in the copper, lead, zinc, and tin markets. Prices have also tended to higher figures, and it now seems unlikely that the low extremes of early 1920 will be repeated. Demand generally is for small tonnages for prompt delivery, but it is well distributed.

Copper

Sales in satisfactory volume have been made since our last report, at 12⅝@12.75c. delivered, and certain small tonnages of spot copper are reported at the 12.50c. level. Over the week-end, however, the sellers who were quoting this extremely low price dropped out of the market, and today one might have some difficulty in finding anything but small lots of spot metal at less than 12.75c. However, there has been some weakening on the part of large producers, and although some continue to quote 13c., and are standing by that price, others are meeting the market. Large tonnages of May-June copper could be obtained at 12.75c. Practically no business is being done in copper for delivery later than this, but a premium would be asked for such forward contracts.

Demand has been well distributed, though wire and cable manufacturers have been the principal buyers. The brass mills continue to be well supplied by Government stocks of scrap, so are not interested in much new metal. Foreign buying has not been large, but it is generally conceded that it only awaits a settlement of the reparations question. Japanese copper production is reported to be greatly curtailed, it being more economical for Japan to buy copper on the Pacific Coast than to produce it.

Lead

On Tuesday, April 26, the American Smelting & Refining Co. increased its official contract price of lead from 4.25c. to 4.35c., New York and St. Louis.

Lead has been distinctly stronger and in increasing demand at the prices quoted by the A. S. & R., which are lower than the metal could be obtained for in the outside market. It is altogether likely that the market will continue to become firmer, as this interest is hardly capable of supplying so large a demand as now exists. The comparatively low prices quoted are no doubt influenced by the activity of the Penarroya agents in New York, who are trying to interest large consumers in lead for shipment from Spain at approximately current London prices. We have not heard that their efforts are meeting much success. The demand for forward metal is small, but American producers are asking a premium. Practically all the lead which has been sold is for prompt or May shipment, and June metal could not be obtained at any time during the last week for less than 4.50c. Chemical lead is quoted at 4 35@4.50c., St. Louis.

Zinc

The improvement noted last week has continued, and today it is difficult to obtain Prime Western zinc under 5c., East St. Louis. A steady demand from galvanizers, who have taken all the metal offered, mainly accounts for the rise of 40 points in the last two weeks. Large tonnages for these times were sold at the prices recorded during the week, and the market still has a firm undertone. Although zinc production is exceptionally low, it was the influence of demand rather than supply which led to the improvement. Many smaller zinc producers are not in a sufficiently strong position financially to accumulate stocks, and as a result their necessity of disposing of their metal regardless of the market has frequently prevented the price from rising. Little interest is manifested in futures, but a premium would be asked. Electrolytic and high-grade zinc was sold during the week for 6.50@6.75c. in somewhat larger tonnages than usual.

Tin

The week-end advance in London resulted in better prices here, naturally, but the interest was largely confined to dealers. Apparently consumers do not yet find their business sufficiently improved to order in any quantity. The demand has been better for 99 per cent grades than for Straits. A fair tonnage of electrolytic has been sold at prices equal to Straits and down to as much as one-half cent below. Futures are quoted at the same prices as for spot, but for deliveries as late as August a premium of at least a quarter of a cent would be asked.

Arrivals of tin in long tons: April 21st, London, 50; Straits, 20; 23d, London, 25; 25th, Liverpool, 100; 26th, Straits, 100.

Gold

Gold in London: April 21st, 104s. 8d.; 22d, 104s. 10d.; 25th, 104s. 3d.; 26th, 104s. 2d; 27th, 104s. 2d.

Foreign Exchange

On the improved outlook for a settlement of the reparations problem, francs have gained nearly half a cent over a week ago. Sterling has continued firm. On Tuesday, April 26, francs were 7.6825c.; lire, 4.90c; and marks, 1.58c. New York funds in Montreal, 11$\frac{3}{32}$ per cent premium.

Silver

The silver market in London has ruled fairly steady in the last week at 34⅝d., with the exception of a slight spurt on April 23 to 35d., on speculative demand. The New York quotation has closely followed the London price, with some improvement, due to higher rates for sterling exchange. The market continues dull, with moderate offerings of silver on the one hand and a limited demand on the other. Basic commercial conditions in China and India are unfavorable for an immediate advance in the price of silver, and the market is likely to rule around present levels unless some speculative demand causes an advance.

The price of domestic silver is now 99[illegible] instead of 99½c. This is because of the fact that coinage of silver dollars has been begun at the Denver mint and all silver must be delivered at that point. This adds about [illegible] to the cost of delivery under the former conditions.

Mexican Dollars—April 21st, [illegible]; 22d, 45⅞; 23d, 46¼; 25th, 46⅛; 26th, [illegible]; 27th, 46⅛.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 22@23c. per lb.; 22½c. for imports, duty paid.

Antimony—Chinese and Japanese brands, 5¼c.; market dull. W. C. C. brand, 5½@6c. per lb. Cookson's "C" grade, spot, 9½c. Chinese needle antimony, lump, nominal at 5c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.60 per lb., 500-lb. lots.

Cadmium—Nominal, $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $4 per lb.; black oxide, $3@$3.10 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $250@$300 per oz.

[1]**Molybdenum Metal in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.**

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 38@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—$72@$75 per oz.

Quicksilver—Nominally, $46@$48 per 75-lb. flask. San Francisco wires $48.50.

[1]**Rhodium—$200@$225 per troy oz.**

Ruthenium—$175@$200 per troy oz.

[1]**Selenium—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.**

[1]**Thallium Metal—Ingot, 99 per cent pure, $20 per lb.**

[1]**Tungsten Metal—Wire, $35@$60 per kilogram, according to purity and gage.**

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 45@50c. per long ton unit, f.o.b. Atlantic ports.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $7.45; Mesabi bessemer, 55 per cent iron, $7.20; Old Range non-bessemer, 51½ per cent iron, $6.70; Mesabi non-bessemer, 51½ per cent iron, $6.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5.80; old bed concentrates, 63 per cent, $6.70; Harmony, cobbed, 63 per cent, $6.70; new bed low phosphorus, 65 per cent, $9.50.

Manganese Ore—30c. per unit, seaport; chemical ore (MnO_2) $60 per gross ton, lump; $70@$75 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.**

Zinc and Lead Ore Markets

Joplin, Mo., April 23.—Zinc blende, per ton, high, $25.10; basis 60 per cent zinc, premium and Prime Western, $25; fines and slimes, $22.50@20; average settling price, all grades of zinc, $22.61.

Lead, high, $48.40; basis 80 per cent lead, $47.50@$50; average settling price, all grades of lead, $47.23 per ton.

Shipments for the week: Blende, 4,993; lead, 963 tons. Value, all ores the week, $158,380.

Platteville, Wis., April 23.—A base price of $27.50 was offered for 60 per cent zinc ore this week, but operators refused to sell at this price. Shipments for the week: Blende, 84 tons. Shipments for the year: Blende, 11,295; lead ore, 550 tons. Shipped during the week to separating plants, 421 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $2,000@$3,000; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats $8.50@$15, all per short ton, f.o.b Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7 per long ton, f.o.b. Cartersville, Ga. Small lots as low as $5.

Bauxite—High-grade French bauxite, $8@$10 per ton, Atlantic ports. American quotations the same. Consumers generally well supplied. Prices vary according to grade. Crude, unground, $16.50 per ton; ground, $22; calcined, ground $35; unground, $45, f.o.b. plant.

Chalk—English, extra light, 5@5½c. Domestic light, 4½@5c.; heavy, 4@4½c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$10; washed, $10@$12; powdered, $15@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $15@$20, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $15@$25, f.o.b. American ports; powdered, $35@$45, f.o.b. New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c. f.o.b. New England points.

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$25 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $15, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $32, New Mexico, Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines. Market is improving in western ground acid grades for glass and enamel manufacture.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 7½@8c. per lb.; chip, 6@6½c.; dust, 4@4½c. No. 1 flake, 7c.; amorphous crude, ¾c.@2¼c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$2 per net ton; 1½ in., $1.50@$2. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined—Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead - Burned — $38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); all f.o.b. New York.

[1]**Monazite — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.**

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $7.35; 68 per cent, $6.85; 68@66 per cent, $6.60.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 14c., c.i.f. Atlantic seaport; furnace size, 14c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 12 @ 14c.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported generally dull.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$40, talcum powder grade. Southern talc, powdered, carload lots, $10@$14 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic — White arsenic, 8@9c. per lb. in carload lots.

Sodium Nitrate — $2.75@$2.85 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; $33@$35 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.75@$1.80 per unit, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 15c. per lb. of chromium contained; 4 to 6 per cent carbon, 16@17c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $85@$90, f.o.b. furnace; resale, $90, delivered; English, $90@$95, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $32, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $50@$55; 50 per cent, $80@$85; 75 per cent, $145@$150.

Ferrotungsten—Domestic, 70 to 80 per cent W, 50@55c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$5@$6 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 20½@20¾c. per lb.; wire, 15c.

Lead Sheets—Full lead sheets, 7½c.; cut lead sheets, 7¾c. in quantity, mill lots.

Nickel Silver — 33½c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets 18¼c.; sheathing, 17¼c.; rods, ⅝ to 3 in., 15¼c.

Zinc Sheets—$11 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter: zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $35@$50 per ton, f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, **$45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.**

Chrome Brick—Straights, $75 per net ton, shipping point; arches, keys wedges, $80; splits, soaps, $90.

Fire Brick—First quality, 9-in. shapes, $40@$50 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $40@$50.

Magnesite Brick—9-in. straights, $90@$95 per net ton; 9-in. arches, wedges and keys, $100; soaps and splits, $110.

Silica Brick—9-in., per 1,000: $45@$55 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, April 26, 1921.—Steel prices as recently equalized between the Steel Corporation and independents are holding without difficulty.

Standard, small and boat spikes are again quoted at a single base price, 3.40c., as was the practice before the war, the extras for small sizes being those of the war control, slightly greater than in the old list. Chain has been reduced again, from 6.75c. to 6.25c., base, and extras on sizes under ½-in. are lessened by 25c. Cold-finished steel bars are now uniformly quoted at 3.10c., base, against cut prices recently ruling of 2.90c. to 3c. Consumption of steel is unchanged.

Pig Iron—The report that a sale of 5,000 tons of basic has been made at $22.50 is both denied and reaffirmed. Foundry is offered at 50c. under former quotations by one producer. The market is quiet. We quote: Bessemer, $25; basic, $23; foundry, $24.50@$25, f.o.b. Valley furnaces, with $1.96 freight to Pittsburgh.

Coke

Connellsville—Furnace, $3.50@$4.25; foundry, $4.50@$5.50.

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[1] Foote Mineral Co., Philadelphia, Pa.

Record Gold Tribute

Imports of the Metal From All Over the World Into the United States May Break Record of 1917 and Have Reversed the Tide of 1920—Effect on Domestic Industry Problematical—Present Gold Production Is Insignificant Compared With Imports

EDITORIAL MARKET STUDY

A YEAR AGO exports of gold from the United States impelled many bankers and economists to question the effect of these movements on the financial structure of the country. One large bank in New York seriously proposed the consideration of an embargo on gold, so as to prevent undue disturbance and contraction of the credit of the country. A reverse movement is now taking place; gold has been pouring into our coffers to the amount of about $280,000,000 net during the last six months, and the gold holdings of the United States are approaching closely the record set in 1917. Should the present movement continue, this record may be surpassed and a figure established such as was never attained by any single country's gold accumulation in all history.

What will be the effect of this tribute of the precious metal from so many countries? Some bankers maintain it will inflate prices here, and hence are skeptic as to its effects and advisability. One beneficial effect has been and will be the betterment of exchanges in those countries exporting the gold. In general, most of the nations of the world can ill afford to release their gold holdings and must resort to other methods in settling their adverse trade balances, i.e., selling goods or services, which is the only way they can ultimately discharge their heavy obligations.

Credit Inflation or Reserve Strengthening?

The stupendous economic disturbances of the last seven years have set in motion great tides beyond the control of any one nation. Fortunately, most of the unusual economic conditions arising out of these disturbances have a way of becoming settled without any extraneous assistance. So it will probably be with the present inward gold movement as it was with last year's outward movement. The added gold supplies may increase prices of commodities in the United States, in which event, theoretically, our export trade should diminish and imports should increase, resulting in subsequent exportations of gold to pay for them. Regardless of the theoretical considerations involved in the results, and viewed from an international standpoint, it is regrettable that large shipments of gold are being added to our already abnormally great stock of the metal. However, there seems to be no immediate way out of the difficulty. European nations cannot be blamed for wishing to restore their currencies to a gold basis, and one of the easiest and quickest methods is by means of gold payments.

According to a statement issued by a leading New York bank, a gold dollar in the vaults of a Federal Reserve Bank serves or may serve as the basis of deposit liabilities of $2.50 (40 per cent gold reserve behind notes) and these deposits to the credit of a member bank may in turn serve to create credit extension by that bank of anywhere from seven and one-half to fourteen times that amount, or, say, $19 to $35. Hence the alarm over another period of credit expansion. A wide difference of opinion exists, however, as to whether this would be the effect of the present gold movement, other financiers maintaining that any additional supply of gold would tend only to strengthen reserves. The results would appear in large measure to follow the banking policy of the country.

Last Year's Gold Loss Regained

On April 1, 1921, gold stocks were reported by the Treasury as amounting to $3,001,488,000. The record held by the United States was $3,121,[illegible],440 reported May 1, 1917, so that it is not unlikely that the record will be broken by the present movement. The low point in gold holdings occurred exactly three years later, following the long drain of gold after the embargo was lifted (June 1, 1919), and stocks then, May 1, 1920, totaled $2,646,615,750, a drop of over $475,000,000. This loss has been almost wiped out by the accumulation of the last eleven months.

The heaviest shipments of gold are being made from France, England, and the Scandinavian countries. Total comparative imports and exports of gold to and from the United States for the first three months of 1920 and 1921, as given in the following table, show how completely the gold tide has reversed:

	Exports		Imports	
	1920	1921	1920	1921
January	$47,816,900	$2,725,000	$12,017,500	$38,193,700
February	42,873,400	1,036,000	4,473,400	44,422,400
March	47,049,200	700,000	16,985,200	106,000,000

Although large amounts of gold have come from England, this metal is mainly the product of British mines and is sold in an open market. As an embargo is still in effect on the export of gold from England, it is impossible for bankers who negotiate gold shipments to procure the metal from the Bank of England. However, newly mined gold, South African in particular, is freely sold in the London market and is an exception to the rule. Active competitive bidding may come from India, the United States, or local British financial interests. Of late American bankers have had the field for themselves. The price paid for the gold depends upon the depreciation of the pound sterling, and at present is about 104s., compared with a normal price of about 85s.

Imported Gold Being Carefully Scrutinized

Some of the gold being sent to the United States is reported to be of Russian origin, shipped through neutral countries. Precautions are being taken by the United States Government to prevent any Russian gold being taken by the banks. The prejudice is due to the irresponsible character of an unrecognized government, whose present acts may be subject to later denunciation by a more representative administration and a claim, coupled with legal entanglements, that the Soviet regime has virtually looted the Russian treasury in selling its gold. The attitude of the various governments which are refusing to accept this gold is prompted more by solicitude for the Russian people than by any desire to harm them financially. No doubt the reports that have been circulated about the size of these shipments have been exaggerated.

Circulation of Gold Discouraged

Despite the fact that more than one-third of the world's gold stock is now in the United States, the circulation of gold is still discouraged, due to the great amount of paper money that rests upon the gold reserves.

Japan is another country having an abnormally large stock of gold, and the stagnation of business in Japan is attributed largely to the locally high prices of commodities, as a result of the heavy gold supply.

In view of the great stocks of gold in the United States and the constant additions, the effort of American producers to do their share in adding to the gold reserve seems puny. Almost twice as much gold was imported during the month of March as was produced in the United States during the whole of 1920.

COMPANY REPORTS

Butte & Superior Shows Net Decrease

Zinc; Montana

A report of operations of Butte & Superior Mining Co. for 1920 states that 87,259,471 lb. of zinc, 7,198,086 lb. of lead, 727,113 lb. of copper, 1,617,877 oz. of silver, and 2,853 oz. of gold were contained in zinc and lead concentrates produced. Income account follows:

	Year 1920	Year 1919
Revenue:		
Zinc and lead concentrates and residues	$4,460,547.20	$5,912,640.11
Less freight	681,270.77	1,051,470.59
	$3,779,276.43	$4,861,169.52
Costs and expenses:		
Mining	$2,260,486.52	$2,542,758.12
Milling--334,919 tons	1,020,044.76	1,106,795.58
Other charges, shutdown expenses, depreciation, etc	401,487.50	295,343.49
Total operating costs and expenses	$3,682,018.78	$3,944,897.19
Net income from operations plus depletion	$ 97,257.65	$ 916,272 33
Other income	$ 98,432.80	$ 126,266.40
Total income from all sources	$ 195,690.45	$1,042,538.73
Reserve for taxes, contingencies, etc.	7,761 75	177,549.00
Net income and proceeds of depletion—to surplus account	$ 187,928.70	$ 864,989.73
Surplus from operations:		
Balance as stated Dec. 31, 1919		$3,062,120.81
Net income and proceeds of depletion—as above		187,928.70
Balance of surplus—Dec. 31, 1920		$3,250,049.51

Net current assets Dec. 31, 1919, were $2,808,966.16; on Dec. 31, 1920, $2,722,209.17.

New Cornelia Surplus Increases

Copper; Arizona

A report of operations of the New Cornelia Copper Co. for 1920 shows that 40,104,493 lb. of copper was produced, and 34,146,769 lb. delivered at an average price of 18.56c. per lb. Two dividends, totaling $900,000, were paid. A statement of income and expenditure follows:

EXPENDITURES	
Operating expenses	$3,220,422 31
Salaries, office, general expenses	43,760 04
Freight, refining, marketing	671,548 99
State and Federal taxes	594,939 22
	$4,530,670.56
Depreciation charges	692,582.68
Ore depletion charges	921,028 75
Interest	19,918.68
	$1,633,530 11
Net income	991,136.58
	$7,155,337 25
INCOME	
Total earnings on metals	$7,089,512 99
Dividends	5,100 00
Other income	60,724 26
Total	$7,155,337.25

Earned surplus on Dec. 31, 1919, amounted to $2,857,463.46; on Dec. 31, 1920, $2,948,600.04. Copper on hand valued at 12½c. per lb. amounted to $4,589,691.75.

Silver King Levies Assessment

Lead; Utah

A report of operations of the Silver King Consolidated Mining Co. for 1920 states that 234,509 lb. of lead, 12,771 oz. of silver, and some other metals were produced, to the value of $26,305. Receipts totaled $253,876, and include the items "convertible notes," $152,600; "bills payable," $4,100, and balance on hand Jan. 1, 1920, $32,987. Disbursements also totaled $253,876. Capital stock outstanding Dec. 31, 1920, amounted to 850,537½ shares, $1 par. Owing to the high cost of development operations, an assessment of 10c. per share was levied on April 6, 1921.

Old Dominion 1920 Operations Unprofitable

The annual report of the Old Dominion Co. for 1920 states that 22,854,452 lb. of copper, 181,010 oz. silver, and 3,484 oz. gold was produced, and 28,818,025 lb. of copper was sold and delivered at 18.374c. per lb. Income account follows:

Income:		
Sales of copper, silver, and gold		$5,548,177.28
Expenses:		
Finished metals on hand at beginning of the year	$4,214,775 34	
Mining, treating, and refining	4,045,866 09	
	$8,260,641 43	
Finished metals on hand at end of the year	3,169,579 12	
	$5,091,062 31	
Selling, general, and administrative expenses	127,657.03	
Depreciation of plant and equipment	138,947.68	
Depletion of mines	333,340.92	
Interest	165,334.53	5,856,342 47
Loss for the year 1920		$308,165.19

Surplus balance on Dec. 31, 1919, amounted to $3,364,667.22; on Dec. 31, 1920, $3,056,502.03. No dividends were paid during the year.

Yukon Gold Deficit $393,223

A report of operations of the Yukon Gold Co. for 1920 states that the company's tin deposits in the Federated Malay States are undergoing development. A statement of the income derived from other operations follows:

	Cubic Yards	Production	Working Costs	Operating Gain
Dawson dredges	1,226.578	$415,030	$319,997	$95,033
Dawson hydraulics	1,702,264	284,969	160,837	124,131
California dredges	4,900,726	494,490	358,123	136,367
Murray dredge	1,295,900	96,332	83,248	13,084
Miscellaneous operations	....	34,216	1,244	32,972
Total operations		$1,325,037	$923,449	$401,588
Non-operating income				$109,491
Total income				$511,079
Less:				
Royalties paid			$15,603	
Interest charges, general expense and examinations			191,089	206,692
Net operating income				$304,387
Less:				
Depletion			$206,900	
Depreciation			373,923	
Advance to subsidiary companies—Written off			116,787	697,610
Net deficit for year 1920				$393,223

Tonopah Belmont Net Profits Increase

Silver; Nevada

The annual report of operations of the Tonopah Belmont Development Co. shows that two dividends were paid during 1920, of $75,000 each, or 5 per cent on the $1,500,000 shares of $1 par value fully issued. Operating statement:

	Year Ended Dec. 31, 1020	Year Ended Dec. 31, 1919
Gross value of production	$1,796,141.51	$1,231,482.59
Losses in treatment	141,338.28	106,625.85
Net values realized	$1,654,803.23	$1,124,856 74
Operating expenses	1,252,395.55	742,860.93
Net earnings mine and Tonopah mill	$402,407.68	$381,995 81
Net earnings of other plants	55,418.81	28,103.84
Total net earnings from operation	$457,826.49	$410,099 65
Other income	(a)204,531.74	(a)204,351.94
Gross income	$662,358 23	$614 451.59
Administration, exploration, taxes, etc	59 211.51	44,644 94
Net profit	$603,146.72	$569,806 65

(a) Includes dividends from Belmont Surf Inlet Mines, Ltd.

The Belmont Surf Inlet Mines, a subsidiary company, shows $866,929.46 in values realized, and a net income of $212,103.45, from which $16,844.50 has been deducted as a reserve for income taxes.

MINING STOCKS

Week Ended April 23, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Adventure	Boston	....	....	*60		
Ahmeek	Boston	....	....	49	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	½	7/16	½		
Allouez	Boston	21	21	21	Mar. '19	1.00
Anaconda	New York	39⅞	37¼	39¾	Nov. '20, Q	1.00
Arcadian Consol.	Boston	3	2⅝	2¾		
Ariz. Com'l.	Boston	8¼	8⅛	8¼	Oct. '18,	.50
Big Ledge	N. Y. Curb	5/16	¼	5/16		
Bingham Mines	Boston	....	....	8¼	Sept. '19, Q	.25
Calumet & Arizona	Boston	50	48	49½	Mar. '21, Q	.50
Calumet & Hecla	Boston	238	226	237	June '20, Q	5.00
Canada Copper	N. Y. Curb	....	....	*13		
Centennial	Boston	....	....	8	Dec. '18, SA	1.00
Cerro de Pasco	New York	28⅝	27⅛	28½	Mar '21, Q	.50
Chile Copper	New York	11¾	11¼	11⅝		
Chino	New York	24	22⅛	24	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	‡....	....	*24½		
Con. Arizona	N. Y. Curb	....	....	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	..	..	1⅞		
Copper Range	Boston	35½	34⅜	35	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*30	*28	*28		
Davis-Daly	Boston	6½	6⅛	6¼	Mar. '20, Q	.25
East Butte	Boston	9¾	8¼	9¾	Dec. '19, A	.50
First National	Boston Curb	*85	*65	*85	Feb. '19, SA	.15
Franklin	Boston	2	2	2		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol.	New York	....	....	20½	May '19, Q	1.25
Greene-Cananea	New York	24¾	24	24	Nov. '20, Q	.50
Hancock	Boston	....	....	2¼		
Howe Sound	N. Y. Curb	....	....	2¼	Jan. '21, Q	.05
Inspiration Consol.	New York	35	33⅝	35	Oct. '20, Q	1.00
Iron Cap	Boston Curb	6	6	6	Sept. '20, K	.25
Isle Royale	Boston	20½	19	20	Sept. '19, SA	.50
Kennecott	New York	20¼	19⅛	20¼	Dec. '20, Q	.50
Keweenaw	Boston	....	....	1¼		
Lake Copper	Boston	2½	2½	2½		
La Salle	Boston	1¾	1¼	1¾		
Magma Chief	N. Y. Curb	...	...	*21		
Magma Copper	N. Y. Curb	22	19¼	22	Jan. '19, Q	.50
Majestic	Boston Curb	*9	*9	*9		
Mason Valley	Boston	1¼	1¼	1¼		
Mass Consolidated	Boston	2¼	2	2¼	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	4	3½	4		
Miami Copper	New York	22⅛	20⅞	22⅛	Feb. '21, Q	.50
Michigan	Boston	...	...	3		
Mohawk	Boston	50	49	49¾	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	4¾	4½	4¾		
Nevada Consol.	New York	12	11¼	12	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	15½	13¼	15½	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....	....	*5		
North Butte	Boston	11½	10¾	11	Oct. '18, Q	.25
North Lake	Boston	½	½	½		
Ohio Copper	N. Y. Curb	....	....	5/16		
Old Dominion	Boston	20	18½	20	Dec. '18, Q	1.00
Osceola	Boston	27	26	27	June '20, Q	.50
Phelps Dodge	Open Mar.	†160	†135	....	Apr. '21, Q	1.00
Quincy	Boston	39½	38½	39½	Mar. '20, Q	1.00
Ray Consolidated	New York	13⅜	12¾	13¼	Dec. '20, Q	.25
Ray Hercules	Boston Curb	....	..	*35		
St. Mary's Min. Ld.	Boston	39	36½	38	June '20, K	2.00
Seneca Copper	Boston	15¾	15½	15⅝		
Shannon	Boston	*90	*80	*80	Nov. '17, Q	.25
Shattuck Arizona	New York	6	5¾	6	Jan. '20, Q	.25
South Lake	Boston	....	....	1½		
Superior Copper	Boston	....	....	3	Apr. '17,	1.00
Superior & Boston	Boston	1⅞	1½	1¾		
Tenn. C. & C. cfs.	New York	9½	8½	9¼	May '18, I	1.00
Trinity	Boston	*48	*43	*47	May '13,	.10
United Verde Ex.	Boston Curb	29	25½	26½	Feb. '21, Q	.50
Utah Consol.	Boston	4	3½	3½	Sept. '18,	.25
Utah Copper	New York	[illegible]	50	54	Mar. '21, Q	1.00
Utah M. & T.	Boston	1½	1½	1½	Dec. '17,	.30
Victoria	Boston	1	70	0 90		
Winona	Boston	*46	*45	*46		
Wolverine	Boston	12	11	11		
		NICKEL-COPPER				
Internat. Nickel	New York	15¼	14	15¼	Mar. '19,	.50
Internat. Nickel, pf.	New York	..		80	Feb. '21, Q	1.50
		LEAD				
National Lead	New York	75½	71½	[illegible]	Mar. '21, Q	1.50
National Lead, pfd.	New York	[illegible]	[illegible]	[illegible]	[illegible] '21, Q	1.75
St. Joseph Lead	New York	11½	11⅛	11¼	Mar. '21, Q	.25
Stewart Mining	Boston Curb	....	..	*6	Dec. '15,	.05
		ZINC				
Am. Z. L. & S.	New York	9½	8½	[illegible]	May '20,	1.00
Am. Z. L. & S., pfd.	New York	28½	28	28	Nov. '20, Q	1.50
Butte C. & Z.	New York	[illegible]	4	4½	June '18,	.50
Butte & Superior	New York	12	11½	[illegible]	Sept. '20,	1.25
Callahan Zn-Ld	New York	5	[illegible]	[illegible]	Nov. '20, Q	.50
New Jersey Zn.	N. Y. Curb	[illegible]	[illegible]	[illegible]	[illegible] '21, Q	2.00
Success	N. Y. Curb	*3	*2	*3	July '16	.01
Yellow Pine	Los Angeles			1	Sept. '20, Q	.03

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

Stock	Exch.	High	Low	Last	Last Div.	
		GOLD				
Alaska Gold	New York	1⅛	⅞	1		
Alaska Juneau	New York	1¾	1½	1¾		
Carson Hill	N. Y. Curb.	....	....	22¾		
Cresson Consol. G.	N. Y. Curb	1¼	1 1/16	1 3/16	June '20, Q	$0.10
Dome Extension	Toronto	....	....	*60½		
Dome Mines	New York	21¾	19½	19¾	Apr. '21, Q	.25
Golden Cycle	Colo. Sprgs.	*74	*68	*74	Dec. '20, Q	.02
Goldfield Consol.	N. Y. Curb	*7	*5	*7	Dec. '19,	.05
Hollinger Consol.	Toronto	7 40	7 00	7 40	Feb. '21, M	.05
Homestake Mining	New York	58¼	58	58	Sept. '19,	.50
Kirkland Lake	Toronto	*55	*50	*54		
Lake Shore	Toronto	1 36	1 16	1.36	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	2 14	1 94	2 12	Jan. '21, K	.05
Porcupine Crown	Toronto	*25	*21	*24½	July '17,	.03
Portland	Colo. Sprgs.	*50	*48	*50	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*5	*3	*4	May '19,	.05
Silver Pick	N. Y. Curb	*6	*3	*5		
Teck Hughes	Toronto	*18	*12	*16½		
Tom Reed	Los Angeles	1 12	0.99	1.00	Dec. '19,	.02
United Eastern	N. Y. Curb	2⅞	2⅝	2⅞	Apr. '21, Q	.15
Vindicator Consol.	Colo. Sprgs.	*30	*20	*30	Jan. '20 Q	.01
West Dome Consol.	Toronto	*8	*7¼	*8		
White Caps Mining	N. Y. Curb	*8	*6½	*7		
Yukon Gold	Boston Curb	*73	*70	*70	June '18,	.02½
		SILVER				
Arizona Silver	Boston Curb	*34	*28	*29	Apr. '20, M	.03
Batopilas Mining	New York	¾	¾	¾	Dec. '07, I	.12½
Beaver Consol.	Toronto	*36	*32¼	*34¾	May '20, K	.03
Coniagas	Toronto	1.90	1.75	1.75	Nov. '20, Q	.12½
Crown Reserve	Toronto	*12	*12	*12	Jan. '17,	.05
Kerr Lake	Boston	3	2⅝	2⅝	Apr. '21, Q	.12½
La Rose	Toronto	*23½	*23	*23	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	....	....	*17	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	....	....	0.95	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	7	6	6½	Apr. '21, Q	.15
Ontario Silver	New York	4½	4½	4½	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	1⅜	1¼	1⅜	Jan. '12,	.10
Peterson Lake	Toronto	*6	*6	*6	Jan. '17,	.01½
Temiskaming	Toronto	*24½	22	*23	Jan. '20, K	.04
Trethewey	Toronto	*13¾	*12	*13	Jan. '19,	.05
		GOLD AND SILVER				
Atlanta	N. Y. Curb	*1	*7/16	*1		
Barnes-King	Butte	‡....	....	1 10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*65	*60	*61		
Cashboy	N. Y. Curb	*6	*4	*4½		
El Salvador	N. Y. Curb	..	..	¼		
Jim Butler	N. Y. Curb	*9	*7	*8½	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*7	*5	*6	June '16,	.05
Louisiana Con.	N. Y. Curb	...	...	¼		
MacNamara M. & M.	N. Y. Curb	*14	*13	*14	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1 7/16	1 5/16	1 7/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1¼	1⅛	1 3/16		
Tonopah-Extension	N. Y. Curb	1½	1⅜	1 7/16	Apr. '21, Q	.05
Tonopah Mining	N. Y. Curb	1 7/16	1¼	1 7/16	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	1 1/16	15/16	1 1/16	Dec. '19, SA	.05
		SILVER-LEAD				
Caledonia	N.Y. Curb	*11	*9	*10	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	‡	....	1.05	Dec. '20,	.15
Chief Consolidated	Boston Curb	2½	2½	2½	Feb. '21, Q	.05
Consol. M. & S.	Montreal	15½	15	15	Oct. '20, Q	.62½
Daly Mining	Salt Lake	‡	...	2 50	July '20, Q	.10
Daly-West	Boston	2¾	2¼	2¾	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	....	....	2½	Apr. '21, K	.05
Electric Point	Spokane	*7½	*7	*7	May '20, SA	.03
Federal M. & S.	New York	7	7	7	Jan. '09,	1.50
Federal M. & S., pfd.	New York	23⅞	23⅞	23⅞	Mar. '21, Q	1.00
Florence Silver	Spokane	*16	*16	*16	Apr. '19,	.01½
Grand Central	Salt Lake	‡	...	*37½	June '20, K	.03
Hecla Mining	N. Y. Curb	3¾	3½	3¾	Mar. '21, Q	.15
Iron Blossom	N. Y. Curb	*15	*15	*15	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	‡	.	3 00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*6½	*5	*6½		
Prince Consol.	N. Y. Curb	⅜	¼	5/16	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*5	*4	*5	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*7½	*7½	*7½		
South Hecla	Salt Lake	‡		*91	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	[illegible]	[illegible]	3/16	Oct. '17,	.05
Tamarack-Custer	Spokane	1 90	1 90	1 90	Jan. '21, K	.04
Tintic Standard	Salt Lake	‡		2 60	June '20, Q	.10
Utah Apex	Boston	2	2	2	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*4	*3	*4	Nov. '17,	.01
		QUICKSILVER				
New Idria	Boston			*95	Jan. '19,	.25
		VANADIUM				
Vanadium Corp.	New York	[illegible]	[illegible]	[illegible]	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal	71	67	68	Apr. '21, Q	1.50
Asbestos Corp., pfd.	Montreal			80¾	Apr. '21, Q	1.75
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref.	New York	[illegible]	[illegible]	40½	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf.	New York	77½	[illegible]	77½	Mar. '21, Q	1.75
Am. Sm. pf. A	New York	65¾	65¾	65¾	Apr. '21, Q	1.50
U. S. Sm. R. & M.	New York	32	30	32	Jan. '21, Q	.50
U. S. Sm. R. & M. pf.	Boston	41½	40½	40½	Apr. '21, Q	.87½

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Civil Government at Colleges

WE HAVE OFTEN MARVELED at the intense crystallization of habit and character that goes on, let us say roughly, between the ages of fifteen and twenty-five, which is for many the college period. It is as if Nature had set aside this period to mould the man and then launched him forth, for better or worse, into the game of life.

Why is it that connections, tricks of speech and manner, habits of thought, acquired at this period, outweigh, in intensity and persistence, subsequent far more important associations and development? Many men remain set as it were in the immature mould in which they emerge from that period. Only the most virile of intellect and character keep up their evolution, and so remain in the spiritual sense forever young. But if this is the case, how much thought and care should be applied to this our main formative period! What a burden of responsibility have our college overseers, faculty, and students!

Again, if the accepted principles of evolution and ontogeny be true—and there is little doubt that they are—the individual, from the embryo to the mature man, goes through all the stages of the development of life, in his growth. Passing by the embryonic and pre-natal stages, we recognize in the small boy the so-called savage—the impulsive, nature-reacting, thoughtless stage; and those who really know the so-called savages, or primitive peoples, are quick to prove this by the obverse conclusion, that they simply have the characteristics of children and are to be best understood and dealt with as such.

The further consequence of this theory, in the adolescent youth, has not been so generally perceived; but does it not follow that before he reaches the age of manhood—which the law, dimly striving to fix a limit, has determined at twenty-one, but which may be less or a good deal more, according to the individual—he passes through the stage intermediate between that of the primitive man and the best present-day man to which his individual heritage entitles him? For the so-called Anglo Saxon, will not the adolescent pass through all that struggling, warring, tribal, feudalistic, fiercely sensitive, chivalrous, emotional, intolerant, loyal, impulsive period, which we may understand by studying the history of our race from the remote and middle ages down to the present? The country recognizes this principle when it drafts youths of eighteen into the army but denies them a vote till they are twenty-one, thereby frankly and brutally ruling that they make good soldiers but poor citizens at that age.

This bears on the problem of the colleges—their training, the discipline and government. It means that the student must be educated—led out, as the Latin derivation implies—in the best possible way to the highest that evolution has attained at the present day. It also means moderate and progressive and wisely safeguarded experiments in student self-government; but, as a corollary, that absolute self-government must be tempered and guided and controlled by the mature men; and the responsibility for this naturally rests on the faculty and on the overseers or governing boards. These mature men have, in the best sense, a mandate over the youth under their control; they have at the least a protectorate, and are more responsible for the students than are the students themselves.

Boards of overseers and faculties should bear these truths in mind; and student government should accordingly be under mature control. Such boards and faculties should be chosen with this in view—that they represent the best as mature men and guides and friends of youth—as much as or more than from their learning and their ability to cram the expanding brain.

Where the superior government is inadequate, weak, and unfit, and student government is given full sway, we shall see strange things, which demonstrate at once our theory. Democratic government tends to become tyrannical, just as in our immature democracies: personal liberties are curtailed, and the government indulges itself in making petty rules that attack personal liberty, and takes a mediæval delight in their autocratic and often cruel enforcement. A freshman must not cross a certain strip of grass, or wear a necktie of a certain color, or wear any but a certain cap, and so on and so on. Some of our colleges countenance long lists of gravely enacted and printed rules of this infantile kind. Thus the colleges, which should represent the maximum of individual expression, freedom, and equality, often hark back, instinctively, further than the small-town spirit, to the mediæval classes, cliques, special privileges, and petty blue laws which they should strive to outgrow.

The oldest member of the Cornell faculty, in point of service, Professor George Lincoln Burr, has come forth with a classic pronouncement on this condition as it exists at Cornell. The occasion was the ducking by 200 sophomores of a freshman for failure to wear the prescribed freshman cap; after which ducking the freshman left the college. We quote from the daily papers:

"Professor Burr intimated that he would resign unless the board of trustees of the university took action to prevent the interference of student government with individual liberty. . . .

"In his statement Professor Burr described meeting a group of students on their way home from the Beebe Lake ducking. 'They were returning,' he said, 'from the punishing by lynch law of a fellow student for failure to wear a certain cap. One of them was heard to remark in self-congratulation: "Here are 200 real men." He was right. The other day I saw a group of dogs baiting a kitten. They were real dogs. They had, I have no doubt, red blood.'

"Professor Burr said that he regarded a matter of clothing a small thing to fight for, and asked by what right the students are permitted to prescribe costumes for other students. He then declared that the freshman cap rule was formulated some years ago by a 'handful of students at a down-town resort,' and that the student opinion has since come to acquiesce. 'But what representation was there?' he asked. 'What chance for discussion? What room for protest? And who could give any body of students authority in matters to which not the university itself, nor the civil community, presumes to dictate?'"

Underground Electrical Prospecting

WE PRESENT in this issue the first part of an extended abstract of an article written by C. Schlumberger, a mining engineer and professor in the Ecole Nationale Superieure des Mines, Paris. Sherwin F. Kelly translated the article from the French under the direction of Mr. Schlumberger.

The article is a conservative review of efforts having for their purpose the discovery of mineral deposits by electrical methods, a theoretical discussion of the potentiometer method of examining ground, and a description of experiments to determine the applicability of the method to mineral discovery or ore hunting; together with such conclusions as were warranted by the experimentation. Inasmuch as the subject is presented scientifically, and as the conclusions are conservative and credible, although there is a noticeable optimism on the part of the author at times, we feel justified in presenting the article to our readers.

The method consists in passing a direct current between two distant points and determining lines of equipotential between the two points by means of a potentiometer, equipped with non-polarizing electrodes. The lines of equipotential are mapped and can be traced out with a considerable degree of precision. Concentration, spreading or deformation of the lines of equipotential, symmetrical or unsymmetrical disposition of the plotted curves, are the keys by which the underground structures are interpreted.

Necessarily, there must be worked out a relation between accurately known structure and the indications of the potential map. Mr. Schlumberger has done this in a sufficient number of experiments to be imbued with the thought that the method presents useful possibilities. In his conclusion, he states that "electrical processes will probably never give certain and precise results. Their domain is to furnish more or less clear indications, serving as a guide for the orientation of researches by drill, shaft, or gallery." In a tentative way he limits the application of the method to comparatively shallow depths. He states that "The present study constitutes a beginning. Perfections or other analogous methods present themselves to mind and seem to merit serious investigation."

The weak points of the method appear to be, first, the greater influence of the immediate surface zone upon the equipotential map as compared with deeper zones about which naturally there is need for greater information (a good geologist can usually work out the structure by the customary method of extrapolation from observed exposures to a greater depth than the equipotential map indicates); second, accentuated topographical relief in itself favorable for detailed geological examination appears to be a considerable obstacle to the accurate interpretation of the equipotential map; third, unless the mass of an orebody at depth is sufficiently great, it will have small influence upon the surface equipotential map (where large orebodies exist at depth, the surrounding evidence of their presence in many cases extends to the surface at some point or points and falls within the range of ordinary geological examination); fourth, spontaneous polarization, earth currents, heterogeneities produced by insignificant presence of water zones interfere to a greater or less extent and necessitate greater study before their influence can be estimated accurately; fifth, the method appears to be suitable for the study of steeply dipping strata and formations (in themselves favorable for geological examination) and less adaptable for horizontal or blanket formations; sixth, the crucial test of actually discovering significant ore deposits in regions where there has been no exploitation has not been applied.

Our own study of Mr. Schlumberger's presentation leads us to the conclusion that the method is limited in its scope. Only to the hands of a thoroughly trained and experienced mining geologist can the making and interpretation of the potential map be intrusted. Such a geologist would have to spend several years in intensive study of the method as applied to known field conditions before he would be competent to make use of it. Under such circumstances the method might become an auxiliary to the customary field methods now employed. It would, however, extend and possibly assist the extrapolation between known structures, and thus tend to give both areal and structural geological maps a higher degree of accuracy than they now have. At present, such maps possess a large personal element, and the potentiometer method offers some hope of reducing this, although it cannot eliminate it entirely.

The potentiometer method will not revolutionize mining, nor will it discover many new deposits to further embarrass the lethargic metal market. It will at best simply add another field method and additional instruments to the kit of the field engineer, which up to the present contains a clinometer, compass, magnetometer, and hand level. It will provide further work for the surveyors and endless discussion among mining geologists. In the end, it will probably contribute its mite toward the continuation of the mining industry.

The Licensing of Mining Engineers

THE LICENSING OF ENGINEERS by state authorities has been provided for by law in many states, and in many of the remaining states such a law is under consideration. The American Association of Engineers is active in support of such legislation, believing that it will prevent the practice of engineering by those who are unqualified: and, conversely, secure the available practice to those who are qualified. The Engineering Council, which represents all engineers, has considered the problem, and recommended a model bill which would provide the maximum opportunity and equity, granted that such legislation must pass. We find many engineers in general—civil and electrical engineers—lukewarm or indifferent on the subject and concerned only that the licensing legislation, taken as inevitable, shall be as well planned and thoughtful as possible. In New York State at present there is a movement to take away the privilege of corporations to secure a license, and to insist that instead only the individual engineers employed by those corporations shall be licensed. This is a question that concerns mining engineers little. The great engineering corporations which have developed in civil, mechanical, and electrical engineering have not similarly grown up in mining engineering.

The mining engineer's profession is indeed a thing somewhat apart from engineering in general, and it will be found to be a mistake, and a lack of necessary refinement of definition and precision, to always lump his profession, his needs, and his expression with all the other engineers, from ceramics to sanitation. He is engineering the great mining industry; he is a scientific exploiter of natural wealth, more akin to the scientific farmer than to the builder of subways. He must know geology, mining methods, chemistry, metallurgy, mechanical and electrical engineering, accounting, marketing, labor, and human nature. He should speak for himself.

What does the mining engineer think of the system of licensing? We find in conversation a wide diversity of opinion. Many mining engineers are opposed to it as (in their opinion) productive of no tangible good, while it would involve red tape and the prospect of politics and ring methods. Others believe strongly in it, holding that it will exclude the unfit pretender or the half-baked pseudo-engineer, and, of course, to that extent, protect them in their own practice. But through none of his organizations has the mining engineer expressed his collective opinion on the subject.

Dollar Copper

DAIRYMEN WHO PURCHASE margarine instead of butter for home use are the object of much contemptuous criticism by journals serving the dairy industry. How can the general public be expected to favor butter over margarine when dairymen themselves buy the cheaper product, is the general argument. Following the same idea, why don't we urge copper producers to buy copper products? Frankly, we do not have the heart.

Not long ago, a certain company in one of our best-known Western mining districts had occasion to buy some sheet copper and some copper tubing. The order was sent to the Salt Lake Hardware Co., reputed to be one of the largest and most reliable supply houses of the country. Now, with copper selling for less than 13c., and sheet copper quoted at 21¼c. wholesale in New York, what do you suppose this buyer of a few sheets of copper had to pay? Why, 54c. per lb. plus freight. And with copper tubing quoted at 26c. per lb. in New York, what do you think the buyer had to pay for 200 ft. f.o.b. Salt Lake? A mere $1.04 per lb. The extra 4c. over the round figure in each case is interesting. Is it to make it appear that the justifiable price has been carefully calculated to the exact cent, or is the hardware company patterning after the department store bargain? If the latter, why not 49c. and 99c. instead?

Copper tubing is of course in great demand just now, but we don't all use it for that, and it seems unfair that the law-abiding consumer should pay bootleg prices. The next time we see a copper producer who has purchased something of copper when he might have taken a substitute, we shall feel it in order to salute him as a true sport.

The High Cost of Mining

MINING MEN ARE COMPLAINING about the high prices still charged for many necessary operating supplies, particularly for explosives, and generally believe that sellers of such commodities are neither doing their part in assisting deflation nor in any way trying to alleviate conditions for the miner, compelled to market his product below cost or cease operations. In the *Engineering and Mining Journal* of April 9 was published a table of the comparative cost of mine supplies in recent years. This table was prepared by the American Zinc Institute. Comparing prices in December, 1920, with those in 1914 for some of the more important articles listed, we obtain the following percentages of present as against pre-war figures:

	Per Cent		Per Cent
Coal	304	Canvas belting	167
Gasoline	260	Iron pipe	308
Kerosene	305	Malleable fittings	286
Cylinder oil	321	Brass valves	225
40 per cent gelatine	174	Drill steel	200
Fuse	243	Wire-wound rubber air hose	212
Waste	222	Carbide	165
Sheet steel	140	Nails	247
Hard iron	140	Wire cable	222
Rubber belting	140	Manila rope	260
Babbitt	129		

It will readily be seen that deflation still has a considerable distance to go, although, of course, prices have dropped considerably in the last four months since the data were collected. Metal producers are in a different position from most manufacturers. They not only find little outlet for their product, but must take approximately pre-war prices. Manufacturers, in general, are asking prices which would net them a profit with normal sales, but can sell next to nothing.

As to explosives, they do not seem to be advanced as much as most other supplies, but the fact that aggravates and exasperates mining men is that present prices are approximately the same as were charged at the height of the war demand. For example, 40 per cent gelatine was $11.50 in 1914, $20.50 in 1917, $22.50 in 1918, $21.50 in 1919, and $20 in December, 1920. Large quantities of glycerine and sulphuric acid are used in the manufacture of explosives. Early in 1918, sulphuric acid was about $42 per ton, and glycerine, 70c. per lb., compared with $20 and 20c. at the end of 1920. It would appear that the manufacturers of explosives did not boost prices to the extent that was fashionable during the war. Doubtless they felt that their tremendous profits were sufficient without their doing so. Now, with labor still high, they probably do not feel that their prices are exorbitant compared with those of other commodities. However, mine operators do not look at things in this light. They note the low cost of acid and glycerine and feel that prices of the finished article should come down. They are dissatisfied, and we have heard that some explosives consumers are uniting to manufacture their own dynamite.

Metals seem to be the only commodities that are cheap. In the whole list of supplies whose prices were published, elevator cups were the only things shown to be cheaper now than before the war. But, unfortunately, even elevator cups are more expensive, the pre-war price apparently being a typographical error! However, we should take heart. Cheap raw materials will in time result in reasonable prices for manufactured products, and probably by that time we shall also have good prices for our copper, zinc, and lead. So the cycle goes.

WHAT OTHERS · THINK

Is It Taxation Without Representation?

At a meeting of the New York Section of the Mining and Metallurgical Society of America on March 24 the subject of mine taxation was discussed by several specialists on that subject. The absence of bias, and the fairness with which the whole matter of national and local taxation was handled, would have delighted departmental officials had they heard it. The tone of the discussion augurs well for the results of the work of the committee which the society has appointed for the purpose of considering mine taxation. The bulletin containing a report of this meeting will be one of the most interesting that the society has issued. Its subject matter may not properly be suggested in advance of publication, further than to state that nothing was said at the meeting of the taxes paid by American-owned mines in foreign countries and by American employees working abroad.

This is a subject entirely sufficient unto itself and is, perhaps, more closely associated with another interesting activity of the society than it is with mine taxation. I refer to the subject of an American foreign policy as relating to mining industries abroad.

What encouragement, if any, is offered to Americans by our Government to develop mineral resources outside of the United States? Little or none. Mining is not singled out for special neglect, but stands on much the same footing as the development of any other foreign business.

The Carnegie Endowment for International Peace recently published a collection of official statements of Presidents and Secretaries of State on the American foreign policy as it has been developed through various administrations, from that of Washington down to the present time.

It does not require many pages to give a fair idea of the extent of our foreign policy. Three points only stand out with prominence, the Monroe Doctrine, the settlement of international differences through arbitration or an international court, and the desire to keep the United States out of trouble by advising the citizens to settle their own difficulties in foreign lands without calling for help from home.

But why should we bother our Government with the development and encouragement of foreign industries, with the development of minerals in other lands than our own?

The answer to the first part of the question appears in some form in every issue of the daily press, and as mining is but one phase of the development of industries abroad, the reasons for fostering the mining industry are the same.

We are now fortunate in having in the Cabinet of the President at least one man fully alive to the necessities of the situation. Already he is making headway with plans that have never before been thought of in Washington. And what can the Secretary do for the mining industry? We hope for much. We will be thankful for little. Perhaps one of the greatest aids that we could ask, and one that it would cost least to give, would be the moral support of our Government; a declaration of purpose to the effect that while we conducted our operations in obedience to the laws of our country and in conformity to those of the land where we work, so long will our country undertake to see that we receive justice under those laws.

Again, in the matter of taxation there is an opportunity to render vital assistance. At the last session of Congress the Dyer Bill passed the House. This bill remitted certain income taxes of companies formed to promote trade with China. This principle could logically be expanded until it included incomes derived from foreign investments in mining enterprises, and it would be with entire justice to our Government and all of its citizens.

A serious attempt is now being made through the National Chamber of Commerce, and through American chambers abroad, to except from the Federal income tax all or a portion of salaries earned abroad, salaries that are earned in the development of foreign trade or industries.

Many mining engineers feel that they are today paying a high price for the privilege of retaining their American citizenship, while they and their families remain abroad and suffer all the inconveniences of the absentee.

Many an engineer who regularly pays his taxes feels that his Government is giving him no quid pro quo. It would be proper that these taxes be reduced or remitted until the American or his family set foot on their native land, but what would be far more proper, and more to the point, would be the establishment and maintenance of a policy recognizing the responsibility of this Government toward its citizens temporarily abroad; a policy that would make the payment of American income taxes by this class of citizens a pleasant duty rather than a disagreeable necessity.
F. F. SHARPLESS.

New York.

How Should a Mining Engineer Be Trained?

No man hurts our feelings more than he who asserts or implies our personal inferiority—even if the inferiority be real, the assertion of it irritates none the less. I am therefore not surprised that several of your readers have taken exception to your expression, "only a correspondence-school engineer." So, also, they may to your jocular suggestion that such engineers "should be restricted in their practice to engineering by correspondence."

Let us be quite honest with ourselves, and see if we do not all agree on the main points under discussion. Lincoln was the greatest American of his time, if not of all time, yet not even the most ardent of the home-study advocates would recommend an educational system based on his training. But no more should we deride him, as did the press of his day, because of his lack of a "school" education. In other words, though practically every one of your readers will acknowledge that a technical training is of real value, this does not justify the implication that because a man has not had that advantage he cannot be a first-class mining engineer.

All men of average intelligence may be divided into three classes: First, the considerable number who could not, with any amount of training, become mining engineers. Second, the many who can achieve that distinction (?) only by years of careful instruction, both theoretical and practical. Third, the select few who perhaps have had no more schooling than Lincoln, but who so quickly grasp the essentials of the profession and exercise such good judgment that they speedily develop from muckers and miners into first-class mine superintendents and managers. These men of the third class are deserving of high praise, and merit the name "mining engineer" quite as well as the average technical graduate in the profession.

Eight years of university life, as student and instructor, have fully convinced me of the value of the training obtained in such institutions. But I have great respect for the man who has actually "made good" in any profession, be he a correspondence-school graduate or otherwise. F. E. LATHE.

Deschenes, Que.

Reminiscences of Cyaniding in Ecuador

In connection with the article on a cyanide plant in Ecuador, which appeared in the *Engineering and Mining Journal* of April 2, I wish to make a few comments:

It is fourteen years since some of us talked over the proposed plant for the property discussed. It is twelve years since I was there, as resident manager.

The author refers to the small percentage of sulphides in the ore. From 1902 to 1908 the ore contained about 10 per cent of sulphides, if my memory be reliable. The total gold and silver extraction then, with a crude plant, was about that now claimed for the new plant, with its high gold and low silver extraction.

The plant is situated where severe earthquakes occur frequently, averaging two per month, besides the little shakes like those one still feels in San Francisco. Several concrete vats, rectangular, without reinforcement, were still standing, badly cracked, in 1902, when I first saw Portovelo. A year or so later a reinforced, circular, concrete vat was constructed for mill solution storage. It resisted the shakes for several years, and was in good condition when I last saw it. It was built much more cheaply than the vats described. The reinforcement was chiefly of spirally wound steel cable.

The author's description of the pebbles used for regrinding is of interest. A consumption of 110 lb. of pebbles per ton of ore will materially affect assay results per ton. I wonder if this "salting" was taken into account. The minimum mule freight on Danish pebbles from the coast to the mine, at the property described, is about the same as the railroad freight from Galveston to Colorado mining camps. Sometimes three pounds of pebbles will crush a ton of ore. I think the Zaruma ores are about as hard as the Telluride, Col., ores. With an experience of over five years in each place I think the Zaruma cheap pebble experiment was not worth while.

A dozen points in the operating details interest me. The great improvement in precipitation over our old methods there is noticeable. When we precipitated three pounds of copper per ton of solution, and had a string of zinc boxes almost as long as a modern carbon black plant, we welcomed the use of lead acetate and other helps.

The property of the South American Development Co. is of great promise. Large areas are almost unprospected, although Pizarro's men mined there. Some day operations will be conducted on a scale that will attract the attention of the world. W. H. STAVER.

Idaho Springs, Col.

To Which We Say "Amen"

The present depression in the mining field has hit all classes connected with the industry. Technical men are no exception. Many able men have had to turn from mining and metallurgy to new and untried fields in order to maintain a livelihood. Some have not even succeeded in doing that. Fortunate individuals are about to take much-needed vacations while awaiting the turn for the better. Certain it is that many accomplished men are now finding considerable time on their hands after their activities of the last few years.

Contemplating this condition, it occurred to me that now might be a good time for these technical men to set down some of their experiences. When rushed with daily duties there has been little time to make records of the methods used and the results obtained. There is the danger that, if these things are not recorded, the first fresh impressions may fade away.

It would be a fine thing if our technical men could be induced to contribute some of their experiences to the literature of the day. The preparation of the technical article is one of the finest possible ways for a man to get a good bird's-eye view of his own work and to make more exact many things which were rather hazy in his own mind. When he comes to put down in black and white just what has been done he finds considerable data requiring verification and correlation. Oftentimes when all the data has been got together and studied as a whole, a better method of procedure will be revealed than had been actually utilized. Would it not therefore be a good thing for both the writers themselves and their brethern of the same profession to now use some of the idle time in setting down the experiences and conclusions of the last few years' work?

Salt Lake City. L. D. ANDERSON.

The Crowe Process on Gold Solutions

Allan J. Clark's figures in *Engineering and Mining Journal* of March 19 are welcome: they amply confirm my suggestion that that consumption of 0.407 lb. of zinc per ton of ore should never have been permitted. They emphasize Mr. Clark's own figures (p. 23, Vol. LII, *Trans.* A. I. M. E.) of 0.2 lb. of zinc dust to the ton for precipitation of his low-grade solutions.

I shall be grateful to Mr. Clark if he will supplement his figures by a statement as to the tonnage and content of solutions precipitated and the efficiency and proportion of the precipitation in both circuits. A low zinc consumption obtained by the recirculation, through ore charges, of solutions imperfectly precipitated would not commend itself to the majority of cyanide workers. Mr. Clark himself states (p. 69, *idem*): "The establishment of the decantation process creates a large volume of low-strength solution which is successfully precipitated by zinc shavings, where zinc dust has made only a qualified success." ALFRED JAMES.

London.

The Vanadiferous Asphaltites of Central Peru

Occurring as a Series of Veins in Cretaceous Limestones, They Are Found in Four Districts—Vanadium Is Present, but Not in Sufficient Quantity To Make Commercial Extraction Profitable

BY JOHN G. BARAGWANATH
Written for *Engineering and Mining Journal*

THROUGHOUT the period of the war, and during the year following the armistice, attention was turned to the asphaltite deposits of central Peru as a possible source of vanadium, the ores of which were then in considerable demand. Investigations of some of the more promising of these deposits were made by a number of engineers with a view to burning the asphaltite and producing an ash sufficiently high in vanadic oxide to warrant its exportation to the United States or England. After satisfactory tests had been carried on in the laboratory, several practical experiments were made in the field on small lots, but the results obtained were not definite enough to justify the exploitation of any of the deposits on a commercial scale. It is extremely doubtful, in fact, whether the contained vanadium of these asphaltites could ever be profitably extracted, except under abnormal conditions.

Many of the Yauli and Huari deposits have been worked intermittently for the last thirty years, the asphaltite being burned under boilers and in reverberatory furnaces, and used for domestic purposes.

OCCURRENCE OF VANADIUM COMMON IN PERUVIAN ASPHALTITES

The presence of vanadium in the Llacsacocha asphaltite was discovered as early as 1892, at which time the mine was being worked by a French company to furnish fuel for boilers at the near-by silver mines of Andaychagua. Several tons of the ash are reported to have been shipped to France for experimental purposes. Subsequent investigations showed that the occurrence of vanadium was not confined to the Llacsacocha deposit, but that practically all of the asphaltites of the region carried appreciable amounts of the metal.

D. Foster Hewitt has described some of the asphaltites of the Yauli district in connection with his reports on the famous Minasragra mine of the Vanadium Corporation, and has suggested an interesting theory of their origin. Among other authorities who have discussed these deposits are W. F. Hillebrand, W. G. Wagner, Lester Strauss, F. Malaga Santolalla, and C. L. Romero. In 1919 I had occasion to make a detailed study of this field, and I present herewith some of the data obtained at that time.

OCCURRENCE IN FOUR DISTRICTS

The vanadiferous asphaltites of central Peru are found in the departments of Junin and Lima, along both slopes of the western Cordillera of the Andes, at altitudes ranging from 12,000 to 16,000 feet. The known occurrences extend from Marcapomacocha on the north to Sillapata on the south. They may be roughly divided into four districts, the location of which is shown on the accompanying map.

The district of Yantac, near Marcapomacocha, comprising part of the Province of Yauli, Department of Junin, and part of the Province of Canta, Department of Lima, lies about twenty-eight miles over rough trails from Casapalca, on the Central Railway of Peru, at an altitude of over 15,000 ft. More than a dozen veins have been discovered. They occur interstratified in limestone of Cretaceous age and vary in thickness from a few inches to five feet. The asphaltite carries from 10 to 20 per cent ash, which runs from 5 to 16 per cent vanadic oxide, with an average of about 7 per cent. A typical analysis of the asphaltite is as follows: Moisture, 5.2 per cent; volatiles, 10.3 per cent; fixed carbon, 72.2 per cent; ash, 12.3 per cent.

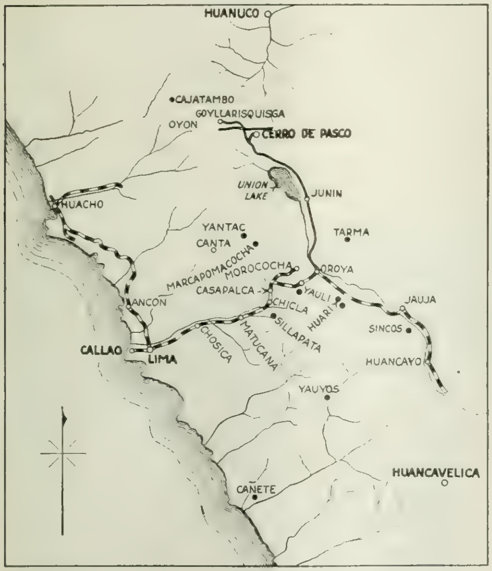
The Yantac district is at present of little or no commercial importance as a source of fuel, because of the difficulties of transportation and the irregular occurrence of the asphaltite in *rosarios*, or small lenses separated by nearly barren stretches. Furthermore, the high percentage of ash and the comparatively low vanadium content render the asphaltite unsuitable as a source of the alloy.

THE DISTRICT OF YANTAC (MARCAPOMACOCHA)

The asphaltite deposits of Sillapata are situated in the Province of Huarochiri, Department of Lima, fifteen miles from the railway station of Matucana, at an altitude of 14,000 ft. The veins occur in a strip of metamorphosed limestone between two large flows of rhyolitic rocks. They are narrow and irregular, the asphaltite having been deposited both along the planes of stratification of the limestone and in fissures cutting across the formation at various angles. The asphaltite is low in volatiles and high in fixed carbon and ash. It breaks fine, and, consequently, is practically worthless for domestic use. The vanadium content of the asphaltite will average slightly less than 1 per cent V_2O_5.

The most important deposits of asphaltite are found near Huari, a small town in the Province of Tarma, Department of Junin, lying a few miles west of the southern extension of the Central Railway, at an elevation of 12,000 ft. The mineral is more nearly a true asphaltite (grahamite) in its appearance and behavior and in analysis. There are two deposits in the Huari district which warrant a brief description.

The Chiucho Mine.—This property is situated fifteen miles from the railway, at an elevation of about 13,800 ft. It has been worked to a depth of 150 ft. and produces about 300 tons of asphaltite per month. The asphaltite occurs in lenticular deposits interstratified in a series of limestones and sandstones. The principal vein, which varies in thickness from 6 in. to 35 ft., strikes northwest and southeast, with a nearly vertical dip. Unlike most of the other asphaltites, the mineral burns with a long, yellow, smoky flame and easily melts down into a sticky, tar-like substance. Owing to its low ash, the asphaltite is regarded highly as fuel. A typical analysis of Chiucho asphaltite is as follows: Moisture, 2.35 per cent; volatiles, 40.45 per cent (sulphur, 4.9 per cent); fixed carbon, 55 per cent; ash, 2.20 per cent.



SKETCH MAP OF CENTRAL PERU SHOWING THE LOCATION OF THE ASPHALTITE DEPOSITS

The percentage of vanadium present in the ash is unusually low, ranging from 1 to 2.5 per cent.

The La Lucha Mine.—This property is situated five miles from the railway, to which it is connected by a small tramway. The vein, which follows the bedding planes of limestone, consists of a series of lenses widely separated by long barren stretches. A notable feature of the deposit is the number of narrow, horizontal stringers of asphaltite which branch off from the vein and penetrate the cracks in the limestone. The asphaltite is similar in character to that of the Chiucho mine, though somewhat higher in ash and even lower in vanadium. A typical analysis is as follows: Moisture, 1.15 per cent; volatiles, 48.65 per cent (sulphur, 5.2 per cent); fixed carbon, 44.48 per cent; ash, 5.72 per cent.

The asphaltites of the Yauli district, which, with the exception of the Rumichana mine, are not at present important as a source of fuel, are of interest because of their generally high vanadium content, and the consequent possibility of their being worked for that element. The asphaltite is distinctly anthracitic in character, is low in ash, and burns with little or no flame, leaving a light, feathery ash, which when exposed to the weather becomes green, owing to the presence of vanadic oxide. It occurs in highly deformed and tilted limestones of Upper Cretaceous age, both along the planes of stratification and in gash veins cutting independently across the formation. To illustrate the varied types of deposits in the district three characteristic veins will be described.

Llacsacocha Mine.—The old Llacsacocha mine lies thirteen miles, by trail, south of the town of Yauli. The asphaltite, though softer, resembles certain types of anthracite in appearance. It is black and lustrous, apparently free from pyrite, and occurs as a series of lenses which may be traced for more than 1,200 ft. along a single bedding plane in limestones dipping at angles of from 55 deg. southwest to nearly vertical. Numerous faults of small displacement and lines of shearing within the lenses are evidences of considerable local movement since the formation of the asphaltite. With the asphaltite are associated bands of dark shale.

At first glance the deposit appears to be an ordinary seam of somewhat crushed semi-anthracite coal, but closer inspection reveals tiny fissures filled with asphaltite radiating from the main vein. The inclusion of "horses" of waste within the asphaltite, and especially the manner in which it has been deposited around these fragments, are additional proof of the origin of the vein.

About one hundred feet east of the Llacsacocha vein in the foot-wall country rock occurs an intrusive sheet of light green, acidic rock, which also follows the bedding planes of the limestone. This intrusion may have had some influence in the alteration of the original asphaltum to its present anthracite state. Several analyses of the clean Llacsacocha asphaltite are available, and of these the following is a typical example: Volatiles, 88.2 per cent; fixed carbon, 9 per cent; ash, 2.8 per cent.

Samples of several piles of clean asphaltite on the dumps averaged 3 per cent ash, carrying 15 per cent V_2O_5, indicating a vanadium content in the material of but 0.45 per cent V_2O_5. Mr. Hewitt, however, gives as the result of thirty-seven samples, secured from the workings, an average of 7.3 per cent ash and 1.06 per cent V_2O_5 in the asphaltite, which probably more nearly represents the average vanadium content of the deposit as a whole, inasmuch as the "bone" appears to run higher in the metal than the clean asphaltite. It is probable that asphaltite could be produced in some quantity from the mine which would average from 4 per cent to 5 per cent ash, with 15 per cent to 20 per cent as the proportion of V_2O_5 in the ash. In actual practice the percentage of ash would be higher, owing to the difficulty of obtaining complete combustion. Although the vanadium content of the asphaltite may average 1 per cent V_2O_5, attempts to burn it on a commercial scale have not proved successful, because of the mechanical difficulty of securing an ash free from unburned asphaltite and the fact that the proportion of ash in it is so low that, even should a clean ash be obtained, the large tonnage that must be mined and burned to produce a ton of ash makes the cost almost prohibitive.

Rumichaca Mine.—This property is probably the largest of the Yauli series. Owing to its favorable location on the railway, the mine has been extensively worked for the last eight years, the asphaltite being shipped to the Casapalca smelter. The asphaltite is similar in character to that of Llacsacocha, but breaks finer in mining, making it of little value, except for certain smelter purposes. It occurs in irregular lenses interstratified in limestone, and varies in thickness from a few inches to forty feet at one point. The strike is north 37 deg. west, and the dip varies from 70 deg. southwest to vertical.

A large number of samples, taken from the run-of-mine, clean-screened asphaltite and "bone," show that although the "bone" is much higher in ash, it is also somewhat richer in vanadium. The average of all samples gave 16 per cent ash, with 5.3 per cent V_2O_5 in the ash. Samples of a 2,000-ton pile of clean asphaltite gave an average of 9 per cent ash, which carried 7 per cent V_2O_5. Experiments were made in burning the Rumichaca asphaltite for its vanadium, resulting in the production of 1.5 tons of ash averaging 8 per cent V_2O_5. Great difficulty was experienced in causing the asphaltite to burn, owing to the predominance of fines. No doubt special furnaces could be devised to handle this material, but the vanadium content appears to be too low to warrant such an undertaking.

Negrita Mine.—The Negrita mine, situated fifteen miles from the railway, near Huallacocha Lake, at an altitude of nearly 16,000 ft., is an excellent example of the true fissure of asphaltite cutting across the limestones and shales of the district. The vein strikes northeast and dips 60 deg. northwest. Three distinct lenses have yielded about 2,000 tons of asphaltite of good quality. Where the vein cuts a stratum of shale it becomes narrow and badly split up, owing, probably, to the greater elasticity of the shale, in which a clean fracture is less likely to be produced than in the limestone. However, at a distance of about a thousand yards, another vein, known as the Cacharata, exhibits a two-foot fissure of asphaltite, which is entirely across a series of shales. Both veins are not far from a large intrusion of monzonite.

A sample from the only available pillar in the Negrita workings showed 2 per cent ash, with 17 per cent vanadic oxide in the ash. A general sample of a pile of 130 tons of asphaltite gave 9.5 per cent ash, carrying 5 per cent vanadic oxide. Although the Negrita asphaltite breaks more coarsely and is generally purer than that of Llacsacocha or Rumichaca, it is similar in appearance and analysis.

ASPHALTITES OCCUR AS LENSES IN CRETACEOUS LIMESTONES

It will be noted from the foregoing that, with the exception of the Huari veins, there exists a marked similarity in the occurrence and geological association of the Peruvian asphaltites. They are all found as series of lenses in extremely deformed and tilted limestones of Cretaceous age, in which are narrow interbedded bands of shale. They appear to be invariably in the neighborhood of later igneous rocks, a circumstance which may be only accidental, or may have exercised some influence in the formation of the deposits. The asphaltites exhibit little or no pyrite, but carry from 2 to 5 per cent of sulphur. They all contain vanadium, which is probably present as a sulphide.

Judging from their analyses and physical properties, the Huari asphaltites must be classed as grahamite (G. H. Eldridge, 22d Ann. Rep., Geol. Sur. 1901). Practically all of the other asphaltites more nearly resemble impsonite, although in many cases the proportion of fixed carbon to volatile hydrocarbon is higher than that indicated in typical analyses of impsonite. The impsonite varieties undoubtedly represent a later stage in the metamorphosis of the asphalts than the grahamites of Huari. Their relation to the grahamites corresponds to that between anthracite and bituminous coal. The difference between the two types of asphaltite may be due to greater distortion of the sedimentary strata in which the impsonite occurs and to the proximity of recent igneous rocks.

LENSES SHOW CHARACTERISTIC WIDENING AND PINCHING

The asphaltites seem to have been formed toward the close of the period of movement which resulted in the violent warping, faulting, and tilting of the limestones which are so prevalent in central Peru. The lenticular formation of the deposits may be due to the fact that they are invariably fissure veins, whether they follow or cut across the bedding planes of the limestone. These fissures having originally had a somewhat undulating course, subsequent movement has brought the concave and convex portions of the fissure walls opposite each other, causing the characteristic widening and pinching of the asphaltite.

VIEW SHOWING LLACSACOCHA LAKE AND THE OUTCROP (IN WHITE) OF THE LLACSACOCHA VEIN

Fairly definite theories have been advanced regarding the origin of asphaltites in general. In Peru it would appear that certain fissures had tapped "pools" or reservoirs of heavy asphaltic petroleum existing either in the limestones and shales or in some underlying formation. The oil probably arose in the fissure, owing to hydrostatic pressure, much as it rises in many wells when the oil sands are perforated. True asphalts were then formed by the inspissation of the petroleum. They were the products of natural distillation, the volatile constituents of the original petroleum having been lost. Subsequent pressure, creating a tendency for the fissure to close and thus squeeze the asphaltum filling, caused some of the material to be forced out into the tiny joints and crevices of the wall rock. Continued pressure, aided possibly by heat and by the presence of sulphur in the form of sulphuretted hydrogen, produced a general hardening of the material and a metamorphosis to its present coal-like state.

EXPLANATION OF VANADIUM CONCENTRATION DIFFICULT

The origin of the vanadium in the asphaltite presents an interesting, if difficult, problem. Vanadium is known to occur in minute quantities in many rocks, both igneous and sedimentary, but its possible presence in the country rock of these asphaltites would scarcely explain its concentration and intimate mixture with the asphaltite. Assuming that the asphalt was derived from petroleum which originally occurred in the surrounding sediments and which found its way into open fissures, presumably this oil followed certain definite channels in reaching such fissures. It is hard to conceive of its having percolated through the entire rock mass in such a manner as to dissolve and collect any vanadium present, even if the chemical reactions required in such a process were possible.

There seems to be a relation between the bitumens and the presence of vanadium. Although I was unable to discover any instance of vanadium having been detected in asphaltic petroleum, traces of the metal have been found in many asphaltite veins in the United States, and even in deposits of asphalt. This association is particularly marked at Minasragra, Peru, the most important known deposit of vanadium in the world, which Mr. Hewitt regards as "an extreme phase of differentiation from asphaltite." Again, in the Province of Jauja, many miles from the nearest asphaltite deposit, I examined a stratum of black carbonaceous shale of great length, and more than thirty feet in thickness, which careful sampling showed to have an average vanadium content of over 1 per cent V_2O_5.

The unlikelihood of vanadium having been derived from the rocks in which the asphaltite fissures are found, or from vanadiferous solutions circulating in the veins during their formation, together with the widespread occurrence of vanadium associated with asphalts, asphaltites, and even oil shales, in various parts of the world, leads me to believe that the metal was an original constituent of the asphaltic petroleum or bitumen from which the Peruvian asphaltites were formed.

South African Gold Production

The following table, compiled by the Transvaal Chamber of Mines, shows the comparison between the Transvaal gold output in quantity and value for the years 1919 and 1920:

Witwatersrand:	1919	1920
Yield, ounces	8,111,271	7,949,585
Estimated value	£38,261,020	£43,486,224
Outside districts:		
Yield, ounces	218,820	204,587
Estimated value	£1,032,180	£1,118,631
Transvaal:		
Yield, ounces	8,330,091	8,154,172
Estimated value	£39,293,200	£44,604,855

Movements of Metals and Ores

Imports and exports of the more important metals and ores to and from the United States as reported by the Department of Commerce for March, 1921, and the figures for March, 1920, as finally revised, are as follows:

IMPORTS MARCH, 1920 AND 1921
(In Pounds, Unless Otherwise Stated)

	March, 1920	March, 1921
Antimony ore, contents	89,653	
Antimony matte, regulus, or metal	4,665,778	1,776,484
Brass, fit only for remanufacture	2,819,756	539,068
Copper:		
Ore, contents	4,638,591	4,029,414
Concentrates, contents	2,952,288	4,816,400
Matte, regulus, etc., contents	2,175,457	1,020,103
Imported from (in part):		
Spain	118,720	123,648
Canada	4,900,757	423,480
Mexico	1,939,658	2,432,400
Cuba		2,852,773
Chile	1,980,494	2,782,246
Venezuela		49,307
Peru	49,227	330,952
Unrefined, black, blister, etc	19,108,437	12,448,823
Refined, in bars, plates, etc	10,139,643	324,060
Old, etc., for remanufacture	120,824	35,062
Composition metal, copper chief value	8,897	450
Lead:		
Ore, contents	1,698,771	341,211
Bullion, contents	2,582,956	1,867
Imported from:		
Canada	1,141,974	163,269
Mexico	3,132,378	9,867
Other countries	7,375	169,942
Pigs, bars and old	563,031	1,993,264
Imported from:		
Germany	......	127
Canada	2,880	7,800
Mexico	560,151	1,985,337
Manganese ore, long tons	18,970	69,710
Imported from (in part):		
Cuba, long tons	29	
Brazil, long tons	12 200	30,750
British India, long tons	1,000	38,460
Tungsten ore, long tons	217	64
Pyrites, long tons	14,251	18,773
Imported from:		
Spain, long tons	14,251	11,223
Tin ore, long tons	541	1,852
Tin bars, blocks, pigs, etc	11,980,019	3,028,356
Imported from (in part):		
United Kingdom	1,764,609	907,289
Straits Settlements	9,490,145	1,689,489
Hongkong	409,613	319,201
Australia	159,510	56,000
Zinc:		
Ore, contents	5,355,218	981,494
Imported from:		
Canada	786,963	470,927
Mexico	4,568,255	510,567
Blocks or pigs and old	2,748	6,162,061

EXPORTS OF COPPER, LEAD AND ZINC
(In Pounds)

	March, 1920	March, 1921
Copper:		
Concentrates, contents	10,000	60,970
Unrefined, black, blister, etc	....	33,613
Refined, in ingots, bars, etc	82,266,959	36,574,236
Exported to (in part):		
Belgium	2,605,158	2,106,438
France	7,203,950	2,925,938
Germany	10,661,454	19,020,962
United Kingdom	12,439,106	7,406,780
Canada	4,861,385	1,224,040
Netherlands	2,652,061	1,164,846
Composition metal, copper chief value	60,308	3,216
Old and scrap	5,600	....
Pipes and tubes	405,756	293,826
Plates and sheets	2,267,786	830,544
Wire, except insulated	2,965,129	984,878
Lead:		
Pigs, bars, etc.:		
Produced from domestic ore	960,207	77,458
Produced from foreign ore	4,894,156	3,138,794
Exported to (in part):		
Netherlands	896,000	784,000
Sweden	448,000	112,000
United Kingdom	448,000	2,017,347
Argentina	421	112,000
China	112,172	1,200
Canada	730,234	21,649
Zinc:		
Dross	1,481,676	7,340
Spelter:		
Produced from domestic ore	18,542,204	174,106
Produced from foreign ore	9,516,034	.....
Exported to (in part):		
France	6,309,990	....
United Kingdom	18,706,833	....
Canada	18,063	3,750
Mexico	1,295	136,833
In sheets, strips, etc	2,481,851	171,865

Study of Underground Electrical Prospecting—Part I

Conductivity of Rocks and Minerals—Potential Chart—Distribution of Electrical Currents in the Earth—Making a Potential Chart—Direct Current Best—Non-Polarizing Electrodes—Spontaneous Polarization—Earth Currents—Apparatus

By C. SCHLUMBERGER*

Translated, under the direction of the author, by Sherwin F. Kelly†

MAGNETIC PERMEABILITY is the only physical property of rocks and minerals which has been employed for underground investigation by means of observations at the surface. The other properties equally susceptible of being used in observations made at a distance, such as density, elasticity, specific induction, transparency to X-rays and electrical conductivity, have given rise up to the present to relatively unimportant work, which has not had any practical results.

Among the methods thus indicated, those based on electrical conductivity are the most attractive. They make use of precise measures, arrest the attention on a large variety of geological problems, and finally point directly to the metalliferous minerals, good conductors of electricity. In this field I have conducted a series of experiments begun early in 1912, interrupted in August, 1914, by the war, and since continued. The present article is a summary of theoretical considerations, previous attempts at electrical prospecting by various experiments before 1912, present methods employed, and practical experiments.

ELECTRICAL PROSPECTING PREVIOUS TO 1912

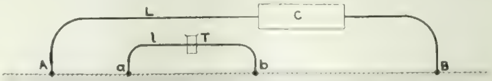
Method by Measurement of Resistance.—By means of suitable apparatus, the resistance of an earth current between two points A and B, a predetermined distance apart, is measured. The constant base is then displaced and another resistance measured. The finding of a line or area of particularly low resistance is, according to the projectors of the method, presumptive evidence of a conducting mass or an orebody. No noteworthy results have been secured by this method to date, but, in my opinion, it should not be absolutely rejected.

The erroneous conception of the method lies in the fact that an electrical current passed through the earth between two points A and B does not travel directly from one to the other by the shortest route, but uses to the greatest advantage the entire section under investigation and distributes itself in the ground by a law which may be figured out if the earth is homogeneous. The lines of current come close together at the extremities of the circuit A and B, whereas in the intermediate portion they have a larger section and some even an infinite section.

The resistance of the circuit AB, instead of being regularly distributed along the line between the two points, as in the case of a cylindrical conductor, is concentrated in the immediate neighborhood of the contacts, A and B. The nearer to the contacts, the more pronounced is this action. On the other hand, the portion of the earth where the section of these threads of current is large, hardly enters into the value of the resistance. The resistance of the earth circuit between the two points depends, therefore, upon the dimensions and forms of earth sections at the contacts and the nature of the ground in the immediate neighborhood; it is almost independent of the constitution of the earth at a distance, and notably so of the region that is between the two.

A conducting mass buried in the ground will not lower appreciably the resistance of the circuit except when it is near one of the contacts A or B. Moreover—and this is of importance from the point of view of application—the value of the resistance is in a large measure a function of experimental contingencies (disposition of the earth contacts and condition of the soil at those points), so that the results are necessarily irregular and lack precision. Where a thin regular bed of superficial earth (plant soil) covers rocks of different constitutions (sandstone, schist, igneous rocks), it should be possible to distinguish the nature of the hidden rocks by means of comparing resistances.

Telephonic Method.—(Daft and Williams.) In this method, by means of an insulated line containing an induction coil, rapidly variable currents are passed between two points A and B of the earth. A removable line containing a telephone and touching the earth at a and b enables the passage of the currents through the earth to be detected, making use of the principle of telephoning through the ground, as depicted in the illustration. Lack of precision and the need for great experience on the part of the experimenter caused the method to be abandoned.



ILLUSTRATING TELEPHONIC METHOD

Hertzian Waves Method.—The Hertzian waves traverse dielectrics, but are absorbed or reflected by bodies which are conductors. Lowy and Leimbach have taken out patents and have published a series of studies. For a conducting mass C, Fig. 1, situated in a mountain made up of insulating rocks (dry) and presenting steep slopes, the procedure is evident. The transmitting station E is on one side of the mountain and a movable receiving station R on the other side, by which the waves traversing the mass are studied. It should thus be possible to determine, judging at least from the theory of defraction phenomena, the shadow cones due to the interception of the waves by the opaque masses such as *C*. For examinations of flat and rolling country Lowy and Leimbach propose to place transmitting and receiving antennæ in drill holes. They think it possible to separate the antennæ as much as fifty kilometers. No practical attempts have been made in this direction, and a good many objections could be raised to such a project. As far as conductors not vertical, like veins, but horizontal, like underground water strata, are concerned, the reflection of Hertzian waves should be of some practical utility. The most that can be said for the method is that it is in the experimental stage.

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*[illegible] des Mines, professor at the École Nationale [illegible] des Mines. Abstracted from the English translation [illegible] with the permission of the author.

†[illegible] of the translation of the original, which approxi[illegible] a considerable part of the [illegible] the continuity [illegible] possible [illegible] without [illegible]

ELECTRICAL CONDUCTIVITY OF VARIOUS ROCKS AND MINERALS

Two kinds of conductivity should be distinguished. Certain minerals, not numerous, conduct electricity in the same way that metals do; that is, without the displacement of ions. They play, therefore, the rôle of metallic conductors. The other minerals, whether ores or barren rocks, are more or less perfect insulators, and owe their apparent conductivity to the absorbed water which they contain. They assume the rôle therefore of electrolytic conductors.

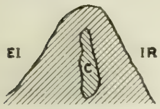

FIG. 1

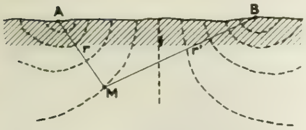

FIG. 2

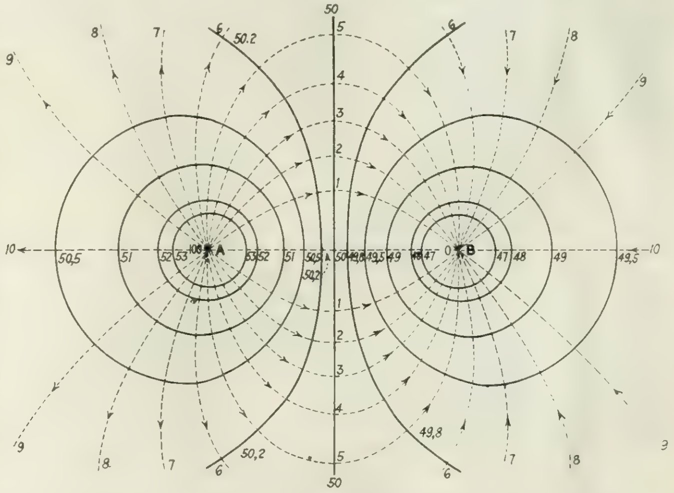

FIG. 3

The principal ores usually metallic conductors are pyrite, mispickel, galena, and copper sulphides. Among the oxides are magnetite and pyrolusite. Zinc blende is an insulator. Stibnite is also an insulator. From experiments which I have made, the conclusion has been reached that hematite, both massive and crystalline, does not conduct appreciable amounts of electricity, though this opinion is contrary to that apparently held by various other writers on the subject.

The resistance of ores which are conductors, especially pyrites, is approximately one ohm per centimeter per square centimeter (the unit taken for resistance measurement is one centimeter long and one square centimeter in cross-section, and is represented by $cm–cm^2$). This resistance is comparable to the resistance of concentrated saline liquids or acids and is 100,000 times as great as the resistance of ordinary metals. One is here dealing with mediocre conductors which cannot be compared with metals. I found that a sample of chalcocite indicated 0.005 ohm per $cm–cm^2$, and for galena a fraction of an ohm has been frequently indicated.

The numerical order of resistance is the only interesting point. Measurements made upon various samples show a wide divergence, and the value for a crystal cannot be taken as showing the average of a mass of the same substance, because of the presence of gangue and of the imperfect contact between crystals. In certain types of deposits the mineral crystals are separated from each other, despite their appearance of continuity and compactness and their low gangue content.

Carbonates and oxides have only, like rocks and earth, electrolytic conductivity, due to absorbed water; at least, if they are actually conductors, the fact may be practically ignored. The quantity and composition of the absorbed water control the phenomenon, but the fact that this water is retained by capillarity should be considered, and that therefore its properties are those of capillary water strata, which may differ appreciably from those of a mass of water.

Whatever may be the restrictions relative to the capillarity, the resistance of various natural waters is easily measured. Some measurements are as follows:

	Ohms per Cm–Cm²
Water containing selenium	1,000
Water containing calcite	2,000–3,000
Pure water	5,000–7,000
Damp ground (very wet pyritic blue clay)	1,000
Argillaceous sand	20,000
Argillaceous limestone	30,000
Granitic sand	70,000

Fresh compact rocks give, even after absorbing water, resistances considerably higher than the foregoing, approximately ten megohms in laboratory experiments upon samples cut in the form of prisms. Such figures do not always correspond to the average resistance of rocks in place, which, especially if numerous fissures be present, are much better conductors. Measures made in the field and covering large masses are the only ones that give valuable practical results. Unfortunately, the experiments can be made with ease only on rock outcrops, which, of course, are more or less altered. The figures which are found in practice vary in ground of average moisture from 50,000 to 200,000 ohms per cm–cm².

The ratio of the conductivity of ores which are conductors to that of rocks is at least 1,000 and may easily attain 10,000 or 100,000. Also, for different rocks, the conductivities, rather variable, are frequently in the ratio of 1 to 10. Loose earth and superficial clay should in general be much better conductors than deep-seated rocks, because of their high water content. The rise of temperature at depth, which operates to increase the conductivity, has only slight effect at the ordinary depths to which investigation may be carried.[1]

THEORY OF THE METHOD OF THE POTENTIAL CHART

Principles of the Method.—If a difference of potential is applied to two points A and B of the earth, there will result between these points an electric current which will produce variations of potential in the earth, because of the latter's resistance. If, for example, the current goes from A toward B, the voltage will drop in the same direction. To represent the distribution of potential in the ground, the simplest way is to consider the surfaces of equal potential, and to number them according to their value. In considering the superficial phenomena, the only ones that it is practicable to observe, it will be noted that it is possible to trace curves of equal potential on the ground traversed by the current. These curves are the "outcrops" of the equipotential surfaces in the ground, and each may be numbered according to the value it represents. These lines constitute a map of the potentials of the region, analogous in principle to a topographic map wherein the elevations are traced by connecting points of equal altitude.

Where the ground is homogeneous and flat, the distribution of the potentials between the contacts A and B may be calculated. That is to say, the potential chart is known *a priori*. When the earth contains rocks or minerals of different conductivities, this condition modifies the distribution of the potentials and produces perturbations which are reflected in the form or value of the superficial equipotential lines. These lines may be easily traced and numbered in the field, the deformations figured out, and the provoking causes beneath the surface deduced. Such is the principle of the method.

Theoretical Study of Flat, Homogeneous Ground.—The question is the following: Between two points A and B of flat, homogeneous earth a current is passed, and it is desired to know what are the value and form of the equipotential surfaces below, and the equipotential curves at the surface.

This problem relative to the application of Ohm's law to a limitless conductor is solved by the following formula:

$$V = \frac{\rho i}{2\pi}\left(\frac{1}{r} - \frac{1}{r'}\right) + \text{constant}$$

in which V represents the potential of a point M of the earth, ρ the specific resistance, i the intensity of the current, r and r' the distances of M from the contacts A and B (Fig. 2).

The equipotential surfaces defined by the equation $\frac{1}{r} - \frac{1}{r'} =$ constant, are of the fourth degree, and are generated about the line AB. They are of simple form in the neighborhood of A or B and midway between. In fact, near A it is possible to neglect $\frac{1}{r'}$ in comparison with $\frac{1}{r}$ so that the surfaces are hemispheres centered at A. Midway between A and B they are, because of the symmetry, planes perpendicular to AB.

The chart of the superficial potentials is reproduced in Fig. 3. This also represents the subsurface potentials. The equal potential surfaces in the ground being ones of revolution about AB, to obtain them it is only necessary to revolve half of the figure.

The numbering of the curves (or surfaces) has been done on the following principle: The unit of length chosen is $\frac{1}{100}$ of the distance AB. The potential of the point α situated at the distance 1 from A is chosen as 100, and the potential of the point β at a distance 1 from B is taken as 0. This is equivalent to choosing as the unity of potential $\frac{1}{100}$ of the difference of potential between α and β.

Under these conditions the fundamental formula becomes

$$V = 50.5\left(\frac{1}{r} - \frac{1}{r'}\right) + 50$$

which gives $V = 100$ for $(r = 1;\ r' = 99)$ and $V = 0$ for $(r = 99;\ r' = 1)$. The potential midway $(r = r')$ and at infinity $\left(\frac{1}{r} = \frac{1}{r'} = 0\right)$ is then 50, average between 0 and 100.

To put it in a more concrete fashion, the chart gives, closely with these conventions, the voltage that would be observed at each point in the ground if the sections chosen at A and B were hemispheres of one meter radius situated 100 meters from each other, and if a difference of potential of 100 volts were maintained between them. The advantage of this relative notation is to give an invariable basis for making a potential chart of homogeneous ground.

This graph translates a formula into numerical coefficients; it does not depend on the resistance of the ground, on the difference of potential applied, on the distance between the contacts, or on the form or disposition of the latter. With regard to this last point, the section just at the contact must be ignored. All experimental contingencies are thus eliminated from the method.

It is well to use, in investigations in heterogeneous ground, the same conventions for evaluating distances and potentials. The chart, which will be disposed differently in each particular case, is independent of the difference of potentials applied, of the average specific resistance of the ground, and of the forms or dimensions of the sections which are being investigated in detail.

Distribution of the Current in the Earth.—The current is usually considered as the cause of the fall of potential. It is thus often clearer to think of the distribution of the lines of current than of the potentials, although, in reality, the potentials alone are directly observable, as the current remains hidden and gives evidence of its passage under the surface by such observable phenomena as the fall of potential. One conception is easily translated into the other.

At each point, the direction of the current (dotted lines, Fig. 3) is at right angles to the equipotential surface passed through that point. Thus the lines of current are trajectories perpendicular to those surfaces. The density of the current (intensity per square centimeter normal to its direction) is proportional to the drop $\frac{dV}{dn}$ of potential per unit of length (intensity of the electrical field) and in inverse ratio to the specific resistance, as Ohm's law is written $\frac{dV}{dn} = \rho\,\delta$. In homogeneous material the density of the current is greater when the surfaces are close together.

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[1] [illegible] per degree and [illegible] half of [illegible] temperature for [illegible] degrees.

Profiles of Potential and Profiles of Electrical Field.—The potential chart with its equipotential curves is analogous to a topographic map with its contours. It is useful to complete this chart with a graph showing the values of the potentials along a line traced from one point to another, exactly as a contour profile is drawn. Fig. 4 shows such a graph along the line *AB*, with the conventional units chosen.

Instead of the potential, it is sometimes more convenient to represent the intensity *H* of the electrical field, or fall of potential per unit of length $\frac{dV}{dn}$. The field *H*, being the derivative of the potential, is naturally larger the faster the latter varies; that is to say, when the curves are closer together. To refer again to the topographical analogy, the field is comparable to the slope of the ground. The curve in Fig. 5 gives the profile of the field along the line *AB*, always with the same units.

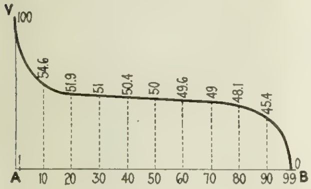

FIG. 4

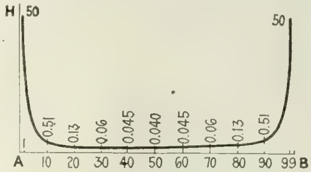

FIG. 5

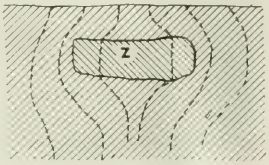

FIG. 6

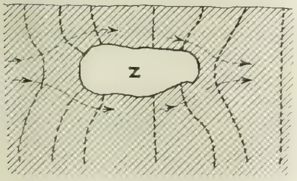

FIG. 7

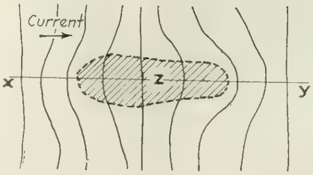

FIG. 8

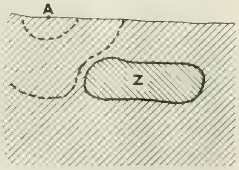

FIG. 9

Perturbation in the Potential Chart Produced by Heterogeneities in the Soil.—When the soil, instead of being homogeneous, contains zones of different conductivity, these affect the distribution of the potentials. The theoretical calculation of such distribution presents well-nigh insurmountable difficulties, even in the simplest case. Under such conditions an approximation giving a qualitative view of the perturbations must suffice.

Suppose, for example, that in the region halfway between *A* and *B*, where the equal potential surfaces are usually parallel vertical planes, a conducting mass *Z* (Fig. 6) is buried. To aid in understanding the deformation produced by this mass on the equipotential planes, consider first the extreme case in which *Z* is a perfect conductor. Under these conditions the mass is at the same potential throughout, the drop produced by the resistance being negligible. The entire volume of *Z* would then be enveloped by the surfaces of equal potential, these passing by one side or the other, according to whether their potential is superior or inferior to that of *Z*. This may be summarized by saying "a conducting mass repulses toward its exterior the equipotential surfaces which tend to approach it." Passing to the case wherein the conductivity of *Z*, instead of being perfect, is merely superior to that of the surrounding territory, it will be noticed that the preceding deformation holds in principle, although in a less marked manner. There will still be the same repulsion of the surfaces, although they penetrate the mass, as indicated by the figure, which shows the distortion of the lines due to the presence of the body *Z*.

Observing now the reverse case, that of an insulating body: Suppose, first, that its conductivity is nil (cavity in the ground) and reason this time on the lines of current. These pass around the space *Z*, obliging the equipotential surfaces to cut *Z* normally. The inflection which results is directed toward the interior of *Z*, as shown in Fig. 7. Thus it is possible to say that "an insulating body acts as though it attracted the equipotential surface toward its interior." This attraction is less clear, but holds, nevertheless, if *Z*, instead of being a perfect insulator, is merely a poorer conductor than the soil around it.

The perturbations that have just been analyzed are not solely local; they react at a certain distance from *Z*. If, then, this mass is not too deeply buried in the ground, it will produce the reaction above described on the equipotential curves on the surface. For example, in the case of a conducting mass, the chart of the equipotential lines will look something like Fig. 8, making it possible to find the location, and to a certain extent the dimensions, of the buried mass.[2]

The deformations of the potential graph often translate themselves particularly well on the profiles of the field. A profile along the line xy of Fig. 8, for example, will have the form indicated in Fig. 10.

Refraction of Equipotential Surfaces on Passing From One Medium to Another.—A surface of equal potentials is refracted in traversing a plane separating two mediums of different specific resistances. The refraction takes place in such a manner that the equipotential surface approaches the plane in the poorer conducting substance; it is a maximum when the surface encounters the plane at an oblique angle of incidence and nil when the incidence is normal or tangential. The numerical calculations show that the angular change in direction produced by the refraction is considerable even when the difference in specific resistances is small. The surface bends in the medium which is the poorer conductor, so that it encounters the contact plane at a small angle, bending back abruptly in the other medium.

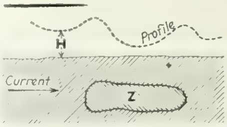

FIG. 10

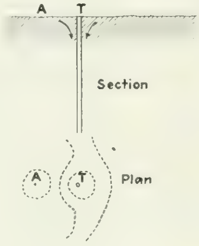

FIG. 11

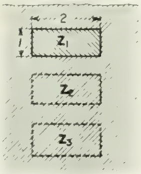

FIG. 12

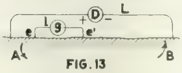

FIG. 13

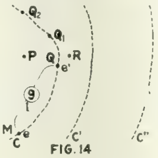

FIG. 14

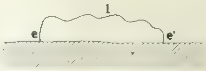

FIG. 15

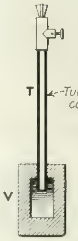

FIG. 16

Perturbations Due to the Relief of the Ground.—The potential chart of homogeneous ground so far studied refers to flat ground. More or less important disturbances result from sharp relief. A hollow, such as a valley, constitutes a lack of matter and produces the same effect as an insulating mass, attracting the equipotential surfaces. An elevation, such as a hill, corresponds to an excess of matter, and reacts in the opposite manner. These disturbances play a varying part, resulting in much trouble in rugged country. The difficulties are especially grave, in view of the fact that it is not easy to evaluate, *a priori*, the quantitative importance of the deformation produced by a given relief.

Action of Vertical Conductivity.—A conducting body with its principal dimensions vertical, as, for example, the casing of a drill hole or a narrow mineralized column, can be marked on the chart, provided that it be sufficiently near one of the contacts. Consider (Fig. 11), a vertical conducting stem T, near the contact A. Its lower extremity being in contact with deep points of the earth, distant from A, this stem produces a diversion of the current downward, and to its summit are attracted the lines of current, which converge upon it. On the potential graph this is manifested by the presence about the summit of the tube of small, closed curves, formed out of the near-by ones by repulsion, as in the general case of conducting bodies. Nothing of this sort would be observed in the region midway between A and B where the equipotential planes are vertical, and the tube would be without any action.

Possible Depth of Investigation.—The question may be considered from two points of view. Assume a conducting mass Z, for instance (Fig. 12), buried in the ground in the region where the equipotential surfaces would be parallel vertical planes in homogeneous soil, and imagine that this mass occupies the positions Z_1, Z_2, Z_3, deeper and deeper, retaining its dimensions and conductivity. It is evident that the deformations this body causes in the superficial equipotential lines will become less and less marked as it takes a deeper and deeper position in the soil, because such perturbations are only the surface reflections of the disturbances caused at depth to the vertical equipotential planes. They will be too indistinct to be perceptible at a certain depth, thus limiting the possible depth of investigation.

The problem thus presented requires a mathematical solution, complex, if not impossible, even in the simplest cases, because there is no way of calculating the form of the equipotential surfaces. The best way to get an idea of the relative sizes of the disturbances is to experiment in the laboratory, in miniature, on artificial ground. It happens, unfortunately, in my experiments, that the perturbations in the potential chart disappear rapidly as the depth of the disturbing body is augmented. As a concrete example, taking for Z (clayey ground) the form of a parallelopiped with dimensions 1 x 1 x 2, with its conductivity fifteen times greater than the surrounding soil (argillaceous sand), the perturbations of the chart become with difficulty perceptible when the thickness of the covering soil becomes greater than 1. It must be concluded, then, that the deformations produced in the equipotential surfaces are local and have no effect at a distance.

The problem may be considered from another point of view. Instead of replacing the same mass Z at different depths, multiply all the dimensions by the same number simultaneously; that is to say, the depth of Z, its breadth, its length, and other dimensions, at the same time. The entire figure, and especially the graph of equipotential lines, remains similar, the scale only being modified. Thus it appears that a mass Z', twice as deep as Z, will appear just as distinctly on the chart of potentials, provided that all the dimensions of Z' are double those of Z, that the contacts are twice as far apart, and that the chart embraces a region doubled in all its dimensions.[3]

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[2] [illegible]

[3] The cubical contents will then be eight times as great.

The study of deep-lying heterogeneities is entirely possible if their dimensions are comparable with their depths. From the practical point of view, two difficulties are encountered. The first, a simple one, is that in taking in a large superficial area so as to observe the major figure of deformation produced by Z, one also takes in the diverse rocks of the region which are not homogeneous with the rest of the terrain. From this there result minor disturbances with no relation to Z, and masking its action.

The second difficulty comes from the fact that the current is, in general, denser in the superficial crust than at depth. If the disturbing mass is deeply buried it will react on the lines of current of feeble intensity only; therefore on but a small part of the total current. This perturbation will be but feebly reflected, then, in the superficial curves of equal potential, which, on the contrary, are in a zone of great current density.

Whatever the difficulties may be, investigations to great depths should be possible for phenomena sufficiently marked; it is possible, even, to imagine studies of the terrestrial crust carried to depths of several kilometers. This should furnish interesting information relative to zones at present unexplorable by the usual processes. Such experiments would not present great difficulties of realization.

MAKING OF A POTENTIAL CHART

General.—To cause a current to pass in the ground between two points A and B (Fig. 13), they are connected by an insulated line L to the two poles of a generator D (dynamo or batteries). The differences of potential caused in the ground by the passage of the current are studied by means of a movable line l, which includes a measuring apparatus g (telephone, galvanometer, voltmeter), and touches the ground with two electrodes e and e'.

To trace a line C of equal potential, the electrode e is kept on a fixed point M (Fig. 14), and the soil is touched at different points, P, Q, R, with the other electrode e', while observations are made with the measuring apparatus g. When this gives no indication (no sound in the telephone, no deviation of the galvanometer), it is because the point touched, Q, is at the same potential as M and forms a part of the curve C searched for. One may determine thus a sufficient number of points Q, Q_1, Q_2 . . . at the same potential as M, and connect them topographically, to obtain the trace of the curve C upon the potential chart.

To number the curves C, C' C'', it suffices to measure, utilizing an arbitrary unit, the differences of potential between them. To establish a profile of potentials, or intensities of the field, the differences of voltage are measured which exist between a series of points in the ground, disposed, for example, along a line at equal intervals.

Choice of Current.—Alternating current was tried and discarded in favor of direct current. Direct current presents the two following advantages: The galvanometer g (Fig. 14), placed in the movable line, indicates the direction of the current traversing it; that is to say, the direction of the difference of potential existing between its two extremities e and e'. On touching the ground at the points P, Q, R, with movable electrode e', it may be determined whether the point touched is within or without the curve C, and which way it is necessary to move it to encounter that curve. This cannot be done with the telephone used with the alternating current, which is merely an indicator of the zero point. The second advantage, of greater importance, is that it is possible to place in the circuit l with the galvanometer, a voltmeter, permitting the measure, by a method of equilibrium, of the difference of potential between the points e and e'. Thus, quantitative measures may be made instead of merely qualitative observations. The numbering of the curves of equal potential and the establishing of the profiles of potential or intensity of field are greatly expedited.

Non-Polarizing Electrodes. — The employment of direct current carries with it also certain causes of grave error, which must of necessity be eliminated. On touching the soil with two metallic electrodes e and e', connected by a wire l, a battery is formed of which the moist soil is the electrolyte (Fig. 15).

The electromotive force of this element, zero with two identical electrodes in ground perfectly regular, is greater in proportion to the lack of similarity in the two metallic contacts. In practice, even with unattackable metals (gold-plated rods), the electromotive force easily amounts to several hundred millivolts. The greater part of it comes from the polarization produced, at the contact of the metal with the soil, by the current flowing in the line l, a current which must necessarily exist in these measures. This electromotive force is considerable, but also quite variable, and, in actual practice with metallic electrodes, measures at the surface of the ground cannot be made with an exactness greater than a hundred millivolts.

To remedy this defect, recourse must be had to non-polarizing electrodes. I have used the following type: A tube T of copper (Fig. 16) is inserted in a porous container V, which is filled with a concentrated solution (with an excess of crystals) of copper sulphate. Only the container touches the ground. The electrodes thus made do not become polarized, as the flow of current through them causes opposite reactions and does not change the composition of the bodies in contact. They do not give rise, on the other hand, to appreciable, permanent electromotive forces, as they are nearly identical. Thus, it is possible, by choosing appropriate electrodes, to prevent such a force becoming greater than a millivolt, and to keep it at about this magnitude during prolonged experiments.

The differences of potentials that may be measured correctly at the surface by this means are at least a hundred times smaller than those that can be measured with ordinary metallic electrodes. This permits the reduction of the power necessary for the circuit in the ratio of 10,000 to 1. This big reduction makes possible the employment of storage batteries or light generators, an indispensable condition for practical work.

Elimination of Errors Due to Spontaneous Polarization and to Earth Currents.—A second difficulty inherent in the use of direct current is due to differences of potential which exist spontaneously between any two points of the earth, and which superpose their action on that of the current being studied. These differences are of two types. The first, constant, and due to chemical or electro-capillary phenomena, are discussed under the title of "Spontaneous Polarization." The second are variable, and due to the earth currents which flow in all directions in the globe's crust.[4] These two causes of error, which would be annoying under some conditions (long lines, proximity of pyrite deposits), are eliminated by opening and closing the principal circuit at regular intervals and paying attention in the reading of the galvanometer only to the deviations thus produced.[5]

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[4] In regular earth the spontaneous polarization does not exceed about ten millovolts, but near a mass of pyrites may amount to 500 millivolts. Earth currents, extremely irregular, cause differences of potential usually smaller than one millivolt per five meters.

General Information Concerning the Apparatus.—Each of the contacts *A* and *B* is formed of several metallic pegs, one to eight in number, driven into the ground, several meters apart and usually arranged in a circle.[6] The resistance of the earth circuit between them varies considerably according to the nature of the soil, especially the ground near the contacts. In a territory of average dampness it is usually between 30 and 300 ohms, varying most often between 50 and 100 ohms. A sufficient sensitiveness for observations of the potentials at a great distance from the contacts (several hundred meters) is obtained by passing a current of two to five amperes. For this, the difference of potential at the generator should be between 100 and 200 volts,[7] and the power delivered between 300 and 1,500 watts, for example.

As source of current, I use either a gasoline-driven dynamo or a set of storage batteries. The movable line, with the non-polarizing electrodes just described, at each terminal, is about fifty meters long, and is provided with a reel, for winding up the wire, on each of the copper stems of the two electrodes. The galvanometer included in the line carries a scale and pointer sensitive to one division per microampere. It weighs about a kilogram, and may be carried on a cord over the shoulders. For making the readings, resting the galvanometer on one of the electrodes, held vertically, gives a sufficiently solid support. The voltmeter is a simple type, weighing about 300 grams and attached beneath the galvanometer. It is arranged to give a reading of 200 millivolts by fractions of ten millivolts.

With this equipment it is possible to measure differences of potential as small as a millivolt, if the ground is not too dry. In the latter condition, the resistance of the movable line circuit becomes too high, and the deviations of the galvanometer are distinct only for several tens of millivolts.

Accuracy of the Results.—Within the limits of power and sensitiveness indicated, it is possible to trace equipotential curves with great precision over a wide extent of territory. Thus, in favorable ground, such as clay not too dry, at a distance of 400 meters from the contact *A* (the other contact being far off), it is possible to determine, by successive steps, equipotential curves having a developed length of 2½ kilometers, and to close the curves with an error of only a few meters.[8]

The measurements with the potentiometer of potential differences between two points of the earth are slightly less satisfactory, especially as it is difficult to maintain a constant current throughout a long experiment.[9] Nevertheless it seems to me possible, taking everything into consideration, to avoid errors relatively greater than 1/10 or even 1/20. One may count on that order of precision in the establishment of the profiles of potential or of field.

The apparatus for studying the earth seems to be well developed and permits the complete and precise study of the surface distribution of potentials over an area of several square kilometers around the contacts *A* and *B*. This requires the expenditure of about one kilowatt of power for the electric current.

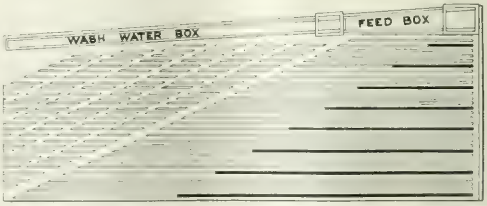
(To be concluded in May 14 issue)

A Riffle System for Tabling Complex Ore

Tabling complex ores containing galena, sphalerite, pyrite, and siderite, with accompanying gold and silver, offers much scope for experiment, in order to have the different minerals distributed over the concentrate end of the table to the best advantage. C. Y. Garber, of the Bunker Hill concentrator, at Kellogg, Idaho, recently described some of the work done at that mill in an effort to solve the problem. His paper was presented before the Columbia Section of the A. I. M. E. at the tenth annual meeting.

The system of riffling which was developed for treating such complex ore is indicated in the accompanying illustration. The lower right hand part shows a table deck riffled in the ordinary manner.

When the feed bed reaches the tips of the riffles on the diagonal line, some gangue still remains, but on crossing the diagonal line nearly all remaining gangue is washed off as the concentrate advances on the dressing surface of the deck. The heavier particles of the gangue are repeatedly washed off as they pass from tip to tip of the riffles, while the metallic minerals progress a short way on the dressing area. Now, if more riffles be introduced at such a distance from the diagonal line formed by the tips of the first riffling that they will just dip into the concentrate advancing on the dressing area, that concentrate will be carried farther along the table. In the case of an ore containing galena, pyrite, and sphalerite, the galena, being of the highest specific gravity, is best able to face the wash water and advances farthest into the unriffled area. It is just able to reach the second series of riffles, most of the pyrite and sphalerite is left behind, and the galena is rapidly carried away under the protection of the second riffles. Whatever zinc and iron have succeeded in crossing the first area with the lead must face the wash water on each succeeding dressing area. This results in a wide distribution of the minerals into their respective areas, making it possible to recover the concentrates in the various grades desired.



RIFFLES FOR SEPARATING COMPLEX-ORE CONCENTRATES

[illegible]

[illegible] of the contacts [illegible] of [illegible] of the earth [illegible] in a succeeding part of this paper.

Quarry Mining Methods at Fresnillo, Mexico

Tests Made To Determine Most Favorable Breaking Conditions and Costs Showed That Increase of Explosives in Primary Blasting Produced Most Efficient Results—Drilling, Loading, and Blasting Practices

BY D. B. MCALLISTER
Written for *Engineering and Mining Journal*

THE SILVER MINES of Fresnillo, Mexico, have been described in various publications at different times, and the following paper is therefore confined to a discussion of recent mining methods employed and those proposed for the larger-scale future operations. The former were those of the Fresnillo Co., which operated continuously from 1918 until 1920 on a 500-ton daily basis, and the latter are those proposed by the Mexican corporation which has leased the mines from the owners for a period of twenty-five years, one of the conditions of the lease requiring the erection of a cyanide plant to treat 2,000 tons daily.

ONE OF THE SMALLER QUARRIES AT FRESNILLO, SHOWING ONE PAIR OF MEN DRILLING AND ANOTHER PAIR CLEANING HOLES

The ore deposit as now developed consists of a stockwork of veins and veinlets in a medium hard porphyry varying from the thickness of a sheet of paper to well defined, formal quartz veins two to three feet thick. The latter veins have been worked out to a considerable depth, at least in some places as deep as 1,500 ft., and all that remain are the honeycombed mountain and the vein walls which constitute the present deposit. The proved mineralized ground is about 120 meters wide by 600 meters long, with an average depth of about 47 meters. An estimate of the ore within these limits, which form a comparatively small portion of the entire mineralized section, is placed at 7,000,000 tons having an average assay of 180 g. silver and 0.18 g. gold.

When the Fresnillo Co. began operations there were five large open-cuts or quarries, and the problem was to break this ore and deliver it to the crushing plant at the lowest possible cost. A main haulage level was established at about the level of the bottom of the quarries, 100 ft. above the mill bins, and all quarries were connected with the main haulage level. No mechanical power whatever was available for mining operations.

In the beginning, the usual hand drilling methods were employed, each pair of men drilling holes about three feet deep. The tonnage broken and the explosives used in this method proved too costly, and required a large number of workmen. The next step was the experiment of drilling vertical holes three meters deep, which showed a considerable increase in the tonnage broken per man shift as well as a corresponding saving in the amount of explosives consumed. After gradually educating the native miner to this depth of hole, experiments were continued with the drilling of still deeper holes, four, five, and six meters in depth. The last-mentioned was adopted as the economical depth in consideration of time, cost, weight, and length of steel to be handled, and the difficulty of cleaning the holes. For a depth of less than three meters the holes were drilled with a double jack, one man holding and one striking the steel with an 8-lb. hammer. In the deeper holes, four to six meters in depth, the first meter and a half was drilled by means of the double jack, but the remaining distance was accomplished by churning the steel up and down, bringing all the force possible with the down stroke, similar to a large-scale well-drilling machine. From time studies made in drilling the various depths of hole a standard price was fixed that allowed a good wage to the average miner and a much better one for good miners. The scale fixed was as follows:

Depth of Hole		Price	
Meters	Feet	Mex. Cy.	U. S. Cy.
3.0	9.8	$2.00	$1.00
4.0	13.1	3.00	1.50
5.0	16.4	5.00	2.50
6.0	19.7	7.50	3.75

The process of educating the miner to drill the deeper holes was a slow and tedious one until he was convinced that by conscientious work he could make wages far in advance of the standard daily wage, which was $1.50, Mexican, per day. The best miners, working in pairs, could drill a six-meter hole in one shift, ordinary miners in one and a half shifts, and the poorer workmen in two shifts.

The steel used in all holes up to four meters in depth was ⅞-in. solid octagonal, the first one and a half meters of the five- and six-meter holes were drilled with 1⅜-in. cruciform, and the remainder of these holes with ⅞-in. solid octagonal. The 1⅜-in. cruciform steel was dressed in the cross-bit form on one end only, allowing for striking on the other end. The ⅞-in. solid octagonal steel, however, was dressed in the ordinary chisel or well-bit form on both ends, as no striking was necessary. The gages were reduced $\frac{3}{32}$ in. per run of 50 cm., or about 20 in.

HOLES DRILLED WET BY CHURN METHOD

The drilling of the hole was by means of the slow hand-churning process by two men. The steel was turned slightly on each up stroke and the cutting was done on the down stroke, which had the weight of the drill plus the additional force applied by the drillers. The length of stroke was about 24 in., the average driller making about sixty strokes per minute while working. Naturally, the men required resting periods; also, such time as was needed for cleaning the hole, adding water, and changing drills. The best results were obtained by having enough water in the hole to keep the cuttings in suspension while drilling was in progress, and this also made drilling easier for the men. As stated, the best miners could complete one six-meter hole in an eight-hour shift, but the average pair of men could not finish the same work in less than a shift and a half, or twelve hours of actual work.

The cuttings were cleaned out with an ordinary tamping stick, long enough to reach to the bottom of the hole, whenever they became excessive. This was done by simply running the stick up and down in the hole, in which there was just enough water to make the sludge adhere to it. On withdrawing the stick the cuttings were wiped off and the cleaning was continued until all loose material was removed.

HOLES CHAMBERED PREVIOUS TO BLASTING

After drilling the hole to its required depth, it was allowed to dry for about a day. In order to place sufficient explosives, it was necessary to chamber the bottom of the hole to about the size of a man's head. This was done in three stages, first with one stick of dynamite, then with two sticks and finally with four, giving plenty of time for the hole to cool after each chambering charge. By trial the above chamber proved to be of sufficient size and allowed the greater part of the final loading to be concentrated at the bottom of the hole.

After the holes had been chambered and cooled they were loaded with ⅞-in. dynamite to a point about one-third the distance from the top. Various kinds of dynamite were tried, including ammonia, gelatin, and nitroglycerin, the last named giving the best results, owing to its higher rate of detonation. A No. 8 plain blasting cap was placed about midway in the charge and an electric cap near the top. The remainder of the hole was stemmed with a mixture of sand and clay to the top. The holes were spaced about two meters back of the face, and from two to two and a half meters apart. The electric caps were connected in series to a blasting machine and the holes were shot in sets of from four to ten at one time.

TABLE I. TESTS ON DRILL HOLES 3-METERS TO 6-METERS DEEP

(Costs in U. S. Currency per Metric Ton)

	Eight 3-Meter Holes		Six 4-Meter Holes		Five 5-Meter Holes		Four 6-Meter Holes	
	Total Cost	Cost per Ton	Total Cost	Cost per Ton	Total Cost	Cost per Ton	Total Cost	Cost per Ton
[illegible]	$8 00	$0 0234	$9 00	$0 0212	$12 55	$0.0137	$16.37	$0.0177
[illegible]	8 50	0248	7 50	0176	24 50	.0268	40.50	.0438
[illegible]	8 80	0258	9.55	.0225	17 85	.0195	19 44	0207
[illegible]	18.43	0539	27 38	0644	58 33	.0638	61 85	0669
[illegible]	22.94	0671	25 50	0600	54 90	0600	55.50	0600
[illegible]	$66 67	$0 1950	$78 93	$0 1857	$168 13	$0 1838	$193.66	$0 2091
[illegible]	.	342 0	..	425 0		915 0		925 0
[illegible]	.	12 46	..	13 78		15 33		14 92
[illegible]	. .	14.25	......	17 71		36 60		38 54
[illegible]	.	42 75	..	70 82		183 00	..	231.2

After considering all the data covering the results of the drilling of different depths of hole, some comparative tests were made to determine what the economic depth would be. Inasmuch as experiments proved that holes less than three meters deep would be a waste of time and explosives, the tests were made on holes from three to six meters in depth only. A representative set of such tests is included in Table I.

The charge for blasting and barring labor was excessive for the six-meter holes, as proved by later experiments. The costs noted in the preceding table are the total for labor and explosives, including hand breaking to an 8 in. maximum size and tramming the ore to the mine bins, a distance of 1,250 meters, or 4,100 ft. round trip. The cars used were the Koppel ¾-cubic meter side-dump type, 20 in. gage, and of a little over one metric ton capacity of broken ore.

The maximum size that could be delivered to the 500-ton crushing plant was 8 in.; therefore all chunks over this size had to be blockholed or broken with hammer and moil. From Table I it will be seen that the charge for hand breaking was the highest item in the total cost. This is evident from the sketch, Fig. 1, which shows the greater fracturing where the explosive charge is greatest, and diminishing directly as the distance from the charge. To load the hole to the top would not be economical; therefore an alternative method was sought to break the same amount of ore and have the whole broken mass so fractured that further reduction in size by either blockholding or hand breaking would be eliminated or reduced to a minimum.

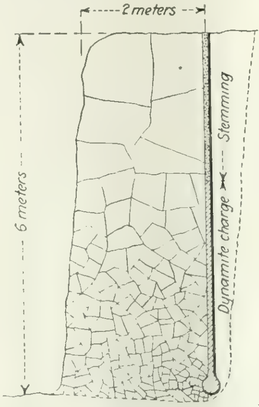


FIG.1

FIG. 1. SHOWING PLACEMENT OF FRACTURING IN BLASTING

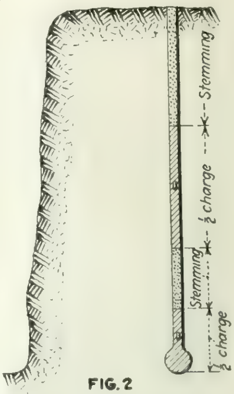


FIG.2

FIG. 2. METHOD OF SPLITTING CHARGE

F. P. Thomas, El Paso representative of the du Pont company, visited the mine, and after studying the problem suggested "splitting the charge." This splitting consists of loading one-half of the charge in the bottom of the hole, then about one meter of tamping, then the remainder of the charge, and finally stemming to the top. Eight holes were blasted in this manner, and although this first experiment was not entirely satisfactory, it showed, nevertheless, that the fracturing was more evenly distributed, which was the exact result desired. Other tests were made in which the splitting arrangement, loading, and the quantity and kind of explosive were varied. The results of the first and last experiment in splitting charges are given in Table II.

TABLE II. RESULTS OF SPLITTING CHARGES

(Costs in U. S. Currency per Metric Ton)

	Charge Split in Two Parts Total Cost	Charge Split in Two Parts Cost per Ton	Charge Split in Four Parts Total Cost	Charge Split in Four Parts Cost per Ton
Drilling labor	$32.00	$0 0229	$9 00	$0.0103
Blasting and barring labor	31.64	.0226	6.00	.0068
Explosives	49.67	.0355	19 02	.0217
Hand breaking labor	60.48	.0432	22.49	.0256
Tramming labor	91.00	.0650	52.62	.0600
Total	$264.79	$0.1892	$109.13	$0.1244
Tonnage produced		1,400.0		877.0
Tonnage per lb. of explosive		8.2		12.04
Tonnage per meter of hole		29.2		73.1
Tonnage per hole		175.0		439.0
Number of holes		8		2
Depth of holes in meters		6.0		6.0
Diameter of holes		2¼ to 1⅛″		2¼ to 1⅛″
Spacing of holes 2.7 m. or 8.9 ft. apart				See Fig.3
2.5 m. or 8.2 ft. from face				See Fig.3
Broken ore plus 30-in. size		25.0%		5.0%

Continuing this method of testing, experiments were made by splitting the charges in three, and finally in four parts, trying various kinds of dynamite and black powder, until the last test made showed only about 5 per cent of the total blasted material larger than 30 in. in size. A particularly desirable spot was selected, as shown by the sketch, Fig. 3—a point of rock projecting into the quarry and open on three sides. Two six-meter holes were drilled and chambered as usual, and the loading was varied as shown in the diagram.

The charge was split in four parts, each part consisting of ⅞-in., 40 per cent ammonia dynamite with a primer of one stick of ⅞-in. 40 per cent nitroglycerin and an electric blasting cap. Instead of stemming between the dynamite charges, black blasting powder was used, with the purpose of aiding the dynamite in making the fracturing more complete. The test was satisfactory from the point of view of the small amount of blockholing or hand breaking necessary, but the amount actually broken was far in excess of the average and could not be taken as representative in this regard, owing to ideal conditions. The main object, however, was to determine the effects of the method in reducing the number of boulders above the 30-in. size remaining after a charge was blasted, or, in other words, how thorough and complete the shattering action was for the entire depth of the holes blasted. The final result showed, as stated, that only 5 per cent of the total blasted material consisted of blocks 30 in. or greater in size, and the cost per ton for hand breaking was reduced considerably. From the diagram it is evident that if the loading were continued up to a point nearer the top of the hole, no doubt the fracturing would have been still more complete. An increase in the amount of explosives used in the primary blasting would decrease the explosives and hand-breaking labor in blockholing.

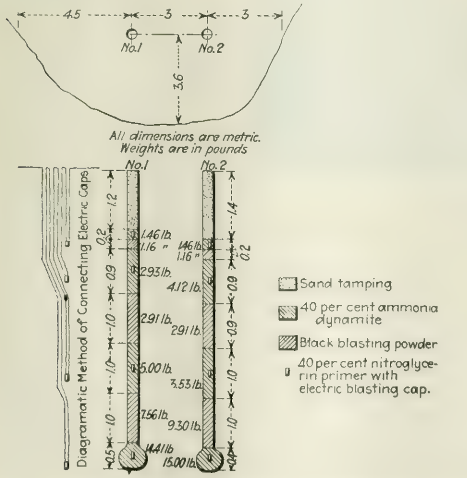


FIG. 3. DISTRIBUTION OF CHARGE IN SIX-METER HOLES

This latter point is of particular importance to the Mexican corporation, which proposes mining 2,000 tons daily by the glory-hole method, breaking the ore from the surface into large vertical raises and drawing it off through chutes in the main tunnel below. A costly item in glory-hole mining has been the expense of bulldozing large blocks of ore that would not pass through the grizzly in the chutes, as well as the trouble, expense, and time lost by these blocks choking the raises to the surface. If this trouble and expense can be eliminated or reduced to a reasonably low cost, one of the important problems in glory-hole mining will have been solved.

Development Methods at Morenci, Ariz.

Since the publication in the issue of April 9 of *Engineering and Mining Journal* of the article "Development Methods at Morenci Branch of Phelps Dodge Corporation," the following data, which may be regarded as addenda, have been sent us by Joseph P. Hodgson:

Effective Jan. 1, 1921, a reduction of wages was made of 18 to 19 per cent, conforming to the reductions throughout Arizona on account of the status of the copper market. Contract rates were reduced proportionately.

The following figures are for the first three months of 1921. Contracts were discontinued March 31 on account of closing down the property:

FEET PER MAN SHIFT

1921	Drifting	Raising	Total
January	1.777	1.809	1.79
February	1.830	1.916	1.86
March	2.100	2 040	2.08

FOOTAGE

	Drifting	Raising	Total
January	1,432½	793	2,225½
February	1,342	876	2,218
March	1,566	911	2,477

COST PER FOOT OF ADVANCE WORK

	Labor	Explosives	Labor, Explosives and Timber	Contractor's Earnings
January	$2.72	$1 09	$4.33	$4 97
February	2.74	1.09	4.29	5.18
March	2 58	1 02	3 71	5 45

Effective Jan. 1, muckers were placed on a separate contract basis. This change is principally responsible for the higher footage per man shift in drifting. The inclusion of muckers' earnings on contract in the contractors' earnings reduces these figures more than the proportional cut in wages.

Mining Engineers of Note

Allen Hastings Rogers

IT IS STATED on authority that Allen Hastings Rogers enjoyed the reputation among some of his college professors of an easy-going loafer, but, be that as it may, those worthy dignitaries have long ago had excellent reason to alter their opinions and have probably come to the conclusion that their judgment, in the matter of predictions, needs a development not usually to be found in books. Mr. Rogers may be classified as a typical engineer in thought, manner, and life; which is by way of saying a great deal, and carries with it the conviction that, aside from his professional proclivities, he possesses several traits that are admittedly admirable in the opinion of his associates. He is a smoker, plays an excellent game of bridge, and, on occasion, can tell a good story. He is very positive in his opinions, but these he forms only after careful investigation and judgment, so that they are not altered easily. Be it said, however, that such opinions are usually correct the first time. Mr. Rogers was born on Feb. 19, 1871, at Marshfield, Mass. After finishing in the Boston public schools, he attended the Massachusetts Institute of Technology, where he received his bachelor's degree in 1890. His first job was that of chemist and metallurgist for Phelps, Dodge & Co. in Arizona. In 1892, he was smelter foreman for the Boston & Montana Consolidated Copper Mining Co. at Great Falls, Mont., and two years later he became assistant superintendent of the Aguascalientes smelter of the Guggenheim Smelting Co. in Mexico. This was the beginning of eleven years that were spent on the other side of the Rio Grande, during which time he occupied engineering and managerial positions at the La Paz and Santa Fe mines, Matehuala, S. L. P., and with the Guggenheim Exploration Co. at the Dolores mine, Matehuala, Carmen mines, Villaldama, and the Velardeña Mining & Smelting Co., Durango. In 1905, he became assistant general superintendent for the American Smelters Securities Co., in New York, and in 1907 entered general consulting practice with offices here. Among his most important examinations during this latter period are the following: Boston Consolidated Copper Mining Co., Utah; Braden mines, Chile; Chino Copper Co., New Mexico; Butte & Superior, Montana; Mascot mine, Tennessee; Canada Copper and Britannia mines, British Columbia; Bawdwin mines, Burma, India; Perseverance mine, Alaska, and the Penyon nitrate properties in Chile. In addition, Mr. Rogers conducted considerable mill test work at Utah Copper, Nevada Consolidated, Ohio and Miami properties; his test run on the Hyde flotation plant at Basin, Mont., in 1912 resulted in its adoption by Butte Superior. Other notable work during this period consists of research for several years on extraction of potash from leucite in Wyoming and in consulting engineering for Chino Copper Co., American Zinc, Lead & Smelting Co., Canada Copper Corporation and L. Vogelstein & Co. In 1917, he became associated, as a member of the firm, with Rogers, Mayer & Ball, consulting engineers, 42 Broadway, New York, and 201 Devonshire St., Boston. Among the companies represented in a consulting capacity by the firm are: Union Minière et Forestière du Congo Belge, Alvarado Consolidated Mining & Milling Co., the American Engineering & Operating Co., the Nevada-Utah Mining & Smelting Corporation, and the Canada Copper Corporation.

A. H. ROGERS

Mr. Rogers is a member of the American Institute of Mining and Metallurgical Engineers, the Mining and Metallurgical Society of America, the Institution of Mining and Metallurgy, and the American Association for the Advancement of Science. He is also a member of the Society of Mayflower Descendants and belongs to the following clubs: Engineers,' Lawyers', Rocky Mountain, Technology of New York, and the Engineers' Club of Boston. He has served as a director of the A. I. M. E., and is at present a delegate of the Institute on the American Engineering Council of Federated American Engineering Societies, and also a representative on the Engineering Division of the National Research Council. He is chairman of the Committee on Technical Education of the Mining and Metallurgical Society of America.

During the war, Mr. Rogers held a one-dollar commission and rendered valuable assistance as consulting engineer to the U. S. Bureau of Mines.

CONSULTATION

Modern Practice in Operating Copper Refining Furnaces

"Can you tell me what the present practice is for blowing copper in refining furnaces? Are water-cooled pipes used for the purpose? Also, has the old method of poling and hand-firing yet been superseded in any of the modern plants?"

The process of blowing is a simple one, and ordinary pipe is used, at least in the big refineries adjacent to New York. Fig. 1 shows the method of oxidizing copper in use at the Laurel Hill plant of the Nichols Copper Co. At the American Smelting & Refining Co. refinery at Perth Amboy, N. J., the air pressure used is somewhat less, being about 25 lb. per sq. in. A. C. Clark, of the Raritan Copper Works, has kindly furnished us with the following description of the method in use at that refinery:

"It is necessary, when melting copper that is to be cast into marketable shapes, in a reverberatory furnace, that the copper bath be subjected to an oxidizing period, to make possible the elimination of impurities that are taken up by the molten copper or are in the copper before melting. This oxidizing process is commonly spoken of as 'blowing copper' or 'blowing the charge,' and is carried out at the Raritan Copper Works as follows:

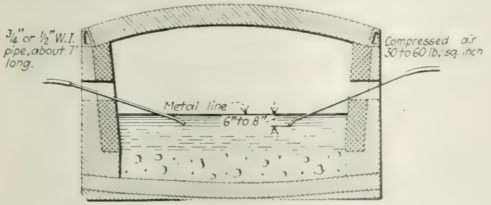

3/4" or 1/2" W.I. pipe, about 7' long.
Compressed air 30 to 60 lb. sq. inch
Metal line
6" to 8"

FIG. 1. METHOD OF OXIDIZING COPPER AT THE NICHOLS COPPER CO. REFINERY

"When the furnace charge is melted, compressed air, at about 45 lb. per sq.in. pressure, is directed into the bath underneath the surface by ½-in. steel pipes, introduced into the furnace through openings provided in the side doors for that purpose. These pipes are cut into 10-ft. lengths, one end connected to the source of air supply, a tap at the side of each furnace door, by a rubber hose; the other end bent so that the outlet will be about 8 in. below the surface of the bath when the pipe is in use. The arrangement is shown in Fig. 2.

"Blowing is usually done through two of the furnace side doors simultaneously, the openings being in the middle of the lower half of the doors and about 16 in. long by 12 in. wide. Two pipes are used at each door, so four jets of air deliver into the bath at once. Whenever the end of the pipe in the bath softens or burns off, the pipe is withdrawn, bent again and replaced. This continues until the pipe becomes too short, when it is replaced by a new pipe.

"Ordinarily, the blowing continues for six or seven hours. Button samples are frequently taken from the copper bath, and the end of the process is determined by the appearance of the fracture of a button sample, which indicates that the copper has reached the stage known as 'set copper,' when it contains from 4 to 6 per cent of cuprous oxide."

Poling is still generally used, green young beech or oak trees being preferred for the purpose. Pine is objectionable. Oil and gas have been proposed as substitutes, and some metallurgists are enthusiastic over the possibilities of pulverized coal combined with steam. With the high cost of wood, it is likely that the poling process will be superseded in a few years, but it still stands supreme.

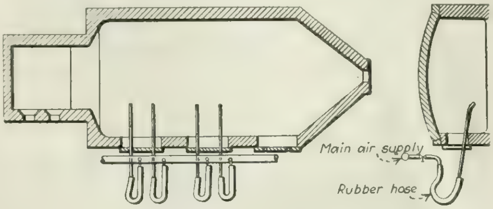


FIG. 2. METHOD OF BLOWING COPPER IN THE RARITAN REFINING FURNACES

Refining furnaces are commonly hand-fired with coal, similar to the manner in which reverberatory copper-smelting furnaces were formerly operated. We understand that at the A. S. & R. refinery at Baltimore mechanical stokers are now being successfully used, and at the Perth Amboy refinery of the same company powdered-coal firing was installed two years ago.

Average Selling Price of Old-Range Non-Bessemer Iron Ore

"Can you advise me concerning the average selling price of Old Range non-bessemer iron ore for the year of 1920? Also the Lake freight rate between Escanaba and Chicago?"

It is impossible to secure an absolutely accurate average selling price of Old Range non-bessemer ores for 1920. To obtain this it would be necessary to have information showing the actual adjusted price for each grade of ore sold and shipped during the year. The Lake Superior Iron Ore Association has, however, made an estimate based on the quantitative average analyses of non-bessemer ores shipped during 1919 and the 1920 selling price. Their average analyses for 1920 are not yet compiled, but they state there is not enough difference in the quantitative average from one year to the next to affect these figures materially. Their estimated average price on the above basis is $6.37, f.o.b. lower lake ports.

The lake freight from Escanaba to Chicago in 1920 was 60c. net, and the unloading charge was 10c. prior to Aug. 25, and 14c. thereafter.

HANDY KNOWLEDGE

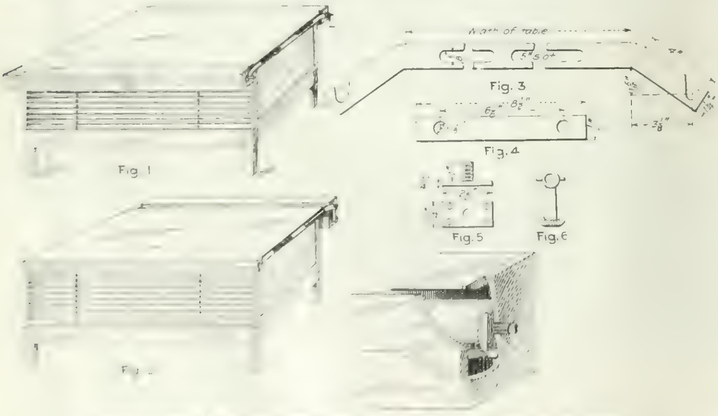
Combined Map Roller and Case

By John W. N. Bell

Written for *Engineering and Mining Journal*

Occasionally when a mining company acquires additional claims it has been found that various changes must be made in the system of keeping engineering records. At a certain mine, when three additional claims of forty acres each were acquired, it was obvious that one map, on a scale large enough to plot details, would be unwieldy to handle and that it would be hard for the draftsman to work on it without damaging it by leaning against it. Also, it was a question whether it were better to keep the maps in two or more sets or to reduce the scale. Neither of these courses was considered satisfactory if avoidable. As the drafting room was not large enough to accommodate another drafting table of the slot-and-roller type, it was necessary to devise a new method of handling the maps.

The device shown in the accompanying drawing was made at the mine in the carpenter and blacksmith shops. It has been tried out and has proved satisfactory. It comprises two wooden rollers 3 in. in diameter and the width of the drawing cabinet. On each end of each roller is screwed an axle, as shown, which is threaded to ½ in. and has a squared head. Attached to the roller for its entire length is canvas, one yard wide, to which one end of the drawing is glued. The roller is then hung in a 6 x 6 in. box made of [illegible]-in. wood. Running the length of the box and ¼ in. wide is a slot through which the drawing may be wound on the rollers. Two lugs (Fig. 5) are screwed on each side of the drawing board on the top of the cabinet (care must be taken to place these low enough so that they will not interfere with the T-square). Fastened in place over these lugs by means of thumbscrews (Fig. 6) are the two roller hangers (Fig. 3) which are made of 1½ x ¼ in. iron strap.



COMBINED MAP ROLLER AND CASE FOR DRAFTING TABLE

After gluing the map ends to the pieces of canvas on the two rollers, the boxes are hung in place in the hangers, and any part of the drawing may be rolled out by means of a crank fitted on the end of the axle (Fig. 1). When through with the drawing it is easily put away by lifting the two boxes out of their hangers, rolling them together, and fastening them in place by means of the two tie pieces (Fig. 4) and thumbscrews. The two hangers are then slid back out of the way, and the boxes, now fastened together, are dropped in place in the hangers at the back of the cabinet, as shown in Fig. 2.

Use of Condemned Hoisting Rope About Open Pits

By H. H. Hunner

Written for *Engineering and Mining Journal*

Old hoisting rope in sizes from ⅝ in. to 1 in. can be cut into lengths of 50 to 200 ft. and used in many places about open pits. Cable clamps are used to attach a hook at one end and a railroad connecting link is fastened on the other. Frequent use for these is found when shifting electric-driven well drills over bad ground. A sufficient number of ropes is fastened together to allow a switch engine to make a direct pull in whatever direction the drill is to be moved. A snatch block tied to the railroad track is sometimes used. The hook end of the pulling rope is always hooked to the rear axle of the well drill. By using a locomotive and these ropes a well drill can often be moved a considerable distance to a new location on the same bench more quickly and more cheaply than by loading and unloading.

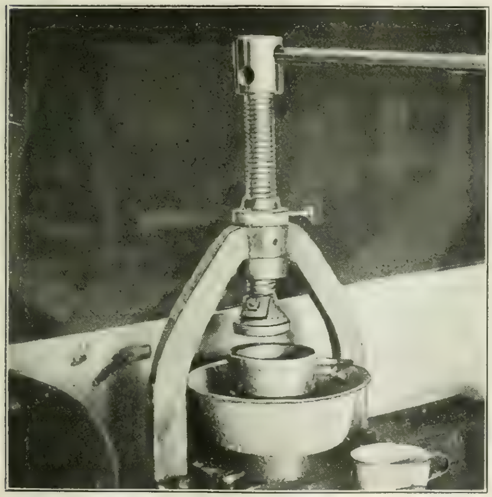
It is sometimes desirable to move a loaded mine car with broken wheel flanges around sharp curves to a point where it can be dumped before putting it on new trucks. The hook end of a pulling rope is fastened to the truck having the broken wheel, on the side that will cause the broken flange to keep clear of the track when the car is pulled ahead with this rope. If the car is to be moved down grade, a second locomotive is necessary to hold the loaded car back in order that the pulling rope can be kept tight enough.

At mines where there is no derrick, or when the derrick may be needed on other work, if a track is to be shifted, a switch engine, an empty 20-yd. dump car, a snatch block and the pulling ropes will answer the purpose. The snatch block is chained to the truck on the 20-yd. dump car and the car is spotted opposite the point at which the first pull is to be made. It makes no difference whether the working track is above or below the one to be shifted. The pulling ropes are selected so that with them single or hooked together the total length will be about 40 ft. more than the distance between tracks. If the shifting is toward the engine, the 20-yd. car will shift itself with the brakes set as the work moves ahead. On working back in the opposite direction, the engine will have to shift the 20-yd. car about every third pull to keep the pulling rope nearly normal to the tracks. This method requires a few more men to handle the rope along the crest between benches than where a crane is used, but will do the work in the same time.

Amalgam Press

Written for *Engineering and Mining Journal*

A handy amalgam press which can be constructed at the mine shop is shown in the accompanying cut. The press was made in the shops of the Plymouth Consolidated Gold Mines, Ltd., at Plymouth, Cal., and is in use in the mill of this company. The plunger is attached to the screw by two clips, as shown. The lower part contained in the enameled iron pan consists of an inner, divided open cylinder held in a stout ring. A setscrew securely clamps the two parts of the cylinder together. A number of small holes are bored in the plunger and in the lower part of the cylinder for the escape of the mercury. In practice this press has given satisfactory results.



AMALGAM PRESS

Varnish for Protecting Underground Ladders

Written for *Engineering and Mining Journal*

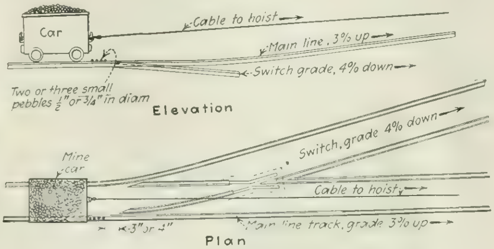
Ladders, step ladders, or light scaffolds for use underground should have their surface protected to prevent decay or dry rot. Paints of various kinds and colors are employed for this purpose, but their use should be forever taboo, for the simple reason that the grain of the wood should be constantly visible, so that if any knots, wind shakes, or other imperfections are present they may readily be seen by the man whose safety depends on the use of the ladder. A good varnish or shellac should be substituted for paint, and one that will answer the purpose is made by dissolving 4½ lb. of orange shellac in one gallon of wood alcohol. White shellac is more transparent, but has less adhesive strength than orange. Two coats of this varnish or shellac should be applied.

Preventing a Loaded Mine Car From Entering a Switch

By Roy H. Poston

Written for *Engineering and Mining Journal*

Underground switches constructed as the one shown in the accompanying sketch are troublesome in that a car will frequently take the opposite track from the one desired. However, if a few small pebbles or pieces of rock are placed on the rail opposite from the frog on the track upon which the operator desires the car to run, it will slow up that side of the car sufficiently to "swing" the other side around enough to insure its keeping on the right track. The pebbles should be placed a few inches in front of the switch point. A little experience will show what is the correct position for them.

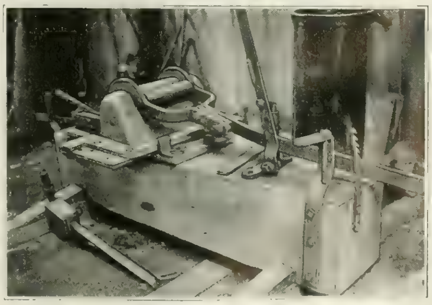


KEEPING LOADED CAR FROM ENTERING SWITCH

Making Elevator Buckets at the Mine

Written for *Engineering and Mining Journal*

As a rule, elevator buckets are purchased. They are seldom manufactured in the mine shop. At the Plymouth Consolidated Gold Mines, Ltd., Plymouth, Cal., a device for forming them has been made by Andrew Riley, the master mechanic of the mine. This consists of a cast-iron bucket form and a lever for rounding the sheet steel over the form. The bucket is cut from the sheet according to a pattern and then formed upon the device. Several rivets serve to hold the bucket to its shape.



DEVICE FOR SHAPING ELEVATOR BUCKETS

THE PETROLEUM INDUSTRY

Oil Prospecting in Papua

SPECIAL CORRESPONDENCE

Three geologists and two surveyors from the Anglo-Persian Oil Co.'s staff, who have been operating on the Vailala oil field, sixty miles from Port Moresby, Papua, recently passed through Brisbane on their way to Rabaul to further investigate the possibilities of oil boring in the mandated territories of New Guinea. One of the surveyors has had previous experience in the territory formerly known as German New Guinea, and considers the prospects for oil discovery in these territories to be favorable. The Anglo-Persian Oil Co., in its operations in Papua, is acting on behalf of the Commonwealth and British governments, which have each provided £50,000 for the work of investigation.

The manager for the Anglo-Persian company in Papua has reported that favorable territory has been found in the Gulf district, extending from Yule Island to the Vailala River. These formations are on Apinaipa and Popo islands. The latter locality is considered to be the better site for a test well, and the prospects of finding oil in quantities there are believed to be good. It is considered necessary to carry out future geological work further afield. Two drilling outfits, it is believed, will soon be available—one to be used at Popo to drill the proposed test well and the other to be retained at Port Moresby till another location is decided upon.

A recommendation is made for the use of aircraft for the pioneer surveying of unexplored portions of the Papuan Gulf coast. A wireless plant has been installed at Upoia, and the service of carrier pigeons introduced. Summed up, the result of the work, so far, is that only one well is recommended (that in the Gulf coast region), and none is recommended in the Vailala region. The geological survey has mapped in detail a total area of over one hundred square miles, and has roughly surveyed, in addition, eighty-five square miles.

Mexican Oil Imports to United States to Approach Six Billion Gallons in 1921

Petroleum is the biggest factor in the growth of United States imports from Mexico, according to the *Foreign Trade Record* of the National City Bank of New York. Petroleum-producing supplies, machinery, pipe-line materials, engines, sheets and plates of iron or steel, drilling and pumping machinery, structural iron and steel, steel rails and railway supplies, and locomotives, to say nothing of the enormous quantities of food and clothing required by those engaged in the industry are taken in exchange for the enormous quantities of oil sent to us. It is an astonishing fact that the quantity of crude petroleum imported into the United States from Mexico in the fiscal year 1921 will be nearly 6,000,000,000 gal. as against 4,[illegible],000,000 gal. in the calendar year 1920, 2,750,000,000 in 1919, and 1,500,000,000 in 1918. Thus, despite the fact that the United States produces three-fourths of the oil of the world, her takings of crude petroleum from Mexico in the fiscal year 1921 will be practically four times as much in quantity as in 1918.

In the single month of February, the latest for which details are available, the quantity of petroleum imported into the United States from Mexico was 478,000,000 gal., against 207,000,000 gal. in February of the preceding year, and for the eight months period ending with February, 1921, 3,853,000,000 gal., against 1,659,000,000 gal. in the same months of the preceding year, and the value of the imports has correspondingly increased, standing at $49,252,000 worth of petroleum imported from Mexico in the eight months ending with February, 1921, against $19,836,000 worth in the same months of the preceding year. In the single month of February, 1921, the total value of petroleum imported from Mexico was $6,006,000, against $2,448,000 in February of the preceding year.

California Oil Statistics for March, 1921*

The year 1921 promises to be important to the petroleum industry in California. After the drain on stocks of last year it would not be surprising to see the industry record a surplus for the current year. The intensive development work throughout the entire state has resulted in a material increase in the production of the Elk Hills district and the discovery of a new oil-bearing strata at Huntington Beach. The extent to which the Elk Hills district is developed and the future possibilities of the Huntington Beach field practically govern any appreciable increase in the state production; all other districts should remain practically normal.

December, 1920, daily production of 322,658 bbl. exceeded any other monthly production in the history of California and this figure was eclipsed by the January daily production of 325,401 bbl. These two records were in turn exceeded by the February daily production of 328,104 bbl. and the March production of 338,544 bbl.

Shipments made during March, 1921, totaled 9,144,432 bbl., the daily shipments of 294,982 bbl. being 22,428 bbl. less than the February daily shipments of 317,410 bbl.

Eighty-nine rigs were erected and 533 wells were drilling during the month. Sixty-one wells were completed, with an initial daily output of 28,000 bbl., an increase of three completions and 14,000 bbl. initial daily production.

Oil-Well Machinery Exports Increase

WASHINGTON CORRESPONDENCE

There was a decided increase in the amount of oil-well machinery exported in March, 1921, as compared with exports of March, 1920. In March of this year the exports were valued at $1,[illegible],018, whereas for the same period of 1920, they were valued at $657,686. The value of other types of mining machinery exported during March, 1921, was $760,152. This shows a reduction, as compared with March, 1920, when exports were valued at $1,158,571.

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*From report by Independent Oil Producers Agency, Los Angeles, Calif.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Pittman Thinks Dollar Silver Likely To Last for Great Many Years

Radiant with optimism as to the future of silver in this country, Senator Key Pittman, of Nevada, addressed the members of the Mining and Metallurgical Society of America at the Columbia University Club, on Thursday, April 28. C. W. Handy, of Handy & Harman, also spoke on silver marketing conditions, and a half hour of general discussion followed.

Senator Pittman made it plain that there is no likelihood of the Pittman Act being repealed. However, he said there is always a chance of hasty and improper legislation, and for that reason all who are interested in the subject should be advised of every fact and of every action so that they can lend their support of the present act if necessary. "Even if it were not for the conditions under which silver was fixed at a dollar, if it depended not upon the honor of the Government to maintain it, but upon the general necessity of the Government, upon the power that the production of silver gives the Government, then that alone would be sufficient to maintain and justify the present price."

Going back to the origin of the act the Senator quoted Lord Reading as stating that the action of the United States Government in furnishing silver for India in April, 1918, was one of the most powerful acts that could have been performed toward the winning of the war. It was essential to have silver in India and have it immediately, and there was not the requisite supply anywhere in the world except in the Treasury of the United States. India had been exporting large quantities of jute bagging, a necessity in the conduct of the war. The Indians had been taught to accept silver certificates for their product. However, the reserve of metal behind those certificates was only 25 per cent. Germany understood this and sent propagandists there, who spread the report that the paper money, which the Indians had always been free to exchange for silver, could not be redeemed beyond a certain point. Instantly a "run" began, and to avert a revolution the silver had to be procured. When Congress understood this the Pittman Act was soon passed.

As to the question of what Great Britain should pay for the silver: The price at that time was 72c. per oz., but it had been demonstrated that under existing costs silver should be worth $1 per oz., so that was the price agreed upon. Now, with the emergency past, the United States Government is simply turning over the proceeds from the British Government to the silver producers who were responsible for practically all of the metal sold. It isn't costing the United States Government a cent.

"It seems to me," said Senator Pittman, "that from a business standpoint, the necessity of silver production in this country, we have got to maintain the present law just as long as we can. I know that as a matter of honor it has got to be maintained. Now, under the rules of the Senate, four Senators have been known to talk so long on a bill that the Senate took up other matters. I know now about thirteen Western Senators who would do nearly anything to prevent a stain being placed on the honor of our Government and upon the Congress of the United States. Some of them are getting old: I doubt if they could talk over six hours a day for over a week. But I know four that are in excellent health and need exercise and can talk in six-hour shifts easily for a year. That bill isn't going to be repealed.

"Now the question is, how long will it be operative . . . I am confident that the price of silver will go above a dollar by reason of natural demand when the world commences to get on its feet again and starts to work and produce. . . . Then the Government will cease to buy, and that fund will remain there until some other cataclysm or some other contingency, or conspiracy, will force the price of silver down below a dollar in the general market of the world. When it does this fund will come into action again. . . . I think it is going to work so well; it is going to prove itself so satisfactory; it is going to demonstrate that the stabilization of the price is such a strong incentive to the production of silver and other minerals in this country, that when the time comes that it expires, if it ever does expire, the Government will re-enact this law, and probably re-enact it with a broader scope, and say we will take the silver of the world at a dollar an ounce, and we will distribute the silver of the world wherever we want to distribute it at the same price."

Fellowships in Metallurgy Open At Utah School of Mines

Applications for fellowships in the Department of Metallurgical Research of the University of Utah for the year 1921-22 may be made until May 15, 1921, and will be received by Joseph F. Merrill, director of the Utah State School of Mines and Engineering at the university. The work of this department is maintained in connection with the Utah station of the U. S. Bureau of Mines, and is under the immediate supervision of metallurgists of the Bureau.

Annual Dinner of I. M. and M. (London) Hears From Many Lands

Two London Societies Unite Library and Secretariat—New Zealand Urges Scholarships

The twenty-ninth annual dinner of the Institution of Mining and Metallurgy took place April 13 at the Hotel Victoria, London. President Frank Merricks occupied the chair, and at the board were seated representatives of many of the dominions of the empire.

Hon. Sir James Allen, High Commissioner for New Zealand, in the course of a speech proposing a toast to the institution, extolled the latter's far-reaching influence in professional education. Particularly, he emphasized the pre-war scholarship scheme and urged its reinstitution. "If you can induce the Dominions and the United States of America," he said, "to . . . again . . . provide the cost of living expenses of students who may be sent to their mines for practical and scientific research a very great work will be done. . . . Britishers are quite as capable of taking in education as any other nation. . . . The competition . . . is not going to be less, and all the mining engineers and metallurgists within the empire have to rely on their best resources, abilities, and capacities in the competition that is bound to take place."

President Merricks, responding to the toast, pointed out the prominent position of the British Empire among gold-producing nations, the serious decline in its production and the fate awaiting many of its gold mines "in the near future if something of an international nature is not done to stabilize, if not to fix, the value of gold at a higher rate than obtains today." He then announced the sale of the institution's home at 1 Finsbury Circus, and the securing of larger quarters at a somewhat less convenient location. Coupled with this change President Merricks further reported that after several meetings between representatives of the councils of the Institution of Mining Engineers and of the Institution of Mining and Metallurgy working arrangements between the two organizations had been agreed on. These provide for maintaining the separate identity of each, but bring the Mining Engineers into the new home of the other institution, unite the libraries and other services under one secretariat, Mr. McDermid of the I. M. and M., and establish a joint advisory committee. The speaker expressed the hope that this federation of the 6,000 members in London might develop "to link up the various mining institutions of the empire under one imperial federation."

MEN YOU SHOULD KNOW ABOUT

E. R. Cullity and **A. K. Knickerbocker** are examining silver properties in Montgomery County, Ark.

A. F. Melcher is making studies of porosity of certain oil horizons in eastern Oklahoma.

W. T. Lee, of the U. S. Geological Survey, will make stratigraphic studies in Wyoming this spring.

Harry L. Glaze, formerly with A. L. Maas, is now connected with the Stebbins Engineering Co., Los Angeles, Cal.

W. E. Cameron, deputy chief geologist of Queensland, has been appointed mining geologist to the Federated Malay States.

J. Ward Williams, recently superintendent of the Peñoles mines, Durango, Mexico, is examining the oil fields of southern Mexico.

Prof. E. W. Skeats, of the Melbourne University, returned to Melbourne, Victoria, in February, from his European and American trip.

W. P. Woodring has returned to Washington after completing certain geologic field work in Haiti for the U. S. Geological Survey.

W. C. Agnew, general manager of the Rogers Brown Iron Co., has returned to Hibbing, Minn., from his recent stay in Baltimore, Md.

William Kent, smelter superintendent for the International Nickel Co., Copper Cliff, Ont., is spending a month in New York City and vicinity.

A. D. Combe, geologist, of Sydney, N. S. W., has been appointed assistant geologist in Uganda, Eastern Africa, under the British Colonial Office.

H. C. Boydell, mining engineer, who studied at Massachusetts Institute of Technology last year, is now at 1 Metropole St., Athens, Greece.

Brokaw, Dixon, Donnelly, Garner & McKee, geologists and petroleum engineers, have moved their office from 90 West St. to 120 Broadway, New York City.

C. F. Kelly, president, and **B. B. Thayer**, vice-president, of Anaconda Copper Co., were in Butte, Mont., last week in conference with the local company officials.

George W. Stose, of the U. S. Geological Survey, has returned to Washington after a field study of limestones in the Hanover-Lancaster valley region of Pennsylvania.

John M. Fox, consulting mining engineer, who has been superintendent for the Belmont Wagner Mining Co., at Telluride, Col., for a number of years, has opened an office at [illegible] Holbrook Building, San Francisco, Cal.

Harley E. Hooper, mining engineer, who has been with the Kanbauk Wolfram Mines, Ltd., Burma, resigned his position about March 31, and returned to Australia. His address now is Finniss St., West, North Adelaide, South Australia.

A. S. Walter, mining engineer and metallurgist, with the American Smelting & Refining Co. for the last six years, is now with R. J. Walter, mining engineer, and president of Uinta Oil & Exploration Co., at 501 Symes Building, Denver, Col.

G. D. Delprat has resigned as general manager of Broken Hill Proprietary Co., Ltd., Melbourne, Victoria, to practice as consulting engineer. His successor, **Essington Lewis**, has been with the company over fifteen years, recently as assistant general manager.

R. J. Morgan, mill superintendent of Spassky Copper Mine, Ltd., Akmolinsk district, Siberia, for ten years immediately preceding the Soviet régime, returned to Sydney, N. S. W., in February last. He was mining geologist to the Russian Far Eastern Republic during the last few months of his stay in Siberia.

H. S. Mulliken, metallurgical engineer and special assistant to the Director, U. S. Bureau of Mines, has left for Fort Worth, Tex., and the Southwest on matters connected with the Government plants for the production of helium gas in that section. He expects to be absent from Washington about three weeks.

Emil Miller, mining engineer, formerly of Russia, who has been in America for the last twelve years, and was reported as being employed in California, has failed to keep his sister, Mme. Ida Grossman, advised of his whereabouts. The secretary of the International Committee of Young Men's Christian Associations Hospitality Service, 347 Madison Ave., New York City, requests anyone having information concerning Mr. Miller (or Mueller) to communicate with him.

Mining and metallurgical engineers visiting New York City last week included: **Karl F. Klein**, Poterillos, Chile; **Thomas E. Holgate**, manager of blast furnaces, Darwen, England; **Frederick C. Gilbert**, American Smelting & Refining Co., Denver, Col.; **H. H. Hoppock**, Joplin, Mo.; **Alan B. Sanger**, Dorchester, Boston, Mass.; **Stanley C. Harold**, Pittsburgh, Pa.; **R. A. Sturgeon**, St. Louis, Mo.

SOCIETY MEETINGS ANNOUNCED

American Zinc Institute, Inc., holds its annual meeting in Hotel Statler, St. Louis, Mo., on May 9. Two days will probably be devoted to the business of the Institute. H. D. Heltzell, 1018 Pierce Building, St. Louis, is chairman of the committee on arrangements.

OBITUARY

Jerome B. Higgins, mining engineer, of Reno, Nev., died on April 8, at Katherine, near Kingman, Ariz. He had been making mine examinations in the new camp for the Oatman Revenue Mining Co. Mr. Higgins graduated in 1897 from the School of Mines of the University of Nevada, and was a member of several fraternities. His professional work embraced service with the Midas Mining Co., of California, the Zacatecas mine of Mexico, the North Rapidan Mining Co., Como, Nev., Consolidated Gold Fields and two other mines in South Africa. For nearly eight years he was at Baruma, Ecuador, with the South American Development Co., before finally returning to professional work in Nevada.

Samuel D. Bridge, Jr., petroleum geologist of San Antonio, Texas, who had been conducting explorations in Bogota for an oil company and was on his second trip there, was reported on April 11 as dead from fever contracted in the field. Mr. Bridge, who was twenty-seven years old, was born in Monterrey, Mexico. He served overseas for eighteen months during the war and was a member of the American Legion. He joined the Association of Petroleum Geologists some years ago, and had been elected an Associate Member of the A. I. M. E. in 1920. He was a graduate of Yale. His father, Samuel D. Bridge, of San Antonio, Texas, who is also a mining man, conducted an assay business in Monterrey for a number of years.

Ambrose Monell, metallurgical engineer, a director and for fifteen years president of the International Nickel Co., Bayonne, N. J., died on May 2, at Beacon, N. Y. Mr. Monell, while he was president of the International Nickel Co., furthered the study and the development of the natural copper-nickel alloy now in commercial use under the name of Monel metal. His metallurgical knowledge was acquired in part at Columbia University School of Mines, from which he was graduated in 1896. As metallurgist Mr. Monell first served with the Carnegie Steel Co., Pittsburgh; later he was connected with the Coronet Phosphate Co., International Motor Truck Co., American International Corporation, the Air Reduction Co., and the International Nickel Co. He withdrew from the presidency of the latter company when he received a colonel's commission in the aviation section of the American Expeditionary Force. Fifteen months of high-tension work in organizing and commanding groups of flying forces in France so undermined his health that he never fully regained his strength. His death at the early age of forty-seven was in part due to his severe foreign service. He had been an esteemed member of the A. I. M. E. since 1902.

THE MINING NEWS

LEADING EVENTS

Silver from Western Mines Must Go to Denver Mint

A. S. & R. Co. Notifies Shippers It Will Pay ⅜c. Per Ounce Less Than Heretofore

The American Smelting & Refining Co. has sent the following notice to ore shippers in the Rocky Mountain region:

"We are advised by the director of the U. S. Mint that all Pittman Act silver must be delivered to the Denver mint until 10,000,000 oz. or more has been so delivered. As long as the Government requires that silver be delivered to the Denver mint instead of the Philadelphia mint, as at present, it will be necessary for us to reduce the price accordingly. Beginning with settlements of today and continuing until the Government changes its instructions as to shipments to the Denver mint we will pay 99¼c. per oz. for silver, instead of 99⅝c."

Practically all of the silver mined in the Western states associated with other metals in the form of base bullion is shipped to seaboard refining points to be converted into a mintable product. Very little silver goes direct to the mint from Western mines. The American Smelting & Refining Co.'s refineries where silver is parted from other metals are situated at Baltimore and Perth Amboy, and the price paid for silver by the smelter is the Government price of $1, less the transportation charge from the refinery to the mint where it is to be coined. At present Colorado silver producers are paying express charges from the seaboard to Denver instead of to Philadelphia, and this accounts for the cut in price for silver from 99⅝c. to 99¼c. per ounce.

It is reported that since the Government started to purchase silver under the Pittman Act practically all of the silver has been shipped to the mint at Philadelphia. Of the 49,000,000 oz. purchased to date approximately 40,000,000 was shipped to Philadelphia. This amount it is said will keep the Philadelphia mint busy for the rest of the year, and it is therefore necessary to divert shipments to other minting points. Denver and San Francisco have been selected, and it is thought that for the remainder of the year the Government price of $1 per oz. will be based upon delivery at these points.

Since 1917 freight rates on bullion have been increased over 300 per cent, and express rates advanced almost as much. Colorado and Utah operators have applied to the Western Trunk Line Committee for a reduction of bullion rates.

WEEKLY RÉSUMÉ

Apex litigation has again been started, this time in Tonopah, where the Cash Boy company has entered suit against the Tonopah Extension Mining Co. The strike situation in this camp and in Divide is unchanged. In the Coeur d'Alene district of Idaho a wage cut of 50-75c. for mine, mill and smelter men became effective May 1. In Utah the case of the Utah Copper Co. in regard to power contracts with the Utah Power & Light Co. is to be reviewed by the State Supreme Court. At Denver, the American Smelting & Refining Co. has announced that all (Pittman Act) silver from the Rocky Mountain district must go to the Denver mint hereafter, instead of to Philadelphia. An explosion of methane recently occurred in a metal mine near Blackhawk, Colo., injuring two. In Minnesota, the state engineers licensing bill has been signed.

At Washington, the Senate Committee on Mines and Mining has been ordered to report favorably on a new bill for liberalizing war minerals relief legislation. A committee of engineers headed by Dr. C. K. Leith is to undertake to collect data to enable the Government to decide upon a definite policy.

U. S. Steel Corporation Announces 20 Per Cent Wage Cut

The U. S. Steel Corporation on May 3 announced a reduction of about 20 per cent in wages at manufacturing plants, effective May 16. At the company's offices in New York it was said that the Oliver Iron Mining Co. was effected by the cut.

Minnesota Engineer Licensing Bill Signed

The bill for the registration and licensing of engineers, architects and land surveyors which was drawn and prepared by the Minnesota Joint Engineering Board, passed the State Senate in the closing days of the past legislature and has been signed by the governor. The bill closely follows the model bill of the American Engineering Council as it provides for a registration board of seven members and with definite stipulations to be met before a license may be procured. The bill is not compulsory but should a person meet the necessary requirements and obtain a license in one of the branches he is then allowed to sign his name or be known as a "registered architect," "registered professional engineer" or "registered land surveyor," while any one not holding a license will not be able to use such titles.

More Apex Litigation in Tonopah

Cash Boy Sues Tonopah Extension, Claiming Latter Has Wrongfully Worked Veins Beneath Cash Boy Claim

By an Occasional Correspondent

Without much seeming partiality the ogre of apex litigation travels from one mining camp to another throughout the western United States. Always more or less of a bogey man, he is no phantom to those whom he actually visits, and with them he soon wears out his welcome. But after his departure, like a poor and hungry relative, he is soon forgotten until again, unannounced, he raps at the door.

It is more than six years since the hearing of the famous Jim Butler-West End case in Tonopah, in which were decided some interesting questions of the mining law, and in which some of the foremost lawyers and mining engineers of the respective professions were engaged.

Now comes the Cash Boy Consolidated Mining Co., on Feb. 17, and files a complaint in equity, in the U. S. District Court, against the Tonopah Extension Mining Co., making allegations substantially as follows:

1. That the Cash Boy Consolidated is a Nevada corporation.
2. That the Tonopah Extension is an Arizona corporation.
3. That there is thus a diversity of citizenship.
4. That the Cash Boy company owns the Cash Boy lode claim.
5. That within the Cash Boy claim there is a vein of rock in place bearing gold, silver, and other valuable metals, having its top or apex wholly within the boundaries of said Cash Boy lode claim extended downward vertically, which said vein at its top or apex and on its course or strike traverses said Cash Boy lode mining claim from end to end, crossing both end lines thereof, and is wholly included within the side lines of said claim.

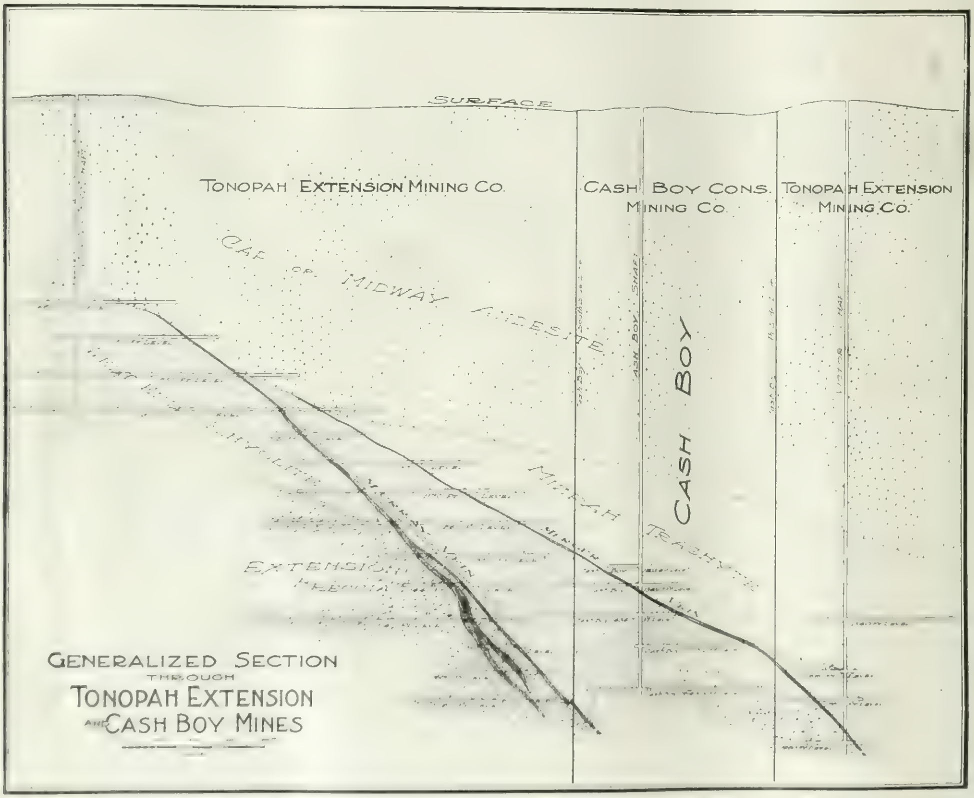
   That the Cash Boy company is the owner of, in the possession of and entitled to the possession of said lode or vein throughout its entire depth between planes drawn vertically through the end lines of said Cash Boy lode mining claim extended in their own direction indefinitely.
6. That the Tonopah Extension asserts an adverse claim to that portion of said vein which lies beneath the surface of the Cash Boy claim.
7. That said adverse claims are false and fictitious and unfounded, and cast a cloud upon the title of the Cash Boy.

And in a second cause of action the Cash Boy makes similar allegations and asserts further that the Tonopah Extension company has entered into and upon a large and valuable body of ore which lies beneath the Cash Boy surface and is mining the ore and converting the same to its own use. Whereupon the Cash Boy company asks for a restraining order and for judgment quieting its title in and to such ores as against any and all claims of the Tonopah Extension company.

The answer of the Tonopah Extension company admits the allegations of the complaint as to diversity of citizenship, and admits that if there are any veins apexing in the Cash Boy lode claim they belong to the Cash Boy company, but denies that there are any veins apexing therein, aside from and excepting the vein [illegible] from the time of patent to be in the Cash Boy territory, and avers that said [illegible] country rock is no part of any lode in relation with the vein described in the complaint or with any of the veins owned by the Tonopah Extension company.

The answer further avers that the veins located [illegible] or otherwise, [illegible] apex wholly or at all within the Cash Boy at that [illegible] are being worked by the Extension company as [illegible]. The answer further claims that the veins [illegible] have worked their [illegible] apices [illegible] of the Cash Boy and within the mining property of the Extension company, and that they have been developed and worked by a system of mine workings over a period of years from their apices downward beneath the claims of the Extension company to and even beyond the Cash Boy territory. The said veins are denominated the "Murray" and "Merger" veins, both of which pass on their dip beneath the Cash Boy and have there been encountered and worked by the Cash Boy through a vertical shaft from the surface. Wherefore, the Extension company prays for an adjudication of title in its favor, for a permanent injunction against the Cash Boy, and for an accounting for ores already wrongfully extracted.

For easier understanding of the situation, which presents some interesting features of both geology and law, a generalized cross-section is given looking northwesterly through two shafts of the Extension company and through the shaft of the Cash Boy.



GENERALIZED SECTION THROUGH TONOPAH EXTENSION AND CASH BOY MINES

Flotation Hearing Postponed

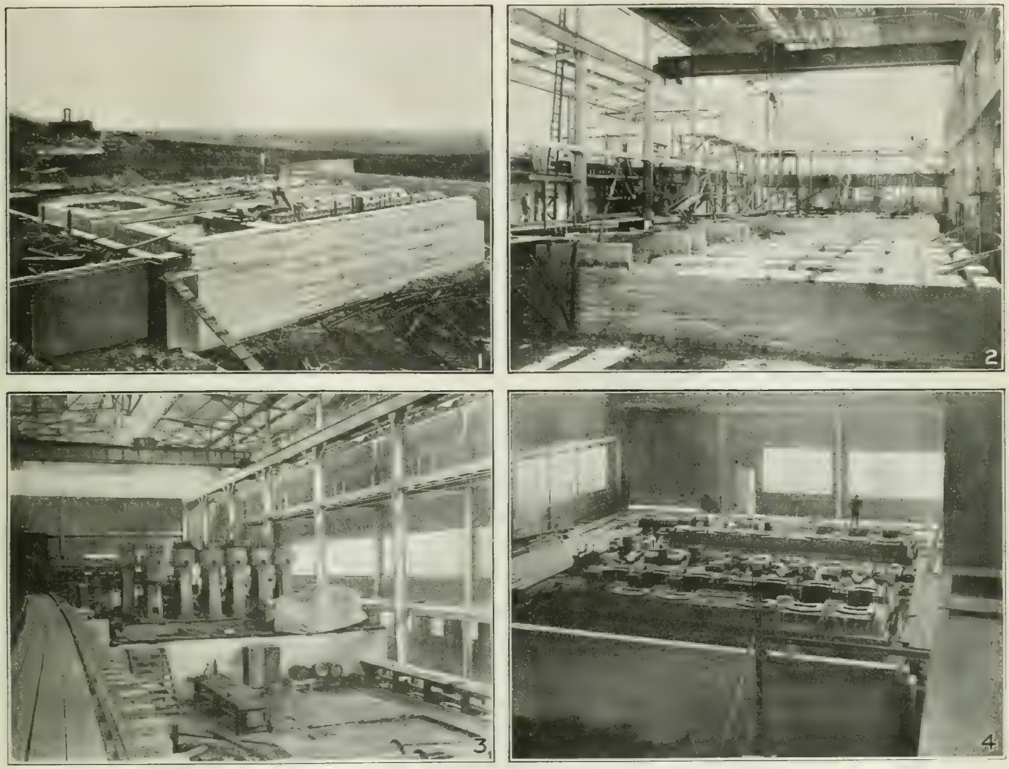
The Federal Trade Commission has postponed until about May 10 its hearing of the defense in the Minerals Separation case which it had intended to hold on May 2. The hearing was to have been in New York.

Wages Again Cut in Cœur d'Alene District, Idaho

50-Cent Reduction at Mines and Mills; 75-Cent Less at B. H. & S. Smelter

As anticipated in the last issue, a further reduction in wages of mine, mill and smelter employees of the Cœur d'Alene district has been announced, effective May 1. The reduction is 50c. per day in the mines and mills, and at the Bunker Hill smelter the cut is 75c. per day. The cut of 75c. per day on May 1 will make the rate at the smelter $4 per day. The reduction of 50c. per day by the mining companies will result in the following scale: Miners, $4.25 per day; muckers, $4; millmen, $4.25; timbermen, $4.75; unskilled surface labor, $3.75. This is the second reduction in wages in the Cœur d'Alene district since the armistice was signed, the first having been on Jan. 1, 1921, when miners' wages were reduced $1 per day and muckers' wages, except at the Bunker Hill & Sullivan, were reduced $1.25, thus making the wages $4.75 and $4.50, respectively, and establishing a differential of 25c. per day in all mines between the wages of miners and muckers.

Wages in the Cœur d'Alene district are subject to a sliding scale adopted in February, 1916, under which the



CONSTRUCTION VIEWS OF NEW POWER HOUSE OF COPPER QUEEN BRANCH, PHELPS DODGE CORPORATION, BISBEE, ARIZ.

1. Foundations for Diesel engines, Aug. 12, 1920. 2. Engine foundations, Nov. 17, 1920. 3. Power house interior, March 4, 1921, showing "A" frames of No. 1 and No. 2 engines. 4. Bed plate of engines, March 20, 1921.

basic wage for miners is $3.50 per day when the average price of lead for the preceding month is 5c. per lb. or less. When the average price for the preceding month is over 5c. per lb. 25c. per day is added for each half cent increase up to 7½c. Under this scale the maximum bonus is $1.25, or $4.75 per day. During the war when the price of lead soared far above 7½c. the operators advanced wages up to $5.75 per day, and, as stated above, did not reduce from that figure until Jan. 1 of this year, when it was evident that there had been a material reduction in the cost of living. After the reduction that becomes effective on May 1 miners will still be receiving a bonus of 75c. per day and other employees in mine, mill and smelter a corresponding bonus, though under the terms of the sliding scale they are entitled to no increase, for the average price of lead is now below 5c. per lb. and has been for four months.

The Bunker Hill & Sullivan, the Federal, and the Hecla are the only large producing mines in operation, the Callahan, Tamarack, Hercules, and Hunter being closed down. All of these, however, are doing considerable development and will adopt the new wage scale.

Phelps Dodge Installing Two 2,000-B.hp. Diesel Oil Engines at Moctezuma Plant, at Nacozari

Two More for New Power Plant at Bisbee—Will Have a Larger Output Per Cylinder Than Any Other Similar Engines in This Country Built for Stationary Work

By CHARLES LEGRAND*

The Phelps Dodge Corporation is now erecting at the plant of the Moctezuma Copper Co., Nacozari, Sonora, Mexico, the first of two Diesel engines rated at 2,000 hp. at sea level. Two similar engines will be erected at the power plant of the Copper Queen Branch, in Bisbee, in the next few months.

These engines are two-cycle and were built by the Nordberg Manufacturing Co. from the designs of Carols Freres in Belgium. They have four cylinders, 26 in. in diameter, with 44-in. stroke, and run at 120 r.p.m. The main shaft is 17 in. in diameter and the crank pins 17½ in. The floor space required is approximately 20 x 53 ft., including the direct-connected generator. Each of the engines weighs, without the generator, approximately 350 tons. They are equipped with a complete oiling system, which circulates lubricating oil to all parts of the engine except the valve motion. They have a complete water-cooling system, with independent regulation for the pistons, the heads, and the exhaust pipes. The pistons have adjustable crossheads and slides, instead of the more usual trunk pistons used in most Diesel engines.

The scavenging of the cylinders is done through four valves in each cylinder head, operated by cams. The exhaust of the burned gases takes place through ports in the cylinder wall, these being uncovered by the piston at the end of the stroke. The scavenging air is furnished by a single-cylinder direct-connected scavenging pump with automatic plate valves. The scavenging air pressure is approximately 4 lb. per sq.in. This high scavenging pressure is used because the exhaust pipes are choked sufficiently to give an initial pressure of $2\frac{1}{2}$ lb. in the engine cylinders at the beginning of the compression stroke. In this way the weight of air in the cylinder is approximately the same at the elevation of 3,600 ft., where the engines will be operated, as it would be at sea level, and the engine can burn the same quantity of fuel and deliver the same number of indicated horsepower as it would at sea level. The higher power taken for the compression of the scavenging air reduces the brake-horsepower output and increases the fuel consumption over sea-level conditions, but the reduction in the investment per brake-horsepower available fully justifies this increased fuel consumption.

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*Consulting Engineer, Mechanical Engineering Department, Phelps Dodge Corporation.

The fuel is pumped to each cylinder by a separate pump. These pumps are under control of a governor which varies the quantity of fuel according to the power demand on the engine. The actual injection of the oil into the cylinder is done by high-pressure compressed air, and this high pressure is furnished by a direct-connected, three-stage air compressor. This air compressor has an excess capacity over that required for the injection of the fuel, and this excess capacity is used to fill air bottles. The stored compressed air is then used to start the engine.

The air-injection pressure varies from 800 to 1,100 lb. per sq.in., according to the load on the engine and the kind of fuel used, the higher pressure being used with the very viscous Mexican crude oil with which these engines will be operated.

The engines are equipped with a double oil-supply system, so that when started a light fuel oil can be used. This light fuel is also used at the time of stopping, so that the pumps and piping on the engines are filled with light oil when stopped. It is necessary to warm the heavy oil before it can be handled successfully by the pumps and pulverizers. For this reason the heavy fuel oil header is equipped with an inside pipe, through which hot water is circulated, the jacket water of one of the exhaust pipes being used for this circulation. All the fuel oil is filtered before being used in the engine, and the filters are a part of the equipment furnished with the engine.

The engines are to drive 1,500-kva., 60-cycle, 3-phase direct-connected generators running in parallel and, with four 5-cylinder 1,250-hp. engines of the same type, will furnish all of the power for operating the mines and mill of the Moctezuma Copper Co.

The decision to use these engines was made after five years' experience with the smaller engine. The engines have a larger output per cylinder than any others of the type built in this country for stationary work.

Only one blast furnace is running at the International Nickel Co.'s smelter at Copper Cliff, Ontario, in the Sudbury district.

Methane Explodes in Colorado Metal Mine

Accident in Tunnel Near Blackhawk Injures Two Workmen

A methane-gas explosion occurred in the Cyclops tunnel, operated by the Midwest Mining & Milling Co., near Blackhawk, Col., on April 21. Two men, E. G. and D. E. Nelson, brothers, were severely burned, but are expected to recover.

The tunnel in which the explosion took place was being driven to connect with an old shaft at a depth of 400 ft. and is about 1,400 ft. long. A long hole was kept ahead of the breast, and usual precautions were taken to prevent accidents. On April 20 indications showed the breast to be close to the shaft, and the long hole was loaded and shot with the regular round in an attempt to break through. The attempt was successful, and was followed by a rush of water which came out of the tunnel a foot or more deep. When the men returned next morning the water had gone down and two of them started in. About 80 ft. from the breast the man who was behind noticed the flame of his lamp shoot out to a length of 16 or 18 in. He was about to call to his brother to look at it when there was an explosion which knocked them both down and burned their heads, faces, necks, and hands severely.

An investigation of the accident was made on April 23 by Horace F. Lunt, commissioner of mines; James Dalrymple, state coal mine inspector; Daniel Harrington, supervising mining engineer of the U. S. Bureau of Mines, and T. R. Henahen, state mine inspector. These officials reached the conclusion that the explosion was caused by methane (fire damp) from decay, under water, of the timbers in the old workings. This gas had probably accumulated, and was pulled out into the tunnel by the rush of water when the hole broke through. Being lighter than air it collected along the top of the drift, mixing with the air in the proper proportion to form an explosive mixture. The draft through the small hole was not strong enough to remove it, and it remained until ignited by the miners' lamps.

Less Than Thirty Zinc Mines Running in Joplin District

Slightly improved zinc ore prices have caused much talk of reopening of mines in the Joplin-Miami district, though most operators in the field hope this will not come about. They point out that there already is an apparent stock on hand of 60,000 tons just in this field, and they feel it would be a serious mistake to increase production at this time.

On the other hand, some operators question whether any material increase in production from this field at this time could be accomplished, even if it was desirable, on account of the labor situation. They point out that hundreds of miners left the field during the past winter, seeking work. Several of the richer mines that have persisted in operation have used night shifts, because they could get the men to reduce rock tonnage costs, and it is believed if many mines start up they will have to take the men from these night shifts. This would mean that these men would go to work in poorer mines and their proportionate output per man would be less than it now is.

The Vinegar Hill Barr mine was started up on April 25, as well as the Muncie and one or two other mines, but for the most part the mines that have been down for some months will continue down until at least \$30 per ton is paid for zinc ore. There are at present about twenty-eight properties operating steadily in this field, with three or four operating a few days a week. This contrasts with 122 in operation a year ago. But production now amounts to about 6,500 tons weekly as compared with probably 12,000 tons a year ago.

Utah Supreme Court To Review Power Contract Case

Litigation between the Utah Copper Co. and the Public Utilities Commission of Utah in regard to increased rates allowed the Utah Power & Light Co. from holders of special contracts entered into a number of years ago is being continued, and the case, through the granting of a writ of certiorari, will be reviewed by the State Supreme Court. In 1919 the commission began an investigation into contracts with the Utah Power & Light Co. held by some of the larger users of power in the state. The Utah Copper Co., with others, resisted the right of the commission to make the investigation on the ground (among other things) that these contracts antedated by some years the creation of the commission as a body. After numerous hearings before the State Supreme Court at Salt Lake City as to the right of the commission to decide in the matter, and in regard to a petition by the Utah Power & Light Co. asking increased power rates—the two cases being combined under one head—a decision was handed down that such a right was vested in the commission. On Oct. 20, 1920, the Utah Public Utilities Commission therefore issued an order dismissing special contracts, and ordering the substitution of regular power rates.

Lessor Must Settle Promptly

The recent session of the Montana Legislature enacted a law designed to afford prompt settlement on ores shipped to smelters by lessees. The act went into effect April 1 and under its terms settlement of smelter returns must be made with the lessee within seven days after the lessor has received a statement from the reduction works. Lessors who fail to observe the provisions of the law are subject to a penalty of payment to lessees of an amount equal to 10 per cent of the net returns from the ore shipment.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Engineers To Aid Government in Determining Petroleum Policy

Lack of Precedents Makes Solution of Economic Problems Difficult—Leith Heads M. M. S. A. Committee

Congress and the State Department are face to face with the intricacies of the economic problems growing out of the petroleum policies of several foreign governments. They are confronted with situations for which there are no precedents. When Congress or the State Department has no precedent to follow each evinces surprising helplessness. Moreover, it develops that there is little definite information to be used in determining reciprocal or retaliatory policies.

In view of the scarcity of such facts a committee of the Mining and Metallurgical Society of America, with Dr. C. K. Leith as its chairman, met in Washington April 29 and determined to gather certain fundamental data which can be put at the disposal of the Government. Conferences were had with interested departmental officials and with the chairmen of the committees on mines and mining of the Senate and of the House. The committee was urged to do all that it could toward gathering facts which would be useful in the foregoing connection.

The question is held to involve more than petroleum. While nature distributed petroleum unequally throughout the world it pursued the same course with other minerals. In some of these minerals the world must depend heavily upon the United States. All agree that restrictions on the international movement of essential minerals should be subject to the minimum amount of control. Nevertheless, there is certain to be more or less trading on the strength of mineral advantages as a result of the acuteness of the oil situation. It is the hope of the Leith committee to be able to furnish information which will make possible a more intelligent consideration of this general subject, when placed at the disposal of the Government.

Senate To Get Favorable Report on New War Minerals Bill

Committee Also for Permanently Changing Assessment Work Year to Fiscal Basis

A bill by Senator Shortridge, of California, providing for the liberalization of the War Minerals Relief Act was ordered reported favorably to the Senate at a meeting of the Committee on Mines and Mining held April 30. The bill is intended to remove inequities in the cases of producers of manganese, chrome, pyrites, and tungsten, who did not receive a personal request or demand from a Government agency. An identical bill passed the Senate Feb. 24, 1921, but it was not acted upon by the House, with the result that the bill died with the last session of Congress on March 4.

The committee also reported favorably a bill providing for a permanent change in the assessment work year so that it will coincide with the fiscal year.

NEWS BY MINING DISTRICTS

Special London Letter

Government Gets Large Share of Gold Mining Areas Consolidated's Profits —Burma Corporation To Curtail To Far East's Needs

BY W. A. DOMAN

London, April 19—When the Government Gold Mining Areas (Modderfontein) Consolidated was formed it leased mining rights from the Union of South Africa Government. Consequently the company differs from the majority of mines on the Rand in having no vendor shares. The whole of the £1,400,000 of share capital produced funds for opening up the mine. This was a distinct advantage from one point of view, though naturally the government comes in for a large proportion of the profits. Last year the gold produced realized no less than £3,388,524, while miscellaneous income raised the sum to £3,419,741. Working costs amounted to £1,680,361, though included in the total is £27,693 on account of miners' phthisis contribution. The net profit was £1,739,380. Of this sum shareholders received £700,000, or 40.2 per cent, equal to 50 per cent on the share capital, and the government takes £882,975, or 50.7 per cent of the profits. Had there been any vendor consideration the nominal capital would have been very much larger and the state would not have benefited to anything like the extent it has done, because its proportion would be confined to the 10 per cent profits tax, reduced by amortization allowance to about 8 per cent. With the exception of the Meyer & Charlton, which also leases claims and pays a percentage of the profits, the Far Eastern Rand companies are the only ones that operate on this basis.

The Government Gold Mining Areas works on a large scale. Last year there were 195 stamps in operation with the high average duty of 27.6 tons per stamp per day, while in addition 25 tube mills were running. Development aggregated 38,195 ft., of which 19,905 ft. were on reef and 19,830 ft. were sampled. The payable reef was 13,100 ft., or 66.1 per cent—rather high for the Far East Rand—and the value 14.6 dwt. over 55 in. As the average stoping width runs nearer 80 in. the mill value is less. Of 1,763,913 tons mined about 14 per cent was rejected as waste and 1,515,000 tons was crushed. The ore reserves stand at the very high total of 10,291,000 tons, averaging 8.2 dwt. over a stoping width of 77 in. Working costs were exceptionally low for the Rand, the 22/2 per ton covering the mine, head-office expenses, gold realization charges and exchange, these three items accounting for a total of £103,694.

The chairman of the Burma Corporation, Sir Trevredyn R. Wynne, has paid a visit to the company's properties and on April 15 he addressed the shareholders on the subject. The company has decided for the present to confine its lead production to the requirements of the Far East, though it is seeking an outlet in this country. With this object it is entering into an arrangement with the Associated Lead Manufacturers. The scheme is to create £500,000 new debentures and hand over £400,000 debentures plus £100,000 in cash. As a result it hopes to secure control of 60 per cent of the selling business at home. F. A. Govett, one of the directors, was rather opposed to the scheme, but later agreed. It appears that the zinc smelting enterprise which was to be inaugurated at Jamshedpur, in India, has come to a standstill. The reason is not quite clear, but it is said that it is because the Indian Government, which was to provide one-third of the capital, is not now doing so. The other two-thirds were to be found by the Burma Corporation and Tata & Company, of Bombay.

AUSTRALIA

New South Wales

Broken Hill's Decline Explained

Broken Hill—Giving evidence before the parliamentary select committee which is inquiring into the decline of mining, C. J. Emery, manager of the British Broken Hill Proprietary Co., and president of the Mining Managers' Association, said that the decline in the industry in Broken Hill was due to increased cost of production. Before the war Broken Hill produced an average of 300,000 tons of concentrates a year. The price of lead would have to be £6-9-0 per ton more now than in 1915 to counteract the increased smelting charges alone. That one item meant over £1,000,000 to the industry. The increase in the cost of coal equaled £50,000 a year, and the increase in freight £34,000. In 1914 they paid 16/6 for 100 super. feet of timber; today timber cost 50/- per 100 super. feet. increased cost of production was not altogether due to the higher wages, but to many other factors. Another factor which militated against lead mining was the absence of a market. Prior to the war Europe had taken from 600,000 to 700,000 tons of lead; today Europe is taking only 160,000 tons. If lead were being produced in Broken Hill they would have difficulty in disposing of it. The increase in freights was also a big tax on the industry. The decline in mining in Broken Hill was due to the greatly increased cost of production.

Mr. Emery also said that 95 per cent of the production in Australia had to be sold in Europe. Broken Hill should produce lead as cheaply as any other place in the world. Generally there was no complaining against the efficiency of the labor at Broken Hill. The witness thought the position would gradually adjust itself, but there would be a period during which they would have a bad time. There was a possibility of a new process coming along to cheapen smelting costs, and even to eliminate smelting. Under the existing conditions the lowest price at which lead could be profitably produced was £25 per ton. The mines at present would therefore be working at a loss. The companies had been making inquiries overseas for a market for their concentrates. If a market could be found there would be no doubt about the Federal Government giving permission for it to be sent away. Germany, France, and Great Britain must have had enormous accumulations of lead during the war that was not being put on the market. There was at [illegible] Broken Hill today [illegible] had been at any period in the history of the field. There was 14,000,000 tons of ore in sight in the Broken Hill Mines.

BURMA

Namtu—[illegible] production for March [illegible] refined lead production, 3,020 tons, and refined silver [illegible]

CANADA

British Columbia

Gold Reported Discovered Between Spences Bridge and Ashcroft

Trail—Ore shipments received at the Consolidated smelter the week ended April 21 totaled 9,977 tons, of which 137 came from the Bluebell at Riondel and the rest from company mines.

Spences Bridge—Gold has been discovered on the old Yale Cariboo road between Spences Bridge and Ashcroft. The find is credited to the Ellingsen Brothers, of Ashcroft, who are said to have taken a number of nuggets from their claims. The section already is extensively staked, and the original locators are proceeding with development.

Penticton—Three workable seams of first-class blacksmith and steam coal are reported as having been developed recently at the White Lake coal mine, near here. There are two shifts on development. Tipples are to be installed soon.

Kaslo—A car of silver-lead ore produced by lessees at Whitewater mine, seventeen miles from Kaslo, and shipped to the Bunker Hill smelter at Kellogg, Idaho, represents the only production and shipment of ore from this section so far this year, with the exception of the Bluebell concentrates.

Silverton — The annual meeting of shareholders of the Standard Silver-Lead Mining Co. was scheduled to be held the last week in Spokane. The annual report was expected to show the company in a strong position financially, notwithstanding the fact that operations during the past year have been confined almost entirely to work by lessees.

Rossland—Douglas Lay, who was connected with operations at the Le Roi 2 about two years ago, has arrived here after an extended sojourn in England, and will be in charge of Le Roi 2 operations, which are expected to be resumed soon.

Cranbrook—At a meeting of directors of the Wild Horse Creek Placer Gold Mining Co., held here about April 15, plans for the season's operations were discussed and arrangements made for beginning active work. The company has about $40,000 invested in the project.

Nelson—A. G. Langley, government mining engineer for district 3, has been giving a series of lectures throughout East and West Kootenay recently, dealing with minerals and ore occurrences, and designed to be of special benefit to prospectors and mining men.

Ontario

More Power for Kirkland Lake—Operators at Cobalt More Optimistic

Kirkland Lake is now receiving a full supply of power, and to keep up with the growing demands of this camp the Northern Ontario Power Co. has increased the capacity of its substation and will now be able to supply 4,500 hp. as against a former capacity of 2 000 hp. This district is daily developing in importance, and is easily the second gold camp of Canada, and stands high among those on the continent. At least two new mills will be put into operation this year; the Teck Hughes mill is being enlarged and the Tough Oakes mill will be restarted.

H. H. Johnston has made an optimistic report on the Tough Oakes, Burnside, and Sylvanite, which will be worked as one property. It is understood that the financing for this amalgamation has been arranged in England and that the work of reopening the properties will be started soon.

The Teck Hughes reorganization, which was necessitated when the bond issue of $500,000 fell due last October, is well under way and will be completed within a month. The property is shaping up excellently, and is making good profits on operations. The Kirkland Gold is progressing well, and purposes doing some diamond drilling from the 900-ft. level to determine the geology at depth. The Wright Hargraves mill is ready to start, and is rated at a capacity of 150 tons a day. This property is considered by many engineers to be the most important in the camp. The Lake Shore mine has ordered the necessary machinery to increase its mill capacity from 60 to 100 tons a day.

Porcupine—In Porcupine all signs point to this being the most important year in the camp's history. The Hollinger is practically up to capacity, and is treating 3,300 tons a day. The company has given a contract to build 150 four-room cottages. The Dome is treating 1,000 tons a day, and, with its low costs, is making a good profit. The mill capacity is approximately 1,500 tons a day, but some changes are necessary to give a good extraction with this tonnage. The price of the stock has doubled within the last couple of months. The McIntyre is treating 600 tons a day, and the North Crown mill, with a capacity of 120 tons a day, will reopen soon.

Cobalt—With silver around 60c. and the belief that the market for silver has seen its worst and is now on the up-grade, the feeling in Cobalt is somewhat better. There is no immediate prospect of any of the closed properties reopening, with the exception of the Mining Corporation, but it now looks as if no others would close.

The Mining Corporation is making changes in its mill to bring the capacity up to 300 tons a day, and may reopen within the next two months. The Coniagas, after passing the dividend due Feb. 1, has declared a dividend of [illegible] per cent payable May 2 to shareholders of record April 22.

Toronto—In view of the depressed condition of the mining industry and the strong opposition encountered, the Ontario government has withdrawn the clauses in the mining bill now before the Legislature providing for an increase in mining taxation.

MEXICO

Sonora

Phelps Dodge Continuing Work on Addition to Nacozari Mill

Nacozari — Though production has been stopped in the Nacozari mill of the Moctezuma Copper Co., construction is being continued on a large addition to the mill. A new Diesel unit of large size has been installed at the power house. Much development work is being pushed at the company's mines, at Pilares. About 600 men have been retained.

Sahuaripa—The Mexican Exploration Co. is reported to have purchased the Herrero mine, in the Sahuaripa district, from Mrs. Fannie Brent, widow of James Brent.

ARIZONA

Boom in Katherine District, Mohave County, Drawing Many

Pearce — A section of the Commonwealth mill at Pearce is to be started June 1, for handling gold-silver ores heretofore shipped to Douglas.

Bisbee—About 1,000 men have been retained, principally on development work, by the Copper Queen and half that number by Calumet & Arizona. They are drawing wages 5 to 10 per cent above the base scale. A large number of the men dropped remain in the camp, favored by rent reductions and other concessions.

Calumet & Arizona has dismantled the electric hoist at the Hoatson shaft for transfer to the Cole No. 3 shaft, in the Night Hawk-Boras section, where new ground is to be explored. The Night Hawk lease has been extended to cover the period of shutdown.

Kingman—The present boom in the Katherine section, northeast of Kingman, is to be compared with that known in the Oatman district years ago, though this does not mean that there is equal justification for it. Local hotels are unable to house the rush, and many who have brought their blankets find the railroad platforms nightly resting places. The new town of Katherine near the Colorado River is growing rapidly, with $75,000 already received from the sale of lots. Numerous automobiles leave Kingman daily.

The hills and plains around the Katherine have been located without a break for miles, and locators are now crossing the river, to stake claims on the Nevada side. Sinking has been started on a 200-ft. contract on the Katherine Extension.

The rich ore in the Katherine was found in north workings of comparatively recent development, most of the early work having been done toward the south. Development is being prosecuted on three levels.

At Oatman, United Eastern will sink an 800-ft. shaft west of the Red Cloud and will make thorough exploration of that end of the property. The Red Cloud is owned by the Tom Reed and has a 350-ft. shaft in which good ore is said to have been developed.

NEW MEXICO

Great Eagle Fluorspar Mill Starts Grinding—Development To Continue at 85 Mine

Lordsburg—The new mill of the Great Eagle Fluorspar Co. has started grinding. At present the capacity is fifty tons daily of 100-mesh product. Work upon the jigs and tables will be completed soon, when operations will be continuous. This is the only fluorspar grinding plant west of the Mississippi River. The entire product is being marketed by W. J. Prowell, of Philadelphia. Alford Roos is manager.

The closing of the C. & A. smelter and the curtailment of mining operations at Warren, Ariz., will have no effect upon the company's plans for developing its 85 Mine, at Valedon, N. M. Development work will continue here as originally outlined. Drifting on the vein on the 1,050 level continues in high-grade copper sulphides.

The pumps in the Tyrone property of the Phelps Dodge Corporation will not be pulled, as was reported.

Hachita—A new 160-cu.ft. air compressor and drills has been installed in the American mine.

COLORADO

Gilpin-Eureka Company To Deepen Shaft, Move Mill and Add to Equipment

Central City—After a conference of stockholders of the Gilpin-Eureka Mining Co. who recently visited this camp, Manager Athanson announced that the company had decided to deepen the shaft 350 ft. below the 700 level, work to start May 1. The company will move the present stamp mill to Eureka Gulch, increase the number of stamps to forty, and send the ore from the mine over an aërial tramway to the mill. Two electric pumps have been ordered, one to be stationed at the 700 level, and the other at 300. Sinking is expected to be completed within about four months.

Ophir Loop—The San Bernardo property is being operated at full capacity by the Valley View Leasing & Mining Co. The mill is turning out about three cars of concentrate per month.

Telluride — The Liberty Bell Gold Mining Co. is dismantling its mine plant, and the surface machinery and other equipment is being shipped to Telluride. This action marks the passing of one of the best-known mines of the Telluride district, and an organization that has been noteworthy for its successful exploitation of low-grade ore under difficult conditions.

At the annual meeting of the stockholders of the Colorado-Superior Mining Co. the following officers and directors were elected: Bulkeley Wells, president; O. J. Larson, vice-president; A. Reeves, Jr., secretary; A. D. Snodgrass, assistant secretary; Ed. Hendrickson, treasurer; H. G. Palsgrove, manager; Isaac Partanen, superintendent; E. B. Adams, and Harry Johnson. The company owns and operates the Black Bear property.

UTAH

Montana - Bingham Shipping Fluxing Ore to Garfield—New Orebody Found in Idaho-Utah

Oakley (In Idaho) — An orebody is reported at the Idaho-Utah adjoining the Vipont properties, both in northern Utah near the Idaho line. The Vipont has been operating a 300-ton mill and shipping concentrates running well in silver regularly to Oakley, the nearest shipping point, twenty miles away. The orebody reported at the Idaho-Utah is 1,000 ft. below the surface, and about 300 ft. from the orebody at the Vipont, although at a lower horizon.

Bingham—The Montana-Bingham is employing forty men and shipping two cars of fluxing ore daily. The ore carries much pyrite and is being used at Garfield since the Utah Copper Co. shut down. The latter had been supplying concentrates running high in iron. Development work is also being done.

Following the closing down of the Utah Copper Co., the train service to Bingham over the Denver & Rio Grande has been limited to one train daily, a morning train from Salt Lake City, permission having been granted the railroad by the Public Utilities Commission to take off the afternoon train. Bingham citizens are petitioning to have the afternoon train put on again, under the plea that the absence of an afternoon mail is prejudicial to business.

IDAHO

Bonner County Mining Association Holds First Meeting

Sandpoint—The first annual meeting of the recently organized Bonner County Mining Association was held at Sandpoint, April 20, the following officers being elected: G. D. McLachlan, Armstead mine, Talache, president; W. M. Hollembaek, Sandpoint, secretary; M. B. Dunkle, Sandpoint, treasurer. Vice-presidents elected were: Robert Rennie, Lakeview section; E. D. Sappington, for the Newport-Priest River section; H. L. Thomas, for the Sandpoint section, and James Campbell, for the Hope-Trestle Creek-Grouse section. Addresses were delivered by Dean Francis A. Thomson, of the mining department of Idaho State University, by Stewart A. Campbell, state mining inspector, and by L. K. Armstrong, of Spokane. The association covers a territory having about thirty or forty-five properties in various stages of development.

MONTANA

Rumored Anaconda May Reopen One or Two Silver Mines

Butte—Anaconda is said to be considering the feasibility of reopening one or two of its silver mines, principally the Nettie property. The Nettie ore also carries considerable lead. The ore would probably be shipped to the Tooele plant of the International company in Utah, which Anaconda controls, for treatment, as at this plant there are facilities for caring for lead. The corporation has set into motion a rotating system of employment so that the greatest possible number of persons may be afforded what relief is possible from the employment at hand.

CALIFORNIA

New Western Pacific Rate to Utah Smelters and McGill Allowed

San Francisco—The Western Pacific R.R. has been allowed by the I. C. C. to put into effect its new rate of $6.50 per ton from Utah smelters and $7.60 from McGill, Nev., to Oakland, Cal., on copper bar, cakes, pigs and ingots, and slabs. The new rate became effective April 29. The old rate was $22 to far Eastern points and $21.20 to Baltimore. Ocean freight rates from Oakland, Cal., via Panama, are now such that combined with the new railroad rate a substantial saving upon copper bullion shipments from McGill and Garfield to Atlantic seaboard refineries can be made.

Grass Valley—Power transformers at the Allison Ranch mine recently burned out, and only prompt work prevented the extensive flooding of the mine. Transformers formerly in use at the Champion mine were quickly secured and installed, enabling the main station pumps to be operated. A ten-stamp mill is to be installed soon by the Kate Hardy mine which is situated near Forest.

NEVADA

Strike Situation at Tonopah and Divide Unchanged—Standard Metals Mill Completed

Reno—The improved concentrator of the Standard Metals, in the Peavine district, has been completed and is operating successfully, treating thirty tons daily. Practically all ore is coming from the new vein on the 300 level. Many properties are operating, or preparing to resume soon. Developments are said to be encouraging.

Tonopah—No progress has been made toward settling the strike against companies which reduced wages 75c. per day on April 16.

The Tonopah "76" company has announced that plans for financing further work in its ground have been completed and that work will soon be resumed by the West End, this work to be done from the 800 level of the Ohio shaft.

Divide—Many small companies are operating in this district, either paying the old scale of wages or working by contract. The principal companies which are supporting the wage reduction, and which are not working at present, are the Tonopah Divide, Brougher Divide, Belcher, and Giant. The Kernick is making good progress in the north and southeast crosscut from the 900 level of the Kernick shaft. Each crosscut has reached a total length of about [illegible] ft. No particular changes of importance have been reported, although narrow stringers in breccia carrying small values have been cut.

WASHINGTON

Northwestern Iron & Steel Co. To Develop Claims Near Lead Point

Tacoma—The Tacoma smelter of the American Smelting & Refining Co. has had a new wage scale in effect since April 1, providing for a 40c. reduction per shift from the former scale, making the minimum wage $3.20 per day, and affecting over 750 employees.

Keller—The plans of the Iron Creek Mining Co., developing the Iron Creek mine, twelve and one-half miles from Keller, provide for installing a small cyanide plant soon, to cost about $3,000. The property already has a mill, and the addition of a cyanide plant will effect a better saving, it is believed. A small crew has been employed on the property during the winter.

Lead Point—The Northwestern Iron & Steel Co., holding a group of iron claims near Lead Point, is preparing to develop the property. Lessees working the Lead Trust mine have a quantity of ore ready for shipping as soon as market conditions are more favorable. A recent promising development in the camp is the Silver Cloud property, owned by Aserford & Hartman, grubstake prospectors, who have shown up a strong 6-ft. vein, with values as high as 22.2 oz. silver and 27 per cent lead.

Spokane—Permission has been given the Great Northern Ry. to reduce the daily train service from this point to the Boundary section, in British Columbia, and to Republic, to three trains per week. This is on what is known as the Marcus division, which formerly handled a large freight and passenger business because of mining activity in southern British Columbia and northern Washington.

Chewelah—An eight-mile stretch of trunk highway between here and Valley is being macadamized with a crushed quartzite assaying $2 per ton silver and a trace of gold. The value of mineral used in this section of roadway is about $15,000.

Wenatchee—An application has been filed with the Federal Power Commission for two small power installations on tributaries of Phelps Creek, in Chelan County, Wash. Each plant will consist of a low diversion dam and short length of pressure pipe line to a small power plant of about 100 hp., to be located at the mouth of two mines of the applicant company, proposed by the Royal Development Co., James Naughten, president, Wenatchee, Wash.

Republic—About twenty men are at present employed in mining in this camp.

OREGON

Roaring Gimlet Being Reopened—Gold Ridge Buys Small Mill

Gold Hill—Mark A. Applegate, A. J. Armstrong, and E. W. Moore, of Medford, Ore., are reopening the Roaring Gimlet gold quartz mine under lease. This has been down since 1906. A new shaft will be sunk on the vein and a new level opened below the old workings, which are approximately 100 ft. deep.

The recently incorporated Gold Ridge Mining Co., of Medford, has purchased the electric-driven ten-stamp mill and equipment at the Bill Nye mine, and is re-erecting it at the Gold Ridge. Development is being pushed.

Work on the Millionaire group, two miles east of the Roaring Gimlet and Gold Ridge groups, has been resumed under the management of the owner, C. A. Knight, of Central Point, Ore.

MICHIGAN

Gogebic Range

Townsite Mine Working Five Days Per Week Instead of Three—Stocking Space Filled at Several Properties

Ironwood—Steamers have come up to the head of the Lakes, but as yet the mines have received no orders to send ore to the docks, where the boats are waiting.

The Steel & Tube Co. of America closed the Newport and Anvil-Palms mines indefinitely on May 4, affecting about 1,000 men.

Several mines will have to start shipping soon or else shut down, as their stockpile grounds are filled. They were left with considerable ore in stock last fall, and the winter's hoist, although smaller than usual, has filled the rest of the space.

The crosscut on the 24th level of "H" shaft of the Pabst mine has gone into rock after passing through 100 ft. of ore.

MINNESOTA

Mesabi Range

Hill Annex Shipping from Pit—Oliver Iron Mining Co.'s Screening Plant at Coleraine Started

Marble — The Hill-Annex mine has started to ship from its open pit. This ore is of the direct-loading class, as the washing plant has not yet been put in operation.

Hibbing — The Winston-Dear Contracting Co. is building coal pockets at the Boeing pit for the Mesaba Cliffs Iron Mining Co. This will permit the unloading of two trains at once.

Coleraine—Work has begun on the construction of the new screening plant of the Oliver company.

Buhl—Two steam shovels have been started loading ore in the open pit of the Dean mine. The resumption at this property relieves the unemployment situation to some extent. The mines and open pits are not opening up very rapidly and it is rumored that the Shenango pit will not reopen this season.

Two Harbors—The hauling of ore to the docks of the Duluth & Iron Range railroad is in progress. Some ore has arrived from points around Ely and Tower. It is anticipated that regular shipments will arrive each week, although these will be light for some time.

THE MARKET REPORT

Daily Prices of Metals

April	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
28	12.375	30.00	31.75	4.50@4.70	4.35@4.50	4.95@5.00
29	12.375	30.25	32.00	4.60@4.75	4.45@4.55	4.95
30	12.375	30.50	32.00	4.60@4.80	4.55	4.95
May 2	12.375	30.50	31.75	4.75	4.55	4.95
3	12.375	30.25	31.50	4.75@4.85	4 60	4.95
4	12.375	30.75	32.00	4.85	4.65@4.75	4 95

*These prices correspond to the following quotations for copper, "delivered": 12.625c. for the week.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

April	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
28	70½	70¼	72	172	174¾	21⅛	21⅝	26¼	27
29	70⅜	69⅞	72	171½	174	21⅜	21⅞	26	27
30	...	...	...	....	....	...	...	...	...
May 2	70½	69¾	71½	169½	171½	21½	21¾	25¾	27
3	71¼	69¾	72	168	170½	21⅞	21⅞	25⅜	26⅝
4	71½	70⅛	72	169½	172	22¼	22¼	25½	26¾

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

April	Sterling Exchange	Silver New York, Domestic Origin	Silver New York, Foreign Origin	Silver London	May	Sterling Exchange	Silver New York, Domestic Origin	Silver New York, Foreign Origin	Silver London
28	394¼	99¼	60⅝	34¾	2	396⅝	99¼	61⅜	34⅞
29	394¾	99¼	60⅝	34⅝	3	397	99¼	61⅜	34⅞
30	395½	99¼	60⅞	34¾	4	397	99¼	61⅜	35

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Monthly Average Prices for April

Copper:	
New York Electrolytic	12.438
London Standard	69.381
London Electrolytic	71.786
Lead:	
New York	4.356
St. Louis	4.272
London	20.589
Silver:	
New York, foreign	59.337
New York, domestic	99.433
London	34.250
Sterling Exchange	391.784
Zinc:	
St. Louis	4.747
London	25.530
Tin:	
99 per cent	28.990
Straits	30.404
London	163.905
Antimony	5.137
Quicksilver	45.423
Platinum	73.404

Metal Markets

New York, May 4, 1921

Lead has been the center of activity in the market during the last week, with copper and zinc practically neglected. The revival of general business is coming slowly, but a slight improvement is registered every week. When the reparations question is settled, a more rapid movement is hoped for. A small reduction is reported in trans-Pacific freight rates, $10 per long ton now being quoted from Hongkong and Kobe to Pacific ports of the United States.

Copper

Copper appears to be inherently the weakest of the common metals, and any improvement in the market seems destined to be followed by weakness. Practically no business has been done during the last week, either domestic or foreign. The figure generally quoted is 12.75c. delivered, but at least two interests have been willing to sell at ⅛c. under this. Some offers have been made by consumers at 12.50c., but so far as we have heard these have been declined. A little business has been done through the Export Association during the week, Japanese buying being included but only in small volume.

Lead

The A. S. & R. Co. advanced its official contract price of lead from 4.35 to 4.50c., New York and St. Louis, on Thursday, April 28. Immediately the outside market made a proportional advance, which continued over the week-end, so that today the Smelting company found it advisable again to increase the price to 4.75c. The strengthening prices have been accompanied by a large and well-distributed demand from consumers. Not as many orders are reported as in some previous buying movements but the tonnage is large, few carload lots being included. London is also strong, one reason no doubt being that Spanish lead has been going to the United States and Germany instead of to England, while the demand from British consumers has increased.

Zinc

Although inquiries have dropped off considerably, and there is a lull in buying, the market has eased only slightly. Small tonnages were sold at 5c., East St. Louis, early in the week, but the bulk of trading took place at 4.95c. Offerings of zinc at present levels are scant, and producers in general are loath to disturb prices by forcing sales. A slight premium is asked for forward delivery.

Tin

There is a belief that 30c. tin has been definitely passed. At any rate, supplies are scant and sellers are not generally anxious for business. The British coal strike has closed down most of the tin smelters, and stocks are being husbanded. Today, the demand from consumers was particularly insistent here in New York, and found the market practically denuded of supplies. London metal brokers are taking advantage of the American demand for 99 per cent grade and are charging £2 premium in addition to shipping some of the metal in 28-lb. pigs, which must be incased for shipment, thus incurring a further extra charge. Tin for forward delivery is quoted at the same prices as for spot, and down to ⅛c. below.

Arrivals of tin, in long tons: Total for April, 755, less exports 200, or 555 net. May 1st, China, 5; Straits, 5; 2d, London, 100; Straits, 325.

Gold

Gold in London: April 28th, 104s. 3d.; 29th, 104s. 1d.; May 2d, 103s. 8d.; 3d, 103s. 8d.; 4th, 103s. 3d.

Foreign Exchange

Sterling reached the highest point since last summer. Francs and marks varied with the status of the reparation question. Considerable speculation has been evident. South American exchanges reached new lows, owing to adverse credit conditions. On Tuesday, May 3, francs were 7.9225c.; lire, 4.835c.; and marks, 1.53c. New York funds in Montreal, 11½ per cent premium.

Silver

The market was steady the last week, with an advance in London from 34⅝ to 35d. on Indian bazaars' buying. The New York price followed London, and with improvement in sterling exchange rose from 60⅜ to 61⅜c. Volume of business, however, has been only moderate, owing to scarcity of offerings. China demand has been lacking, and only small shipments from San Francisco were made in last week's steamer. Domestic demand dull.

Mexican Dollars — April 28, 46½; 29th, 46½; 30th, 46⅝; May 2, 47; 3d, 47; 4th, 47.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 22@23c. per lb.; 22½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 5⅛c.; market dull. W.C.C. brand, 5¾@6c. per lb. Cookson's "C" grade, spot, 9⅝c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.60 per lb., 500 lb. lots.

Cadmium—Nominal, $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $4 per lb.; black oxide, $3@$3.10 per lb. in bbl.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $250@$300 per oz.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 38@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—$72@$75 per oz.

Quicksilver—Nominally, $46@$48 per 75-lb. flask. San Francisco wires $48.50.

[1]**Rhodium**—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 45@50c. per long ton unit, f.o.b. Atlantic ports.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $7.45; Mesabi bessemer, 55 per cent iron, $7.20; Old Range non-bessemer, 51½ per cent iron, $6.70; Mesabi non-bessemer, 51½ per cent iron, $6.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5.80; old bed concentrates, 63 per cent, $6.70; Harmony, cobbed, 63 per cent, $6.70; new bed low phosphorus, 65 per cent, $9.50.

Manganese Ore—30c. per unit, seaport; chemical ore (MnO_2) $60 per gross ton, lump; $70@$75 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., April 30—Zinc blende, per ton, high, $25.20; basis 60 per cent zinc, premium and Prime Western, $25@$26.50; fines and slimes, $22.50@$20; average settling price, all zinc ores, $22.84. Lead high, $52.30; basis 80 per cent lead, $55; average settling price, all lead ores, $48.55 per ton.

Shipments for the week: Blende, 4,461; lead, 808 tons. Value, all ores the week, $141,130. Shipments for four months: Blende 95,188; calamine, 50, lead, 18,228 tons. Same period of 1920: Blende, 226,157, calamine, 3,254; lead, 33,350 tons.

Buyer and seller could not agree on a basis price for this week until after noon today, when a few sellers agreed to accept $25 basis offered. Others sold $26 basis, and some sellers are still holding for $27.50 basis. Lead ore was advanced to $55 basis today, and four mines are to resume operations on lead ore. Three heavy producing zinc mines were closed down last night.

Platteville, Wis., April 30—No sales of zinc or lead ore reported. Shipments for the week: Blende, 125 tons. Shipments for the year: Blende, 11,420; lead ore, 550 tons. Shipped during the week to separating plants, 386 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $2,000@$3,000; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7 per long ton, f.o.b. Cartersville, Ga. Small lots as low as $5.

Bauxite—High-grade French bauxite, $8@$10 per ton, Atlantic ports. American quotations the same. Consumers generally well supplied. Prices vary according to grade. Crude, unground, $16.50 per ton; ground, $22; calcined, ground $35; unground, $45, f.o.b. plant.

Chalk—English, extra light, 5@5½c. Domestic light, 4½@5c.; heavy, 4@4½c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$10; washed, $10@$12; powdered, $15@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $15@$20, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$80; imported lump, $15@$25, f.o.b. American ports; powdered, $35@$45, f.o.b New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c. f.o.b. New England points.

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar—Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$25 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $15, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $32, New Mexico, Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines. Market is improving in western ground acid grades for glass and enamel manufacture.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 7½@8c. per lb.; chip, 6@6½c.; dust, 4@4½c. No. 1 flake, 7c.; amorphous crude, ¾c.@2¼c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$2 per net ton; 1½ in., $1.50@$2. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined—Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned—$38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

[1]**Monazite**—Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $7.35; 68 per cent, $6.85; 68@66 per cent, $6.60.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 14c., c.i.f. Atlantic seaport; furnace size, 14c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Silica—Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported generally dull.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$40, talcum powder grade. Southern talc, powdered, carload lots, $10@$14 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 8@9c. per lb. in carload lots.

Sodium Nitrate—$2.75@$2.85 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; $33@$35 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.75@$1.80 per unit, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 15c. per lb. of chromium contained; 4 to 6 per cent carbon, 16@17c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $85@$90, f.o.b. furnace; resale, $90, delivered; English, $90@$95, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $32, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $50@$55; 50 per cent, $80@$85; 75 per cent, $145@$150.

Ferrotungsten—Domestic, 70 to 80 per cent W, 50@55c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$5@$6 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 20½@20¾c. per lb.; wire, 15c.

Lead Sheets—Full lead sheets, 7½c.; cut lead sheets, 7¾c. in quantity, mill lots.

Nickel Silver—33½c. per lb. for 18 per cent nickel.

Yellow Metal—Dimension sheets 18¼c.; sheathing, 17¼c.; rods, ⅝ to 3 in., 15¼c.

Zinc Sheets—$11 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina $35@$50 per ton, f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $75 per net ton, shipping point; arches, keys, wedges, $80; splits, soaps, $90.

Fire Brick—First quality, 9-in. shapes, $40@$50 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $40@$50.

Magnesite Brick—9-in. straights, $90@$95 per net ton; 9-in. arches, wedges and keys, $100; soaps and splits, $110.

Silica Brick—9-in., per 1,000: $45@$55 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, May 3, 1921

Booking of business by independent steel producers is light, but there is a fair tonnage on books as a result of orders that were placed recently as independents were withdrawing their extreme prices in favor of the equalized prices that now represent the market, and there is an operation of probably 35 or 40 per cent by independents. The Steel Corporation is receiving considerably heavier specifications against contracts than formerly, together with a moderate amount of strictly new business, and is probably operating at above 40 per cent of capacity.

Pig Iron—Demand is almost entirely lacking, and lower prices are expected. Bessemer and basic are quotable nominally at $25 and $23 respectively, and foundry is offered at $24, or 50c. decline. W. P. Snyder & Co. report averages in April at $25 for bessemer and $22.50 for basic. The average quotation on foundry iron was $24.81, all quotations being Valley, with $1.96 freight to Pittsburgh.

Coke

Connellsville—Furnace, $3.50@$4.25; foundry, $4.50@$5.50.

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[1] Foote Mineral Co., Philadelphia, Pa.

COMPANY REPORTS

Miami Copper Net Earnings $2,888,479

A report of operations of the Miami Copper Co. for 1920 states that dividends totaling $1,494,228 were paid in that year. The following income account gives costs of production and total charges:

Expenses:				Per Lb.	Total
Concentrates, 55,553,089 lb				$0.0690644	$3,836,741.12
General mine expense				.0127515	708,387.81
Freight on concentrates				.0063746	354,128.95
Smelting, refining, and freight on pig copper				.0177264	984,756.30
Legal expense and insurance				.0043868	243,700.90
New York office expense and taxes				.0057501	319,441.85
Selling expenses, freight, discount and commissions				.0034382	190,996.02
				$0.1194920	$6,638,152.95
Less silver proceeds			$229.73		
Sale of power and gain in supplies			27,872.47	.0005058	28,102.20
				$0.1189862	$6,610,050.75
Balance carried down					3,259,469.10
					$9,869,519.85
REVENUE					
Deliveries of copper during the year	57,563,038 lb @	.18688			$10,757,362.14
Less on hand Jan. 1, 1920	18,277,689 lb. @	.15848			2,896,564.32
	39,285,349 lb				$7,860,797.82
Plus on hand Dec. 31, 1920					
Refined copper sold	1,153,230 lb @	.18236	$210,303.92		
Copper in process	15,114,510 lb @	.11898	1,798,418.11		2,008,722.03
	55,553,089				$9,869,519.85
Profit and Loss Account:					
Loss on Government securities sold					$333,199.41
Depreciation charged off					286,256.53
Balance					2,888,479.03
					$3,507,934.97
Balance brought down					$3,259,469.10
Interest					248,465.87
					$3,507,934.97

Depletion for the year amounted to $1,807,483.56. Outstanding are 747,114 shares of $5 per share.

Chino Copper's Net Income $1.52 Per Share

A report of operations of the Chino Copper Co. for 1920 states that total income amounted to $1,319,541, or $1.52 per share, compared with $1.50 per share in 1919. Operating statement follows:

[illegible]		
[illegible]	$7,[illegible] 780 [illegible]	
[illegible]	[illegible] 42	$7,698,640.81
[illegible]		
Mining and milling	$3,542,723.46	
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	6,596,441.14
[illegible]		$1,102,199.67
[illegible]		217,340.87
[illegible]		$1,319,540.54
[illegible]		13,549,025.36
[illegible]		1,319,540.54
		$14,868,565.90
[illegible]	[illegible]	
[illegible]	[illegible]	928,777.50
[illegible]		$13,9[illegible] 788.40

Total current assets on Dec. 31, 1920, were $7,825,133, compared with $9,192,400 on Dec. 31, 1919. Current liabilities were $1,864,296, compared with $1,748,016. The net cost of production was 11.4c. per lb., compared with 15.31c. in 1919 (all charges and credits except Federal income and excess profits taxes). Capitalization, $4,349,900 (par, $5).

Utah Copper Operating Income Decreased

A report of operations of the Utah Copper Co. for 1920 states that net operating income was $4,924,498, or $3.03 per share, compared with $8,252,396, or $5.08, for 1919. Operating statement follows:

Operating revenue:		
Copper produced—101,897,758 lb. @ 17.737c	$18,073,591.45	
Gold produced—27,410.869 oz. @ $20.00	548,217.36	
Silver produced—257,515.73 oz. @ $1.091	281,116.14	$18,902,924.95
Operating expenses:		
Mining and milling (including taxes)	$9,256,738.69	
Treatment, refining and freight	5,423,168.35	
Selling commission	151,763.72	
Stripping ore	694,600.00	15,526,270.76
Net income from operation plus depletion		$3,376,654.19
Miscellaneous income:		
Dividends from Bingham & Garfield Ry. Co	450,000.00	
Other income from rentals, interest, etc.	852,703.71	1,302,703.71
		$4,679,357.90
Capital distribution—Nevada Consolidated	750,375.00	
Less loss on bonds sold and worthless accounts written off	505,234.52	245,140.48
		$4,924,498.38
Surplus from operations:		
Balance Dec. 31, 1919		$48,999,864.13
Net income and proceeds of depletion		4,924,498.38
		$53,924,362.51
Less		
Dividends	$2,342,942.65	
Capital distribution	7,403,997.35	9,746,940.00
Balance—Dec. 31, 1920		$44,177,422.51

Current assets were $26,536,672 on Dec. 31, 1920, compared with $33,116,035 on Dec. 31, 1919. Current liabilities were $5,428,525 compared with $5,812,479. The net cost of production was 13.145c. per lb., which includes all credits, but is exclusive of Federal taxes. Capitalization, $16,244,900 (par, $10).

Mining Dividends for April, 1921

Companies in the U. S.:	Situation	Per Share	Totals
American Smelters "A"	U. S.	$1.50 Q	$146,071
American Smelters "B"	U. S.	1.25 Q	39,855
Bunker Hill & Sullivan, l.s	Idaho	.25 M.	81,750
Eagle & Blue Bell, l.s	Utah	.05 K.	44,657
Great Northern Iron Ore	Minn.	2.00 Q	3,000,000
Phelps Dodge Corporation, c	U. S.	1.00 Q	450,000
Tonopah Belmont Development, s.g	Nev.	.05 Q	75,000
Tonopah Extension, g.s	Nev.	.05 Q	64,140
Tonopah Mining, g. s	Nev.	.05 SA	50,000
United Eastern, g	Ariz.	.15 Q	204,455
U. S. Smelting, R. & M., pfd	U. S.-Mex.	.87½ Q	425,556
Companies in Canada, Mexico, Central and South America			
Asbestos Corporation	Canada	1.50 Q	$45,000
Asbestos Corporation, pfd	Canada	1.75 Q	70,000
Dome Mines, g	Canada	.25 Q	100,000
Kerr Lake Mines, s	Canada	.12½ Q	75,000
Manganese Mines of Ouro-Preto	Brazil	50 fr. A	
Manganese Mines of Ouro-Preto, pfd	Brazil	80 fr. A	
Nechi Mines, g	Colombia	1 sh. 3 d. K	18,750
Nipissing Mines, s	Canada	$0.15 Q	$180,000

A, Annually; K, Irregular; M, Monthly; Q, Quarterly; SA, Semi-annually.

L'Echo des Mines et de la Metallurgie (Paris) of March 20 reported that the Manganese Mines of Ouro-Preto (Brazil) company had caught up its arrears since 1914 and had paid, for the interval 1914-1919, preferred dividends of 240 fr., as well as common dividends of 180 fr. per share. The table's statement was given for 1919-1920 results. No information concerning the company has been found. This indicates a state of affairs in contrast to those of New York Honduras Rosario company, which has suspended operations. Asbestos Corporation, Nipissing Mines, Ltd., Eagle & Blue Bell, Phelps Dodge Corporation, Tonopah Mining, all declared decreased dividends; and Howe Sound, Daly West, U. S. Smelting, Refining & Mining common, Vanadium Corporation, and Wolverine Copper were among the numerous companies that passed dividends usually paid at this time. Rio Tinto (Spain) passed its common semi-annual dividend for the first half of 1921.

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York 1920	New York 1921	London 1920	London 1921	Sterling Exchange 1920	Sterling Exchange 1921
January	132.827	65.950	79.846	39.985	367.082	372.650
February	131.295	59.233	85.005	34.745	337.466	385.932
March	125.551	56.023	74.194	32.479	370.870	389.806
April	119.779	59.337	68.848	34.250	392.438	391.784
May	102.585		60.010		383.360	......
June	90.957		51.096		393.663	......
July	91.971		53.736		385.538	......
August	96.168		59.875		360.404	......
September	93.675		59.476		350.370	......
October	83.480		54.197		346.460	......
November	77.734		50.952		342.333	......
December	64.774		41.845		348.101	......
Year	100.900	...	61.590	......	364.840	......

New York quotations cents per ounce troy, 999 fine London, pence per ounce, sterling silver, 925 fine.

Copper

	New York Electrolytic 1920	New York Electrolytic 1921	London Standard 1920	London Standard 1921	London Electrolytic 1920	London Electrolytic 1921
January	18.918	12.597	118.095	70.964	123.238	79.119
February	18.569	12.556	120.188	70.925	126.950	75.925
March	18.331	11.976	109.533	67.565	118.348	71.190
April	18.660	12.438	103.025	69.381	111.500	71.786
May	18.484	......	96.750		109.200	......
June	18.065		87.864		101.909	
July	18.576		90.148		106.455	......
August	18.346	......	93.935		111.143	
September	18.144	......	96.381		111.905	
October	15.934		93.327		104.905	
November	14.257	......	84.807		94.614	
December	13.188		75.702		85.905	
Year	17.456	......	97.480	......	108.839	

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York 1920	New York 1921	St. Louis 1920	St. Louis 1921	London 1920	London 1921
January	8.561	4.821	8.300	4.747	47.095	23.387
February	8.814	4.373	8.601	4.228	50.256	20.650
March	9.145	4.084	8.894	4.000	46.054	18.911
April	8.902	4.356	8.618	4.272	39.225	20.589
May	8.576	......	8.352	......	38.488	......
June	8.323	......	8.169	......	34.330	......
July	8.338	......	8.283	......	34.960	......
August	8.687	......	8.725	......	36.304	......
September	8.177	......	8.160	......	35.452	......
October	7.070	......	7.018	......	35.238	......
November	6.159	......	6.127	......	32.489	......
December	4.727	......	4.717	......	24.089	......
Year	7.957	......	7.830		37.832	......

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton.

Tin

	New York 99% 1920	New York 99% 1921	New York Straits 1920	New York Straits 1921	London 1920	London 1921
January	61.596	36.000	......	36.000	376.512	190.464
February	58.466	28.534	59.932	32.142	395.750	166.250
March	61.037	27.296	61.926	28.806	369.489	156.024
April	61.120	28.990	62.115	30.404	345.450	163.905
May	53.230	......	55.100	......	294.813	......
June	46.125	......	48.327	......	250.614	......
July	45.798	......	49.154		261.886	......
August	43.856	......	47.620		274.048	......
September	41.940	......	44.465		270.120	......
October	39.310	......	40.555		258.190	......
November	35.667	......	36.854		241.080	......
December	31.135	......	34.058		212.440	......
Year	48.273	......	49.101	......	295.866	......

New York quotations, cents per lb. London, pounds sterling per long ton.

Zinc

	St. Louis 1920	St. Louis 1921	London 1920	London 1921
January	9.133	5.413	58.643	25.262
February	8.708	4.928	61.338	24.850
March	8.531	4.737	53.467	25.077
April	8.184	4.747	47.388	25.530
May	7.588		45.088	......
June	7.465		41.193	......
July	7.720		41.886	......
August	7.835		41.220	......
September	7.661		39.690	
October	7.150		39.756	......
November	6.247		35.028	......
December	5.824		27.762	......
Year	7.671	......	44.372	......

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a) New York 1920	Antimony (a) New York 1921	Quicksilver (b) New York 1920	Quicksilver (b) New York 1921	Platinum (c) New York 1920	Platinum (c) New York 1921
January	10.577	5.258	90.192	48.440	154.23	73.400
February	11.588	5.250	84.432	49.545	151.59	70.227
March	11.056	5.282	92.611	46.796	138.56	72.463
April	10.500	5.137	102.192	45.423	127.04	73.404
May	9.655		89.560	......	97.50	......
June	8.289		90.154	......	85.19	......
July	7.500	......	90.333	......	83.94	
August	7.177	......	83.806	......	111.44	......
September	7.113	......	75.000	......	115.20	......
October	6.723	......	67.200	......	101.70	......
November	6.109	......	58.417	......	84.75	......
December	5.534	......	49.577	......	79.62	......
Year	8.485	......	81.123	......	110.90	......

(*a*) Antimony quotations in cents per lb. for ordinary brands. (*b*) Quicksilver in dollars per flask. (*c*) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer 1920	Bessemer 1921	Basic 1920	Basic 1921	No. 2 Foundry 1920	No. 2 Foundry 1921
January	$40.47	33.96	$39.88	31.96	$39.86	33.88
February	42.95	28.96	42.61	26.96	43.40	30.25
March	43.40	28.16	42.90	26.46	43.40	27.85
April	43.72	26.96	44.22	24.46	43.90	26.77
May	44.00	......	44.88	......	45.36	......
June	44.89		45.41	......	46.40	......
July	47.21	......	47.42	......	46.56	......
August	48.90	......	49.88	......	49.35	......
September	50.46		50.46		51.96	......
October	49.21	......	44.38		48.58	......
November	41.26	......	39.20		42.61	......
December	36.96	......	34.90	......	37.73	......
Year	44.45	......	43.85	......	44.93	......

In dollars per long ton

Monthly Crude Copper Production

	1920 December	1921 January	1921 February	1921 March
Alaska shipments	6,631,700	5,241,634	5,482,962	4,985,259
Arizona Copper	2,650,000	2,300,000	2,000,000	2,000,000
Calumet & Arizona	3,300,000	2,438,000	3,330,000	3,455,672
Cons. Ariz. Smelting	476,000	(a)	(a)	(a)
Inspiration	5,000,000	5,000,000	4,500,000	5,000,000
Magma	600,000	600,000	600,000	650,000
Miami	4,373,123	4,439,000	4,200,101	4,572,000
New Cornelia	2,688,456	2,170,000	1,975,918	2,220,186
Old Dominion	2,655,000	2,822,000	1,882,000	2,199,000
Phelps Dodge	5,850,000	6,339,000	5,712,000	6,959,000
Shattuck Arizona	(a)	(a)	(a)	(a)
Ray	2,975,000	2,983,000	2,976,000	2,940,000
United Verde	3,260,000	3,500,000	3,450,000	4,115,000
United Verde Extension	3,204,258	3,219,912	3,349,942	2,951,390
Calumet & Hecla	7,507,712	7,234,300	7,395,084	9,147,000
Other Lake Superior	6,000,000	6,000,000	5,000,000	5,000,000
Anaconda	10,500,000	9,700,000	9,000,000	11,600,000
East Butte	1,538,760	1,600,000	1,500,000	1,000,000
Nevada Cons.	3,000,000	3,000,000	3,000,000	3,100,000
Chino	2,999,000	2,999,751	2,978,934	3,051,838
Utah Copper	7,500,000	7,500,000	7,500,000	7,500,000
Eastern Smelters	1,600,000	1,500,000	1,500,000	1,500,000
Others, estimated	11,400,000	10,000,000	9,300,000	7,100,000
Total United States	95,709,009	90,586,597	86,632,941	91,046,345
Imports: Ore and concentrates, matte, etc.	6,321,559	8,634,206	10,580,611	9,865,917
Imports of blister, unrefined, etc.	21,156,861	21,456,013	19,424,907	12,448,823
Imports of refined, etc.	13,463,058	9,679,973	10,631,161	359,572
Grand total	(b)136,650,487	(b)130,356,789	127,269,620	22,674,312
British Columbia:				
Granby Cons.	2,665,018	2,530,038	2,274,530	2,617,702
Mexico				
Boleo	1,014,160	969,920	813,650	618,222
Cananea	3,700,000	2,530,038	(a)	(a)
Phelps Dodge Mexican properties	2,468,000	2,362,000	1,870,000	2,285,000
Other foreign:				
Cerro de Pasco	4,258,000	4,086,000	4,174,000	4,200,000
Chile	11,542,000	6,732,000	5,278,000	6,000,000
Katanga	2,970,135	2,912,805	3,283,960	5,360,128
Backus & Johnston	1,604,000	1,760,000	1,306,000	1,642,000

(*a*) No copper produced during this month (*b*) Corrected

Comparative Annual Copper Production

	1919	1920	1921
January	135,733,511	121,903,744	90,586,597
February	111,649,512	117,450,000	86,632,941
March	102,040,460	120,309,316	91,046,345
April	98,808,998	116,078,871	
May	92,652,975	114,964,207	
June	95,856,570	116,107,856	
July	100,369,247	109,729,510	
August	107,994,040	116,460,654	
September	108,703,075	(a) 104,919,262	
October	115,143,143	105,231,571	
November	117,289,735	106,700,178	......
December	102,997,633	95,709,009	......

(*a*) Revised

MINING STOCKS

Week Ended April 30, 1921

COPPER

Stock	Exch.	High	Low	Last	Last Div.	
Adventure	Boston	*50	*50	*50		
Ahmeek	Boston	54½	51	53	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	½	7/16	½		
Allouez	Boston	23½	21	23½	Mar. '19	1.00
Anaconda	New York	41¼	39¾	41	Nov. '20, Q	1.00
Arcadian Consol.	Boston	3	2⅝	2¾		
Ariz. Com'l.	Boston	10	9	9¼	Oct. '18,	.50
Big Ledge	N. Y. Curb	5/16	¼	5/16		
Bingham Mines	Boston	10	9	9¼	Sept. '19, Q	.25
Calumet & Arizona	Boston	53	50	52¼	Mar. '21, Q	.50
Calumet & Hecla	Boston	258	244	255	June '20, Q	5.00
Canada Copper	N. Y. Curb	....	....	*13		
Centennial	Boston	8⅛	8⅛	8⅛	Dec. '18, SA	1.00
Cerro de Pasco	New York	30⅜	28½	28½	Mar '21, Q	.50
Chile Copper	New York	12¼	11½	11¾		
Chino	New York	25	24	24⅝	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*25½	25½	*25½		
Con. Arizona	N. Y. Curb	....	....	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	..	.	1⅞		
Copper Range	Boston	36⅜	33	35	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*30	*28	*29		
Davis-Daly	Boston	7	6½	6¾	Mar. '20, Q	.25
East Butte	Boston	10	9⅛	9¼	Dec. '19, A	.50
First National	Boston Curb	*82	*75	*75	Feb. '19, SA	.15
Franklin	Boston	2¼	2⅛	2¼		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol.	New York	23	21	21	May '19, Q	1.25
Greene-Cananea	New York	25	25	25	Nov. '20, Q	.50
Hancock	Boston	3	3	3		
Howe Sound	N. Y. Curb	...	.	2¼	Jan. '21, Q	.05
Inspiration Consol.	New York	36½	35	36	Oct. '20, Q	1.00
Iron Cap	Boston Curb	6⅛	6	6⅜	Sept '20, K	.25
Isle Royale	Boston	23	20¾	21½	Sept. '19, SA	.50
Kennecott	New York	20⅝	20	20⅜	Dec. '20, Q	.50
Keweenaw	Boston	....	....	1¾		
Lake Copper	Boston	2⅝	2⅜	2⅜		
La Salle	Boston	2⅛	2	2⅛		
Magma Chief	N. Y. Curb	...	...	*21		
Magma Copper	N. Y. Curb	22½	20¾	21	Jan. '19, Q	.50
Majestic	Boston Curb	*9	*5	*9		
Mason Valley	Boston	....	....	1¼		
Mass Consolidated	Boston	2¾	2¼	2¼	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	4¾	4	4½		
Miami Copper	New York	24	22½	23½	Feb. '21, Q	.50
Michigan	Boston	3	3	3		
Mohawk	Boston	51	49¾	50½	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5	4¾	5		
Nevada Consol.	New York	12⅝	11¾	12½	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	16	15½	16	Aug '20, K	.25
Nixon Nevada	N. Y. Curb	....	.	*5		
North Butte	Boston	11¼	11	11	Oct. '18, Q	.25
North Lake	Boston	.		½		
Ohio Copper	N. Y. Curb	.	..	1/16		
Old Dominion	Boston	22¼	21	21¾	Dec. '18, Q	1.00
Osceola	Boston	31½	27	31¼	June '20, Q	.50
Phelps Dodge	Open Mar	†160	†140	...	Apr. '21, Q	1.00
Quincy	Boston	42	39	40	Mar. '20, Q	1.00
Ray Consolidated	New York	14	13½	13¾	Dec. '20, Q	.25
Ray Hercules	Boston Curb	*35	*35	*35		
St. Mary's Min. Ld.	Boston	40	37	38	June '20, K	2.00
Seneca Copper	Boston	16½	16	16½		
Shannon	Boston	1	*91	*91	Nov '17, Q	.25
Shattuck Arizona	New York	6½	5¾	6½	Jan. '20, Q	.25
South Lake	Boston			1½		
Superior Copper	Boston	4	4	4	Apr. '17,	1.00
Superior & Boston	Boston	2½	[illegible]	2½		
Tenn. C. & C. cfs.	New York	10½	[illegible]	10	May '18, I	1.00
Tuolumne	Boston	*50	*45	*45	May '13,	.10
United Verde Ex.	Boston Curb	29½	26	[illegible]	Feb. '21, Q	.50
Utah Consol.	Boston	4	3½	3½	Sept. '18,	.25
Utah Copper	New York	55½	53¾	54	Mar. '21, Q	1.00
Utah M. & T.	Boston	1	1	1	Dec. '17,	.30
Victoria	Boston	[illegible]	[illegible]	[illegible]		
Winona	Boston	*45	*35	*35		
Wolverine	Boston	12	11½	12		

NICKEL-COPPER

Stock	Exch.	High	Low	Last	Last Div.	
Internat. Nickel	New York	16¼	15	16	Mar. '19,	.50
Internat. Nickel, pf	New York			[illegible]	Feb. '21, Q	1.50

LEAD

Stock	Exch.	High	Low	Last	Last Div.	
National Lead	New York	78½	77½	77½	Mar. '21, Q	1.50
National Lead, pfd.	New York	106½	106	106	Mar. '21, Q	1.75
St. Joseph Lead	New York	12	11½	11½	Mar. '21, Q	.25
Stewart Mining	Boston Curb			*6	Dec. '15,	.05

ZINC

Stock	Exch.	High	Low	Last	Last Div.	
Am. Z. L. & S.	New York	[illegible]	[illegible]	[illegible]	May '20,	1.00
Am. Z. L. & S. pfd	New York	28	27	28	Nov. '20, Q	1.50
Butte C. & Z.	New York	5½	4	4	June '18,	.50
Butte & Superior	New York	11½	11	11½	Sept. '20,	1.25
Callahan Zn-Ld.	New York	[illegible]		[illegible]	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb	134	127	134	Feb. '21, Q	2.00
Success	N. Y. Curb	*3	*2	*3	July '16,	.03
Yellow Pine	Los Angeles	[illegible]	[illegible]	*50	Sept '20, Q	.03

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

GOLD

Stock	Exch.	High	Low	Last	Last Div.	
Alaska Gold	New York	1	⅞	⅞		
Alaska Juneau	New York	1⅝	1½	1⅝		
Carson Hill	N. Y. Curb.	....	....	22¾		
Cresson Consol. G.	N. Y. Curb	2	1⅞	1¾	June '20, Q	$0.10
Dome Extension	Toronto	....	....	*60½		
Dome Mines	New York	20¼	18⅞	20	Apr. '21, Q	.25
Golden Cycle	Colo. Sprgs.	*77½	*74	*77½	Dec. '20, Q	.02
Goldfield Consol.	N. Y. Curb	*7	*5	*7	Dec. '19,	.05
Hollinger Consol.	Toronto	7.45	7.29	7.29	Feb. '21, M	.05
Homestake Mining	New York	....	....	58	Sept. '19,	.50
Kirkland Lake	Toronto	*55	*54	*54		
Lake Shore	Toronto	1.39	1.32	1.38	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	2.14	2.00	2.00	Jan. '21, K	.05
Porcupine Crown	Toronto	*27	*25	*27	July '17,	.03
Portland	Colo. Sprgs.	*58½	*53	*58½	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*4½	*3	*4	May '19,	.05
Silver Pick	N. Y. Curb	*6	*4	*6		
Teck Hughes	Toronto	*18	*15	*17¾		
Tom Reed	Los Angeles	1.90	0.87	0.90	Dec. '19,	.02
United Eastern	N. Y. Curb	2⅞	2⅝	2¾	Apr. '21, Q	.15
Vindicator Consol.	Colo. Sprgs.	*33	*30	*32	Jan. '20 Q	.01
West Dome Consol.	Toronto	*8½	*7¼	*7⅜		
White Caps Mining	N. Y. Curb	*8	*5	*5		
Yukon Gold	Boston Curb	1⅛	⅞	1⅛	June '18,	.02½

SILVER

Stock	Exch.	High	Low	Last	Last Div.	
Arizona Silver	Boston Curb	*29	*23	*27	Apr. '20, M	.03
Batopilas Mining	New York	¾	¾	¾	Dec. '07, I	.12½
Beaver Consol.	Toronto	*38	*37	*37	May '20, K	.03
Coniagas	Toronto	1.80	1.80	1.80	Nov. '20, Q	.12½
Crown Reserve	Toronto	*13¾	*13½	*13½	Jan. '17,	.05
Kerr Lake	Boston	3	2¾	3	Apr. '21, Q	.12½
La Rose	Toronto	*23	*23	*23	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	....	....	*17	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.00	0.92	1.00	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	6¼	4¾	4⅞	Apr. '21, Q	.15
Ontario Silver	New York	4½	4¼	4¼	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	2	1½	1¾	Jan. '12,	.10
Peterson Lake	Toronto	*6¼	*6¼	*6¼	Jan. '17,	.01½
Temiskaming	Toronto	*22	*20	*20	Jan. '20, K	.04
Trethewey	Toronto	*21	*16	*18	Jan. '19,	.05

GOLD AND SILVER

Stock	Exch.	High	Low	Last	Last Div.	
Atlanta	N. Y. Curb	*1	*½	*½		
Barnes-King	Butte	‡		1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*65	*60	*65		
Cashboy	N. Y. Curb	*6	*4	*6		
El Salvador	N. Y. Curb	....	....	½		
Jim Butler	N. Y. Curb	*9	*6	*9	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*7	*5	*7	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	½		
MacNamara M. & M.	N. Y. Curb	*15	*13	*14	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1⅝	1⅜	1 7/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1¼	1⅛	1⅛		
Tonopah-Extension	N. Y. Curb	1	1½	1½	Apr. '21, Q	.05
Tonopah Mining	N. Y. Curb	1½	1⅜	1 7/16	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	1⅛	1	1 1/16	Dec. '19, SA	.05

SILVER-LEAD

Stock	Exch.	High	Low	Last	Last Div.	
Caledonia	N.Y. Curb	*12	*9	*11	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	1.15	1.10	1.15	Dec. '20,	.15
Chief Consolidated	Boston Curb	2	2⅜	2½	Feb. '21, Q	.05
Consol. M. & S.	Montreal	16	15	15	Oct. '20, Q	.62½
Daly Mining	Salt Lake		....	2.50	July '20, Q	.10
Daly-West	Boston			2¾	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	....	....	2½	Apr. '21, K	.05
Electric Point	Spokane	‡		*7	May '20, SA	.03
Federal M. & S.	New York			7	Jan. '09,	1.50
Federal M. & S., pfd.	New York	....	....	23½	Mar. '21, Q	1.00
Florence Silver	Spokane	‡		*16	Apr. '19,	.01½
Grand Central	Salt Lake	....	....	*37½	June '20, K	.03
Hecla Mining	N. Y. Curb	4	3⅞	4⅛	Mar. '21, Q	.15
Iron Blossom	N. Y. Curb	*15	*15	*15	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake			3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*7	*5	*6		
Prince Consol.	N. Y. Curb		½	[illegible]	Nov. '17,	.02½
Rambler-Cariboo	Spokane	‡....	....	*5	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*14	*7½	*14		
South Hecla	Salt Lake	*65	63	*65	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb		¼	3/16	Oct. '17,	.05
Tamarack-Custer	Spokane	‡....	....	1.90	Jan. '21, K	.04
Tintic Standard	Salt Lake	2.75	2.65	2.65	June '20, Q	.10
Utah Apex	Boston	2⅝	2½	2 9/16	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*4	*3	*4	Nov. '17,	.01

QUICKSILVER

Stock	Exch.	High	Low	Last	Last Div.	
New Idria	Boston	*50	*50	*50	Jan. '19,	.25

VANADIUM

Stock	Exch.	High	Low	Last	Last Div.	
Vanadium Corp.	New York	36	30½	33½	Jan '21, Q	1.00

ASBESTOS

Stock	Exch.	High	Low	Last	Last Div.	
Asbestos Corp.	Montreal	60	57	59¼	Apr. '21, Q	1.50
Asbestos Corp., pfd.	Montreal			89½	Apr. '21, Q	1.75

MINING, SMELTING AND REFINING

Stock	Exch.	High	Low	Last	Last Div.	
Amer. Sm. & Ref.	New York	41½	40½	41½	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf.	New York	78	77½	77½	Mar. '21, Q	1.75
Am. Sm. pf. A	New York	69	69	69	Apr. '21, Q	1.50
U. S. Sm. R. & M.	New York	33	32½	33	Jan. '21, Q	.50
U.S.Sm.R.& M. pf.	Boston	41	40½	41	Apr. '21, Q	.87½

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Progress of the Engineers' Licensing Movement

THE MOVEMENT for licensing engineers has gone further than is realized by most mining engineers. A synopsis of recent legislation as given in the last number of the official organs of the American Association of Engineers notes that the Arizona bill is a law, having been signed by the Governor on March 19; also the Colorado bill, signed by the Governor on April 4, "through efforts of the Colorado Section of Engineering Council." The Minnesota bill has become a law since the writing of the synopsis in question.

On the other hand, the Montana bill, introduced by the A. A. E. chapter, met with the opposition of the Montana Society of Engineers and was killed. The New Mexico bill passed the Senate but failed in the House; and the same fate befell the Missouri bill on March 18. In California a bill sponsored by the A. A. E. was withdrawn from the Legislature. In Nevada, the bill met with the opposition of mine operators and died in committee.

Passing from the distinctly mining states, a bill for this purpose has become a law in North Carolina; in New Jersey the bill became a law April 1; in Indiana on March 10; in Tennessee, on April 19. In Arkansas and South Dakota the bills have failed. In Texas the bill passed the Senate, but failed in the House. In South Carolina the bill failed in committee, "due to opposition from the farmers." Bills are pending in the legislatures of North Dakota, West Virginia, Ohio and Connecticut, being opposed in the latter two states by the Manufacturers' Association. In Pennsylvania, the bill pending in the Legislature is being opposed by various engineering societies in the state, and also by the Scranton Correspondence School, "it being their contention that the law might be construed against the so-called practical engineer." It has passed the House. In New York, there now exists a licensing law, and a fight is on to so amend it as to permit corporation license. In Georgia, Nebraska, and Oklahoma, the movement is being pushed.

We have taken no editorial stand on this important question, but are watching its developments with interest. It behooves all mining engineers to do the same. We know that many are on each side of the question. The rest should ponder, and in their respective states frankly thrash out the merits and demerits of the plan.

Pending Tax Revision

THE SECRETARY OF THE TREASURY has recommended a repeal of the excess-profits tax, and there is no doubt that this will be done, as the sentiment is in favor of it on all sides. The main objection to the tax is that it defeats its own ends: the goose that lays the golden egg quits laying under the harrying—what incentive to lay at all if the tax collector pounces on the egg and devours it, and no little golden goslings can ever be hatched? The Government needs revenue, and must adopt some method whereby it can get it.

The Secretary also is against excessive income-tax surtaxes. He would have the maximum rate 40 instead of 73 per cent. Dropping suddenly from the rarefied regions of high finance to the daily round, he would remove the petty tax on soda water, shirts, shoes, and the like.

As important as the method of raising necessary Government funds is the necessity of reducing Government extravagance. The present rate of Federal expenditure means a contribution of $250 per annum, on the average, from every family in the United States. When state, county, and city taxes and the rest are added, we are quite unnecessarily tax-burdened. We have paid high, as a nation, for what we have obtained. We need a business manager in Washington, who should be assistant to the President, and who should watch over the business operations of the Government (which at present have no head) while the President performs the duties of statesmanship.

The Hardening of Copper

THAT the hardening of copper is a lost art is generally believed. Many of our readers will therefore be interested in the answer to a question put to us by a university professor, which appears on page 826 of this issue. To be frank, we ourselves had only very hazy ideas on the subject until the matter was brought before us. It is true that ancient implements of copper and bronze were of a workmanship not since surpassed and were of a hardness not common nowadays in manufactures of the red metal. However, this is not to say that the ancient results could not be duplicated today if it were necessary; that is, if metals more adapted to the purpose were not now available. The ancient cutting edges were no doubt hardened chiefly by the well-known "Armstrong" method—hammering. Also, it is likely that the crude methods of reduction resulted in the presence of more impurities than are found in the electrolytic product of today. Copper is made much harder and tougher by relatively small amounts of other substances, such as silicon, phosphorus, and tin.

Copper is one of the oldest known metals. Before any metals were used, there was what we call the Stone Age. Then, about 4,000 B.C., archeologists tell us that bronze began to be used in southeastern Europe. Copper and tin are found together in Cornwall and China, but whether it was from the smelting of mixed ores or alloying of the two metals that bronze was made is unknown. Some think that the use of bronze was preceded by that of pure copper, the alloy afterward being found to have more desirable properties. At any rate, the use of bronze gradually spread, and by 1,800 B.C. was general throughout Europe. Then iron began to be used, and with its development, including that of steel, the making of utensils of hardened copper was gradually superseded. So, beside a high degree of technical skill in the working of copper and its alloys bred by sheer necessity as a result of the lack of a more appropriate substance with which to work, it is unlikely that the ancients possessed any important secrets of which we are not aware today. Furthermore, there is a possibility, as is pointed out elsewhere, that as a result of our knowledge of why iron can be hardened, and of our ability to harden aluminum, we may yet discover something regarding the working of copper far in advance of what was known in the reputed good old days.

Back to Silver in Russia

THE AGE OF PAPER has probably reached its zenith, in respect to the belief in the magic of paper notes with sums of money printed thereon, as really practicable currency, to gravely pass from hand to hand as something of value, and to give in exchange for good corn and pork. The simple believers in this sort of magic, from the spectacled American economist to the Russian peasant, are beginning or accomplishing their disillusionment, according to the amount of paper they have swallowed and left undigested. Reports from Russia state that the Lenine autocracy has authorized the coinage of silver, since the peasants are tired of filling their hay wagons with rouble notes whenever they go to market to buy a pair of horses.

There should be a great demand for silver for coinage when the stricken nations of Europe are in a strong enough position so that they can satisfy their hunger to handle real money again, for silver coinage has been cleaned out of those nations, like France, whose currency is depreciated, and sold as bullion in countries where the currency has greater value. This, of course, will be the immediate result of the Russian move. Its silver coin issued will disappear as completely as it does in India or China.

Colorado School of Mines

LEGISLATORS are as a rule a genial lot of men. The particular group which made the "investigation" of present and past conditions at the Colorado School of Mines and reported to the Colorado Legislature is no exception to the rule. The "report," which has just come to our attention, conforms to type and falls into the class rendered conspicuous by a liberal use of milk of lime. It is inept, inconclusive, and not helpful to the school. A skilful surgeon will not cover over a suppurating wound with tightly-drawn bandages and send the patient away with optimistic statements as to his condition. Rather will he open up the wound and cleanse it with liberal use of disinfectants and arrange for proper drainage. He will not delude the patient with misleading statements.

Placed alongside of the report of the American Association of University Professors, the Legislature's report suffers by comparison. The one is definite; the other vague. The report of the American Association of University Professors goes to the root of the problem and states:

"The conditions which were brought out in this investigation, unless remedied without delay, will prove most disastrous to the future of the school. To attract and to retain teachers of superior qualifications, an institution must protect them from administrative tyranny and from interference with their professional functions and responsibilities, and must maintain such standards as will permit men of character to enter and to remain in its service without loss of professional self-respect. This can only be accomplished if the authorities of the State of Colorado will appoint trustees who are competent to select and to support a president who has the proper educational ideals."

C. Erb Wuensch, in the December, 1920, number of the *Colorado School of Mines Magazine* exposes internal conditions at the school in an exceedingly frank manner. Undoubtedly he was in an excellent position to ascertain most of the facts. Having had the benefit of about seven years' varied mining experience after his graduation from the school in 1914, Mr. Wuensch must be credited with a reasonable maturity of judgment, and his presentation is entitled to careful consideration. Mr. Wuensch says: "Conditions are fundamentally wrong at Golden and require immediate correction. The present system of trusteeship by appointment made by the Governor has had a long trial and been proven a failure. The reason is because of the difficulty of selecting men of the proper character—men free from local prejudice—who possess the proper educational ideals." Thus the second indictment in the case emphasizes the weakness of the trustees as did the first. We pass over most of the legislative report and take the liberty of quoting the following paragraph from p. 12:

"Your committee finds that the management of the School of Mines by the present Board of Trustees is highly efficient, and no well-grounded criticism can be made as to the character, qualifications, or energetic efforts of the members of the board to promote the best interests of the institution; but your committee feels that it would be fitting and proper to have a larger representation of the mining industry on the board."

The legislative committee, despite its sweeping commendation of the Board of Trustees, appears, however, to have some slight doubts and endeavors to protect itself by suggesting additional members. We fail to see how this would improve matters unless the additional representation were thoroughly qualified.

The last paragraph but one on p. 12 is as follows:

"Again, the presence of a citizen of Golden seems to be a source of dissatisfaction, and while not questioning in the least the efficiency, integrity and devotion to the best interests of the school, of the present member from that city, your committee would suggest that in the reorganization of the board, if that be decided upon, the members should be selected from elsewhere, in order that no local influence may prevail."

There is much between the lines of this paragraph. It affords small comfort to the citizens of Golden. The succeeding paragraph reveals that the legislative committee is a little dubious about its own findings, and proposes to provide one governing body for all of the state schools. This plan, as well as the recommendation for continued investigation, is merely a time-worn political device that may be compared to the ostrich burying its head in the sand.

After our careful reading of the report we cannot help feel that President Alderson must have blindfolded the committee and led the members around one of the mountain boulevards, returning them safe and sound to the state capitol.

The fundamental weakness of the Colorado School of Mines lies in a succession of inept boards of trustees, and the vain effort of continuing the attempt to administer the school by catering to the selfish interests of a pitifully small town. The legislative report states that after H. C. Parmelee was refused reappointment in 1917, the Board of Trustees "sought long and faithfully to secure a competent man who would take the position and restore the school to its former standing and usefulness. After weeks of searching for a competent man it was finally decided to ask Dr. Alderson to come and take the place, which, after much urging, he consented to do."

The facts were, we are reliably informed, that no educator of prominence could be prevailed upon to take the place, and Dr. Alderson was the last resort. Since Dr. Alderson's appointment there have been twenty-two faculty changes in three years, in a faculty which ranged in numbers from seventeen to twenty-five. This is the best evidence that internal conditions have not improved. With such a large faculty turnover, efficient instruction and proper standards are impossible.

The State of Colorado has put a large amount of money into this institution, but has been singularly inert in demanding that a clean, wholesome school be maintained. Until public opinion takes an active part, the institution will, in our opinion, continue to be a political bean bag, not to be seriously considered as a mining school of high ideals and real worth.

Suburban Lots in the Desert

A NEW DEVICE for unloading mineral, or hopefully mineral, property on the public has been devised by the Great Southern Sulphur Co., through its Eastern representative, Carroll C. Hodges, of 52 Broadway. The plan distinctly suggests a background of experience in selling New Jersey house lots, now applied to the mining industry.

The lands in question are in west Texas, in Culberson County, where sulphur deposits have long been known, but where their profitable commercial exploitation has thus far remained an unsolved problem, owing to their remoteness from transportation and markets and the abundant and even superfluous resources and production of the great sulphur mines of the "domes" in Louisiana and East Texas. There are two thousand acres in all in the company's property, all of which are supposed to be underlain by sulphur. The Great Southern Sulphur Co. is not exactly a going one, according to the prospectus, but it is "95 per cent a going one." We wonder what that means. We are not going to the dinner tonight, but we are just about 95 per cent going. The net result is that we stay at home. Is it something like that?

In putting up your coin and embarking in the sulphur-producing business "You are invited into an enterprise which has no competitors," for the simple reason, as one might say, that no sulphur produced is so absolutely pure as that which this company is going to turn out. A glance at the photographs of tents and our "Laboratory and Laboratory Building, both 14 x 22" and our "Department Heads House, 16 x 60" ought to satisfy the most incredulous. We assume that this is the "plant, 95 per cent completed," from which, we are told, the "Great Southern Sulphur Co. will soon be in a position to supply sulphur in endless quantities." Now, the reason we have poor spotted paper on the market today (saith Mr. Hodges), and the reason that we have so many blow-outs on our automobile tires, is on account of the inferior quality of sulphur used in the manufacture of paper and rubber.

As to the investment. You are not asked to buy stock, but to buy lots, each one a hundred square feet in area (10 x 10), for $100 each. A dollar a square foot is pretty good for desert real estate, whether or not seasoned by sulphur. The company does not intend to sell more than 60,000 lots, which will, if sold, bring in $6,000,000. The company agrees to work all these lots as a whole, and pay the lot holder seven-eighths of the profits: all the company wants is one-eighth. An 87½ per cent royalty on the net should be good enough for the property owner—i.e., the lot holder!

Certainly, in view of this, one cannot doubt the altruistic motives of the promotion, which the circular proclaims. We find in various parts of the circular that the promoters are "truly honest men," and that the proposition is "clean, fine, open, fair—the kind of thing you like." But as to the 87½ per cent of the net profits —will there be any profit? Assuredly, saith Mr. Hodges: "The net profit from the sulphur plant is estimated at $1.75 per ton," and "with a sulphur plant of 1,000 tons' monthly capacity, the net profit would be $175,000 per month." Simple arithmetic, you see; and we are forced to believe that the directors are "men of modern and aggressive ideas" when we turn to our sulphur quotations at $18 a ton.

Sulphur is the mainstay of this company, but by far not its last ditch. The company also owns a "lake of soda" in New Mexico. This at once calls up visions of an unlimited fountain of soda, or soda fountain, but it does not sound so attractive when we find it to be a dry lake, or playa deposit. This soda will yield a net profit of only $20 per ton, according to the circular, but even at that, a 500-ton plant will yield net $10,000 a day, and when we refer to our quotations of sodium sulphate, at $20 per ton f.o.b. mines in Arizona, we cannot but admire the management in which the cost of production is going to be zero, and the market price of the product the net profit.

And still the company is not at all dependent on these earnings for prosperity. "In addition to these minerals there have been discovered several caves which are rich in bat guano, readily marketable as a fertilizer." . . . "It is estimated that this fertilizer will eventually pay all operating expenses, leaving the operation of the sulphur and soda plants practically a clear profit to the lot holders."

How much profit on your investment in your 10 x 10 desert lot? Why, sir, "Conservative estimates place the possible return to stockholders at from 35 to 60 per cent on each $100 invested." The circular saith not whether the 35 to 60 per cent is per cent per annum, or just per cent: but either way you look at it, no mean standard is set, and it is increasingly clear that "big, vital men" are "squarely in back" of this enterprise.

The circular brings in Mr. Courtenay de Kalb, through a little article which he published in the *Manufacturers' Record* concerning the sodium sulphate deposit in New Mexico. It is safe to say that if Mr. de Kalb had known the use to which his article would be put, he would not have taken the trouble to write it.

Altogether, who can doubt that, according to Mr. Hodges, the promotion of this enterprise "went much further than the highest principles of business require." . . . "They went much further than the law of the land requires." Especially the postal laws.

Should sulphur, soda, and guano all fail the enterprise, there is still the unlimited hot air of the desert, which, shipped to New York and peddled in small lots by the company's eastern representative, will, if skilfully handled, pay a handsome profit.

WHAT OTHERS THINK

The Naica Case

The furore caused by the decree of the Supreme Court of Mexico in the Naica case, its apparent bearing upon foreign-owned mine titles and property rights generally, and the aspersions heaped upon the Mexican courts as a result of it seem to justify analysis of its legal aspects. The moral aspects of the controversy from first to last give ground for discussion, to say the least; but with these the courts could have nothing to do. Condemnation or justification of the decree must rest upon its interpretation of the law, for that is the function of the courts.

The story was told in the *Engineering and Mining Journal* of Feb. 12, 1921. What is the law?

Article 95 of the Code of Commerce of Mexico (federal) establishes ten requisites "which public writings of association must contain for their validity"; and Article 96 of the same code reads: "The omission of any of the requisites prescribed in the preceding article is cause of nullity of the social pact which shall be declared at the request of any of the partners (*socios*)."

The writing of the constitution (articles of incorporation) of the Compañía Minera de Naica, S. A., failed in all of these requisites. The company early sought to cure the defects by a vote of ratification and the adoption of a code of bylaws which embodied the provisions prescribed by the law for the writing of a constitution; but the meeting of shareholders in which this action was taken was not legally called nor conducted, and even if it had been, the action would have been without legal effect on the original pact.

The attempt of the shareholders in 1897 to vacate the shares of Stopelli for non-payment of an increase in their par value was undoubtedly illegal; the law definitely provides that full-paid shares may not be assessed.

The validity of the so-called contract of August, 1905, between an alleged attorney-in-fact of the Stopelli estate and the company, seems to have been well refuted on the grounds that the attorney was not legally the representative of the estate; that, even if he had been, a judicial order was necessary to the act, as there were minor heirs, which order was not obtained, and that this attempted settlement had to do only with Stopelli's twenty-five shares of the cash capital and the dividends thereupon and not with his interest in the property nor the capital shares which represented it.

The Supreme Court decree was on appeal from a decision of the lower court in a suit brought by the Stopelli heirs on the ground that the organizers of the company failed to establish in the writing of the constitution those things which the law definitely prescribes as necessary to its validity and whose omission the law definitely declares to be cause of nullity of the social pact, which may be declared on petition of any of the partners. The defendant company contended that the plaintiffs were not shareholders; but the court finds that they are such of right; that they are the successors in interest of one of the original partners; that as such they have the right to ask judgment of nullity, and so decrees that the company, never having been legally constituted, does not exist; therefore the ownership of the property is *ipso facto* still vested in the original owners, and orders the company liquidated and the property with its fruits restored to the original owners.

The court further finds that the attempts to cure the defects in the writing of the constitution were futile, as they were corporate acts; *i.e.*, acts of the supposed corporation *per se* and not of the original partners to the pact as individuals. The doctrine is that the writing of a constitution is a pact among individuals and can be reformed or amended only by those same individuals or their individual successors in interest. A body which does not exist cannot cure itself of an infirmity. A couple not legally married cannot decree the legality of acts growing out of the illegal association, but can only by actually marrying validate the acts of the conjugal partnership from the moment of marriage. The only possible cure for the company would have been a new incorporation, with cession of property rights directly from the original owner.

Notwithstanding that in the finding of the court the corporation as such does not exist, the association or partnership for the purpose of legal service and judgment does exist under the provisions of the Civil Law, Article 2,222, which recognizes to such ends *Sociedades de Hecho*; that is, association or partnership of fact for the moment.

The company's claim of cure by prescription is unfounded because prescription cannot run either in favor of or against a person or body which does not legally exist; it cannot create a fact out of nothing.

It is unfortunate that this important case should have been brought to a decision at the moment when Mexico, by the conduct of her new national administration, is seeking conscientiously to re-establish herself in the good graces of the world. In the average Anglo-Saxon mind, habituated to the operations of the common law and to judgments in equity, it is at once catalogued as a rank miscarriage of justice, a violation of vested rights, a plain case of tampering with the court. But Mexican jurisprudence cannot be judged by the standards of America or England. Mexico is not a common-law country; its laws are statutory. There is no "equity side" to the Mexican courts; they are strictly *Juzgados de derecho*; in this sense courts of law, of the strict letter of the law. Their judges are bound by their jurisprudence no less than by their *protestas* of office to interpret the law according to their reading of its letter. The ideals of all law are justice and equity, but justice and equity are not law.

Undoubtedly, in the attempted incorporation Stopelli and his associates acted ignorantly. It would appear to a disinterested observer that the company was equally ignorant or else culpable in allowing such grave faults in its charter, which was also its property deed, to go uncorrected. In no country does ignorance of the law exempt from its penalties. The lesson is, know the law in so far as it concerns you, or employ a lawyer; better, do both. Trust in God and keep your powder dry.

AN AMERICAN LAY STUDENT OF MEXICAN
LAW AND PRACTICE.

Copper-Leaching Practice

I have read with interest the comments of G. D. Van Arsdale in *Engineering and Mining Journal* of April 16 on my paper presented at the Montreal meeting of the Canadian Institute of Mining and Metallurgy. That paper will be published in full in the June *Bulletin* of the Institute, and will, it is hoped, clear up some of the difficulties found in the abstract. However, as many will not see the complete paper, I offer a few words of explanation.

In ordinary milling practice "setting free a mineral" does mean separating it from the gangue. In leaching practice there is no reason why complete separation should be necessary—all that is required is that the solvent have access to the copper mineral and that the latter be sufficiently crushed to dissolve in a reasonable period of time. The meaning of the phrase as used in hydrometallurgy is therefore modified to that extent.

Mr. Van Arsdale states that in leaching with sulphuric acid the chief objection to the solution of oxides of iron and aluminum comes "from an increased acid consumption and not from fouling the solutions." This may be true of alumina, which is inert, but it is not true of iron oxide, unless we include under acid consumption that lost in discarding solutions *to eliminate the iron.* This is properly chargeable to fouling of the solution. One might infer from Mr. Van Arsdale's statements that iron was desirable in the solutions at Ajo, but if so they certainly have "too much of a good thing." Foul solutions remain a bugbear even in practice. To the credit of hydrometallurgists be it said that methods have been found to overcome some of the difficulties due to the presence of iron, but these methods do not obviate the necessity of discarding a large volume of solution containing some copper and much acid —the latter either free, if electrolytic deposition be used throughout, or latent, if still partly combined with copper.

Regarding my statements that when ammonia and ferric salts were the solvents electrolytic precipitation of the copper was impossible, I should perhaps have said that in those cases the commercial possibility of electrolytic precipitation remained to be demonstrated. I freely acknowledge that the "impossibility" of today often becomes the reality of tomorrow.

In the extract of my article I was made to state that upward percolation "extracts the copper more rapidly and reduces channeling." I do not see this any more clearly than does Mr. Van Arsdale, but I quoted the assertion in my paper as the opinion of the Ajo metallurgists, who have adopted upward percolation. I also said that their "method" resulted in ten times as much water-soluble copper in the tailings as at Chuquicamata. It is quite true, but I referred to their whole leaching method, and not simply to the system of percolation. The direction of percolation I consider important, especially in washing the tailings. For a detailed treatment of this question I must refer readers to the June *Bulletin* of the C. I. M. M.

Mr. Van Arsdale would like acid consumption stated in pounds per ton of copper extracted instead of per ton of material treated. Neither method is entirely satisfactory in comparing plants, for consumption depends principally upon the nature of the gangue and the method of precipitation used, and only to a minor extent upon the copper content of the ore or tailings.

Mr. Van Arsdale's preference for graphite anodes is well known (for a detailed discussion of the advantages of lead and graphite anodes see *Trans.* A. I. M. E., Vol. 55, pp. 843-853), and I myself went so far as to predict their use in large-scale operation. My paper, however, deals rather with present than future practice. I am glad that Mr. Van Arsdale mentioned the value of ferrous sulphate as a depolarizing agent. It is well that something can be said in favor of iron in the electrolyte.

It appears to me an undeservedly severe criticism of the practice at Ajo and Chuquicamata to state that "there is nothing very complicated or difficult in getting a yield of 2.5 to 3.0 lb. of copper per kilowatt-hour." The New Cornelia and Chile Exploration companies would be thankful to get half of those yields. The theoretical value, electrolyzing cupric sulphate solutions without depolarizing agents, is only 2.14 lb. per kilowatt-hour. Assuming an ampere efficiency of 85 per cent, and taking 2.0 volts as the minimum that will give a satisfactory current density under the conditions mentioned, the yield becomes 1.11 lb. Of course, better than this can be done with graphite anodes and efficient depolarization, but it is doubtful if at the above plants this change would be profitable, if at all possible.

Deschenes, Que. F. E. LATHE.

The Fatigue of Drill Steel

In *Engineering and Mining Journal* of April 16, the interesting article by Frank H. Kingdon on drill steel and editorial comment on the same prompt me to state briefly our experience with steel breakage. We have driven a tunnel 8,000 ft. and at the breast we drove an upraise vertically 1,200 ft. to drain 200 ft. of water out of an old mine. Most of this work was done through excessively hard rock, and, although the best drill steel obtainable was used, there was an enormous amount of breakage, due not only to the hard rock but also to the fact that our steel was terribly punished by our water Leyners operating on 130 lb. of air.

At the time our breakage was at its worst, with the steels breaking near the shank, near the bit, in the middle, and every other place, I read an article in the *Scientific American* on the fatigue of metals and determined to try an experiment. From a new bar of steel two starters were made. Number one was sent in the tunnel, started a hole, was immediately brought out, resharpened and sent in to start another hole. This routine was kept up until twelve holes had been started, and then the starter broke in the middle like glass.

The second starter was used on one hole and then allowed to "rest" the next day. The third day another hole was started, and so on until 107 holes had been commenced in very hard rock, when it also broke in two.

Before this experiment was completed, we purchased three times the amount of steel we had been using and used one-third of it every third day. Our steel breakage under the plan outlined became negligible.

I have explained to several mining men our plan of handling steel, and in every instance where the plan has been put in operation it has been a marked success. It is certain that steel does get tired, and is greatly benefited by a rest. CARROLL M. CARTER.

Ohio City, Col.

Study of Underground Electrical Prospecting—Part II*

Dip and Strike of Tilted Strata—Experiments in Iron Region of Calvados—Spontaneous Polarization Due to Chemical Action Resulting From Oxidation—Electrical Prospecting Will Probably Never Give Certain and Precise Results

By C. Schlumberger

Translated under the direction of the author by Sherwin F. Kelly

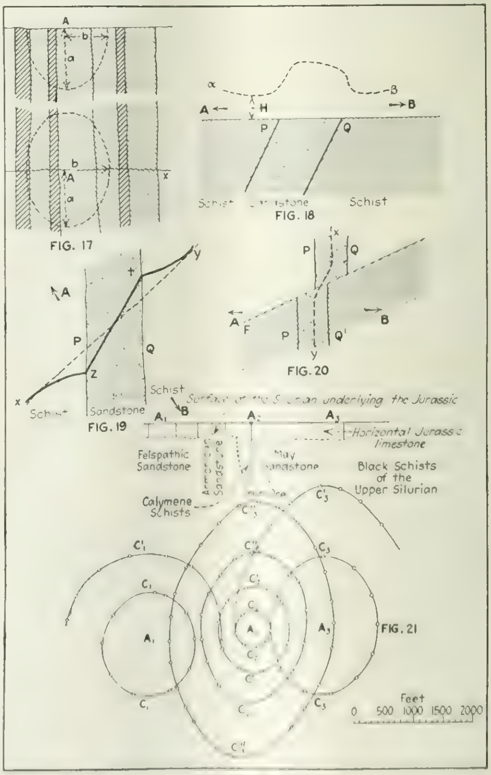
Theoretical Study of Tilted Strata

A TERRAIN OF TILTED STRATA, composed of an alternating series of different rocks, acts after the manner of an anisotropic body, possessing an electrical conductivity greater in the direction of the bedding than perpendicular to it. This holds, no matter what the nature of the layers may be, provided they have different specific resistances. Place a contact *A* in a stratified mass, supposing the stratification to be vertical, the other contact having been placed at a greater distance (Fig. 17). The equipotential surfaces in the ground are flattened ellipsoids of revolution about *Ax* as an axis which is perpendicular to the plane of stratification. The superficial curves of equal potential are ellipses elongated in the direction of stratification. The elongation is greater the greater the anisotropy of the ground. If the beds are inclined, the elongation of the ellipses is less pronounced, and it disappears when they are horizontal.

Strata covered by thick sediments necessitate experimenting on large curves whose radius is double the thickness of the covering. The better conductor the covering sediments are, the more they interfere with the elongation of the curves, so that no precise rule can be given. In practice, overlying sediments are often horizontal and present few irregularities in the relief, and this causes no deformation in the curves, but acts merely as a more or less opaque screen. Operating with curves of large diameter only, the general direction of stratification can be studied over a wide territory.

Conclusive practical studies of the determination of the direction of dip have not been obtained, but, theoretically, there is an unsymmetrical deformation of the surface intersections of the ellipsoid of equipotentials that would indicate the direction of dip. The practical difficulty arises from the lack of homogeneity of the soil. The existence of a drill hole makes it possible to make a contact deep in the earth, and thus discover the direction of the dip by the direction of the decentering of the surface equipotential curves with respect to the point vertically above.

Assuming stratification vertical or nearly so, it is possible to locate a stratum assumed to have, for example, double the specific resistance of the surrounding material by determining the form of the electric field as shown in Fig. 18, the two points being placed a great distance, 1,000 to 2,000 meters, apart. The method of refraction, Fig. 19, presents another possibility. In this case the line *AB* is inclined at about forty-five degrees to the strike. The curve of equipotential, on being traced across, registers distinct deflection on both sides of the stratum of higher resistance. Presence of overlying covering suppresses the phenomenon to a certain extent. For the deformations to be perceptible, the difference between the specific resistances of the two rocks must be great enough to be recognized, and the thickness of the stratum sufficiently large in comparison to the thickness of the cover.



ELECTRICAL DETERMINATION OF THE CHARACTERISTICS OF STRATA

As always, the deep-lying phenomena are perceptible only if pronounced. When the overlying material is irregular, a great difficulty is introduced.

Displacement by faulting can be detected where pronounced differences in resistance of the faulted stratum and its inclosing formations exist. Fig. 20 shows an equipotential line following a stratum of sandstone faulted at *F*.

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*Part I of this paper appeared in [illegible] of *Engineering and Mining Journal*.

In 1912, 1913, and 1914 I carried on a number of experiments in the region of Calvados, in northwest France, that may serve as a practical illustration of a stratigraphical study, based on the foregoing theoretical principles. The Silurian beds studied consist of the compact Armoricain sandstones at the base. Next above are the Calymene schists, containing iron ore and having a thickness of about 100 meters; above these formations are the layers of May sandstones and the Upper Silurian, which are differentiated from the Armoricain sandstones by alternating schists and sandstones. The Silurian beds are generally tilted and covered by horizontal Jurassic limestones. The relief of the surface is not pronounced.

Experiments at Fierville-la-Campagne were carried on in a region of relatively thick overburden, where the older strata were well known through a series of drill holes. The Silurian is nearly vertical. The Jurassic, which is rather argillaceous, an unfavorable condition, is from 60 to 90 meters thick.

The direction of stratification was studied by means of equipotential curves. In the upper part of Fig. 21 is given the profile of the beds examined, as determined in seven drill holes aligned perpendicularly to the strike. The lower part of the figure shows several equipotential curves, traced around three successive contacts A_1, A_2, and A_3, and the other contact, B, remained fixed at about three kilometers from the region being explored. From these curves may be drawn the following observations:

The contact A_1 is placed above feldspathic sandstones of the Lower Silurian. They produce the curves C_1 and C'_1, which have a radius of 250 to 500 meters and are approximately circular.[10] From that it may be concluded that the mass is sensibly isotropic; therefore but slightly fissured in the direction of stratification, without alterations of differently constituted layers.

The contact A_2 was placed near a drill hole which had encountered the Calymene schists and the iron ore. The curve C_2, of 100 meters' radius, is nearly circular, because the corresponding equipotential surface does not penetrate far enough into the Silurian, and so is under the influence of the horizontal overburden. The curve C'_2 begins to show a slight ellipticity, but this is clearly manifested only for C''_2 with an average radius of 400 meters, much greater than the thickness of the Jurassic, which is about 100 meters. The curve C'''_2 presents the same deformation, and its length is more than 3.5 kilometers. The region is therefore anisotropic, its maximum conductivity (that is to say, the direction of stratification) being parallel to the long axis of the equipotential ellipses. The contact A_3, over the Upper Silurian, also gives definitely elongated equipotential curves C_3 and C'_3; therefore it may be concluded that the series is made up of beds of different nature (schists and sandstones). These results are in conformity with those given by the drills. Notably, the strike of the Silurian coincides exactly with the direction of elongation of the curves.

Near the iron-ore deposits the contact of the Calymene schists with the Armoricain sandstones, which constitutes a definite geological horizon, was searched for by refraction of the curves and by the electric field profile. The refraction of the curves was visible in the field, but was not clear, and might have escaped observation if the result had not been known beforehand.

The indications given by the profile of the electric field were more satisfactory. They are represented in Fig. 22. The two contacts A and B having been placed on opposite sides of the contact sought, and at a distance of about a kilometer from it, three profiles were drawn, following the lines x_1y_1, x_2y_2, x_3y_3, parallel to the direction AB. In each one of these the field presents a marked discontinuity at the points P_1, P_2, and P_3, corresponding closely to the juncture sought. The Armoricain sandstones, being of higher specific resistance than the schists, indicate their presence by a sharp rise of the field; that is to say, of the rate of fall of the current, due to the resistance per meter.

It is interesting to note the rapidity with which these profiles may be established. With a personnel of two operators, two assistants, and a chauffeur, six and a half hours sufficed to place the line AB, pass the current, and trace the three profiles, which determine, at three different points, the desired contact within about fifty meters. This point of view of the experiment was of special interest, for no less than seven drill holes, distributed along a line about 1,100 meters in length, were needed to find the Calymene schists, and with them the iron deposits. This uncertainty is explained by the difficulty in distinguishing between the cores taken from the May sandstone, above the schists, and those from Armoricain sandstone, below the schists.

Conclusions—The experiments made in the Calvados show a way in which electrical prospecting seems capable of rendering service in the study of regions not containing good conducting ores. It is applicable only if the strata are tilted, and the indications are clearer as the beds become more nearly vertical. This is of advantage, as it is precisely in such examinations that the drill holes must be placed with the greatest precision. The following points must be noted: First, the facility with which the average strike of strata over a wide area may be determined; second, the possibility of following from place to place a known and conveniently chosen geological horizon.

It may be that the regularity of the Normandy Silurian, the considerable thickness of its beds, and the nature of the overburden constitute particularly favorable circumstances. I think that they are not isolated. Other and analogous conditions should be found in which the thin covering material would permit the rapid planning of a drilling campaign.

STUDY OF THE FORM OF A CONDUCTING BODY

Principles—Suppose a point of a conducting orebody is known, either by outcrop, or by any kind of exploration work, pit, gallery, or drill. Let it be, for example, a body Z of pyrite,[11] touched by a drill hole S at a point A, as is indicated in the plan and elevation of Fig. 23. To determine the approximate form of the deposit, the process is as follows: The contact B having been placed anywhere at a distance, the ore at A is chosen as the second contact, and the equipotential curves are traced at the surface of the ground, above A.[12] Because its conductivity is much superior to that of the surrounding ground, the orebody is at about the same potential throughout its entire mass. The equipotential surfaces envelop it fairly closely, therefore, and their outcrops, following the lines C_1, C_2, are centered on the deposit[13] and follow its form more or less exactly.

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[10] The dots marked on the curves show the points determined in the field. Their positions were then noted in relation to the topography, and, finally, joined with a continuous curve in the drawing.

[11] Or a mass of magnetite, pyrolusite, or other like formation.

[12] If there are underground workings, the observations, which will permit the determination of the form of the equipotential surfaces in the ground, can just as well be made in them.

To determine which of the equipotential, concentric curves coincides most nearly with the apparent horizontal contour of the mass, two features are distinguished. If, by means of work already done, one point *M* of the horizontal limit is known, a curve C_2, passing near the point vertically above *M*, is chosen as the apparent contour, admitting that it incloses the deposit at a practically constant distance. If nothing is as yet known, measures of potential above the mass are made. For example, a profile of potentials is laid out along a line *xy*, which cuts across the curves diametrically. As is represented in Fig. 24, the values *V* of the potential are laid out as the ordinates, with the surface of the ground as zero. Thus, a profile such as $\alpha\beta$ is obtained. The body *Z* being sensibly equipotential corresponds in the profile to a flat portion terminated by two zones where the potential falls rapidly, due to the considerable resistance drop which the passage of the current produces in the surrounding poorly conducting material. The limit of the deposit is taken at the points where this sudden drop is produced.

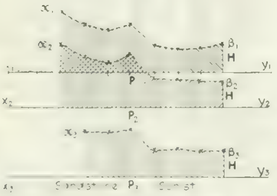

FIG. 22

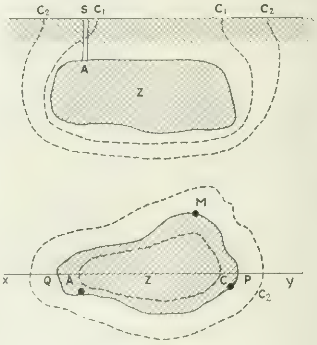

FIG. 23

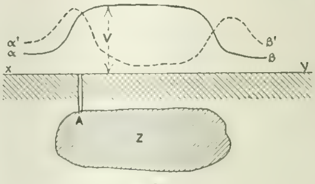

FIG. 24

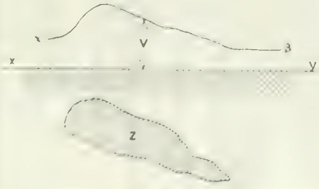

FIG. 25

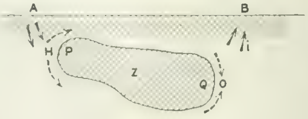

FIG 26

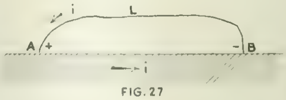

FIG. 27

The preceding is the simplest case, where the mass *Z* is nearly horizontal and distinctly limited by vertical sides. In general, the deposits have a more or less steep dip and taper out in ragged fringes without a well-defined horizontal contour. The potential-chart is then subject to more doubtful interpretation. Take the simple example of a dipping lenticular mass *Z* (Fig. 25). The profile of the potential will not be symmetrical, having a more abrupt slope on the side *X* than on the side of the dip, *y*. As a result, the equipotential curves will be more closely crowded at *x* than at *y*. Evidently, in practice it would be impossible to limit the mass precisely down the dip.

The practical difficulties come from: (1) The relief of the surface, which may cause notable perturbations; (2) lack of homogeneity of the soil; (3) accidents in the mass, such as faults, quartz dikes, and similar characteristics, which interrupt the electric conductivity, although the deposit is continuous from the miner's point of view.

From experiments at Bor (Serbia) upon a known mass of cupriferous pyrite, it seems possible to discover easily (in one or two days) the approximate form of a conductor of which a point has been reached, by determining the equipotential curves around this point as contact. These conclusions would in any circumstance be invalidated if it were to be established that either the real form of the Bor deposit escaped me or that this mass constitutes an exceptionally favorable one that could not be found again, because of the nature of the ore and that of the incasing country rock.

I wish to add that the indications thus given refer to the form of the deposit in horizontal plane only, and that the vertical disposition (depth of the shoots and their locations) escapes discovery entirely, or nearly so, which is a grave disadvantage.

INDUCED POLARIZATION

A mass *Z* of metallic conductivity buried in the ground acts in the same manner as a bit of metal submerged in water. If a direct current, *i*, is passed between the two contacts *A* and *B*, as indicated in Fig. 26, it decomposes the water in the inclosing rocks. There results a deposit of hydrogen on the part *P* where the electricity enters the mass, and a deposit of oxygen over the entire region *Q* where the current

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[13] [illegible] the deposit [illegible] from the [illegible]

[illegible] profile of potential [illegible] profile [illegible] of potential [illegible] of the deposit leaves the ore. The polarization of the orebody is thus produced; that is to say, the orebody transforms itself into a veritable storage battery. As soon as the electrolyzing current *i* is turned off, this battery discharges itself through the ground (dotted arrows), *P* acting as the positive pole and *C* as the negative one. Observations at the surface of the potentials due to this discharge of current[15] should permit determination of the position of the conducting mass *Z*. The entire work is done with the usual apparatus already described (movable line, non-polarizing electrodes, galvanometer, and voltmeter).

Let it be said at once, however, that I have not as yet obtained really satisfying results in the field, but the difficulties which I encountered, on the other hand, enabled me to make two interesting observations. The first is that all pyrite deposits are spontaneously polarized and act permanently like great batteries, without there being any necessity to make use of an electrolyzing current. These forces of spontaneous polarization therefore hide, in the case of pyrite, the phenomena of induced polarization.

The second observation was of the following fact: When a current, *i*, is passed through any given ground between two contacts *A* and *B* in the direction from *A* to *B* (Fig. 27), on interrupting the current, by opening the circuit *L*, there remains for a certain time a residual difference of potential in the ground, the region around *A* remaining positive with respect to that around *B*, just as though the line *L* were continuing to discharge a small current in the original direction. These residual differences of potential do not exceed a fraction of a volt. They disappear progressively of themselves, the speed of dying out being the faster the shorter the length of time the current *i* was flowing. The same thing happens when using pure water instead of wet ground, provided that convection currents do not interfere by mixing the different parts of the liquid.

These phenomena are not caused by the surface polarization which takes place at the contact of the metallic pegs with the moist earth, but in a polarization of volume involving the entire mass of electrolyte around the contacts. There is not a simple diffusion in the ground of the oxygen and hydrogen disengaged at the metallic pegs, because the phenomenon is established instantaneously at a great distance; but the appearances are comparable to those that would be given by a battery containing gas thus formed. There seems to be a movement of ions which creates a dissymmetry between the two regions surrounding the electrodes *A* and *B*. The residual action is more intense and prolonged the stronger and more prolonged the current that provoked it, which appears to imply an electrolytic action.

SPONTANEOUS POLARIZATION

General—Studying the lens of pyrite of Sain-Bel, Rhone, in 1913, I noticed that near it the soil presented, spontaneously, easily measurable differences of potential.[16] This observation has been confirmed since, for pyrite deposits, by an entire series of investigations[17] in the course of which no exception was encountered. The fact may be considered as absolutely general as far as pyrite and pyritic minerals are concerned.

For veins of galena, differences of potential are observed when the ore contains pyrite (as at Villemagne, in the Gard); but it seems that the phenomenon does not exist, or at least is too feeble to be clearly observed, when pyrite is entirely lacking, as in the veins in the Penarroya district, Spain (mines of Villanueva de Duque).

I think that mispickel should be active, but have not had occasion to make conclusive field experiments with respect to that substance. Magnetite and pyrolusite give no results,[18] and it is the same for the non-conducting ores (blende, carbonates, and the like). Iron buried in the ground (pipes, rails and similar objects) on the contrary, causes phenomena analogous to those resulting from masses of pyrite.[19]

From this simple enumeration it may be concluded that the metallic conductivity factors in "spontaneous polarization."

Description of Phenomena Observed—Herewith is the manner in which these things are observed in a large lens of pyrite, such as that of Sain-Bel, of Bor, or of Andalousie:

When the soil is touched with a movable line containing a voltmeter and galvanometer and terminated by two non-polarizing electrodes, on approaching the deposit regular differences of potential will begin to be noticed several hundred meters away from the ore (300 meters, for example), the electrode nearest the lens being nearly always negative to the other. The difference of potential thus observed increases as one advances, and may even attain several millivolts per meter.[20] In the region above the ore the potential is nearly constant; then, after traversing the deposit, new differences are observed, but in the opposite sense from the preceding.

The results of these potential measures, usually made along a line, are easily translated into a profile in which the distances are laid out as abscissæ and the potentials as ordinates. The maximum of separation between the summit of the line and the distant points may be as great as 500 millivolts. It is easy to trace the equipotential lines, and it will then be observed that they follow approximately the outlines of the deposit, surrounding a center of negative potential just above it. Moreover, there is frequently, in the wetter part of the deposit, a center of positive potential, of small extent, and naturally surrounded by the curves. Generally, the equipotential lines of spontaneous polarization close well, with about the same precision as the measures are made (several millivolts). They seem to be as stable as the profiles; that is to say, one finds them unchanged on making the measures over again after a certain time.

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[15] These differences of potential should be weak. In fact, the total electromotive force of the battery should not exceed 1.5 volts, and, of this, a fraction only would be perceptible at the surface of the ground in the form of resistance-drop of potential of the discharging current.

[16] Since then I have searched for observations that may have been made on this subject by other authors. The first studies of electrical phenomena in metallic deposits were conducted from 1830 to 1848 by R. W. Fox, in the veins of Cornwall, using the decidedly rudimentary technique known at that period. (See especially Henwood, "Sur les courants electriques observés dans les filons de Cornouailles," Annales des Mines, 3d series, Vol. 11, 1837, p. 585; Reich, "Notix uber elektrische Strome auf Erzgangen," Annales de Poggendorff, Vol. 48, p. 287.) Then there must be mentioned the interesting observations collected by Carl Barus in 1880 at the Comstock lode and at the Eureka mine, which should have led their author to important results if he had not been handicapped by the imperfect apparatus in use at that time. Finally, in the laboratory, a number of experimenters have studied the polarization of various minerals in contact with different electrolytes. Among the works of this nature the most recent and most remarkable is that of R. C. Wells, "Electric Activity in Ore Deposits," U. S. Geological Survey Bulletin 458, 1914. This publication contains a detailed bibliography of those works anterior to it.

To summarize the status of the question in 1914 I quote the last paragraph of the preface to the work of R. C. Wells, written by George Otis Smith, Director of the U. S. Geological Survey:

"It should be emphasized that results thus far obtained afford no adequate basis for any method of electric prospecting nor any promise of development of such a method by connecting the presence of ore deposits with readily or definitely measurable electric activity. Nevertheless, the data here presented are believed to possess value in the broader investigation of ores, for even feeble currents might exert a directional influence on ore deposition, and chemical conditions, even at a distance, might be a factor in determining mineral association."

[17] The list of the principal pyrite deposits studied is: Sain-Bel, Rhone (pure pyrite); Vaux, Rhone (magnetic pyrite); Saint-Felix-de-Pallieres, Gard (pyrite with galena and blende); Herrerias and Campanario, Andalousie (cupriferous pyrite); Bor, Serbia (pyrite and covellite).

[18] The experiments were made upon the magnetite of Normandy and upon the oxides of Romaneche (Saone-et-Loire).

[19] Thus it would be possible to find buried pipe lines as though they were pyrite deposits, except that the action is not so clear.

[20] The most marked effect noticed in this connection was a difference of potential of 400 millivolts in a line 100 meters long, making an average of four millivolts per meter (northwest border of the orebody of Bor).

Application to Prospecting—Observation of the phenomena described seems, on first consideration, to be susceptible of rendering signal service in prospecting for various pyritic minerals. Their measurement requires only light apparatus, easy to handle; it is extremely rapid; and the action of the deposit is distinguishable at a considerable distance, at least for deposits that are of importance. Thus, it is possible to search the ground thoroughly, hectare by hectare, with a speed that I calculate to be, in favorable ground, at least twenty hectares per day, with two men, a prospector, and an assistant. As the work leaves no trace, absolute secrecy may be maintained, even with respect to the assistant, who does not see the instrument readings. Finally, where the region is indicated as interesting, it may be more thoroughly studied by means of the method of conductivities, which should permit, with or without drilling, the formation of an opinion concerning the importance and form of the deposit. All of this constitutes a tempting method of prospecting. Experience will show how much of this optimism is justified.

Two grave objections to the methods noted must be considered: First, pyrite grains disseminated in the rock may show polarization. It is thus that I encountered a long band of ground, giving in places notable differences of potential (200 to 300 millivolts), and which appeared to correspond to a series of schists strongly pyritized, although the exploration work has not yet disclosed them. How can one distinguish such a zone, lacking in interest for the miner, from a large deposit, compact and of great value? Certainly the general action of the phenomena, the accentuation of polarization at certain prominent points where the infiltration of water promotes the oxidation of the pyrite, should serve as a guide. Nevertheless, the hazard remains.

The second objection concerns the slight activity which even a virgin deposit, near the surface, might show. All the measurements I made (Sain Bel, Bor, and at other places) were upon lenses already being exploited, or at least known by several galleries. It was, moreover, a condition necessary to enable me to ascertain if the results of my observation agreed with the reality. In a mine even slightly worked, there are always infiltrations, and these cause an energetic oxidation. If this is the only cause of the phenomenon, it is probable that the polarization of new deposits, the only ones that interest a prospector, is of little importance, and falls to the magnitude of experimental error (ten to twenty millivolts). This is the more likely the deeper the mineral is buried in the ground and the more compact and impermeable the surrounding rock.

I summarize my present opinion as follows: Although at the beginning of the attempts I thought it possible to determine easily the importance of a deposit by the amplitude of its polarization, today I believe that a virgin deposit, or even one already developed, signals its presence by but localized polarization near its summit, and that will be perceptible only when the mineral comes near the surface (to within ten meters, for example), at least if the porosity of the soil and the position of the water table do not favor oxidation. Finally, one risks confounding a pyritic terrain with a deposit of massive pyrite.

For the exploration of ancient workings, prospecting by polarization would be excellent.

Evidence Obtained at Sain-Bel in 1920—At the moment of giving the order to print this work, I had occasion to make the following important observations on the Sain-Bel vein: At the southern extremity of the deposit, underground work, conducted during the war, encountered a small lens of good pyrite at forty and at fifty meters below the surface. This coincides exactly with the curves of spontaneous polarization, determined in 1913, and which present at this point a small negative center. The mineralization is fifty meters long. Its thickness, not yet known, seems not to exceed several meters. The pyrite probably comes close to the surface, but is hidden by the overlying soil, and so is invisible. These underground workings are two years old. They have not in the least modified the polarization of the ground, which was identical in March, 1920, with what it was in 1913. The water then seeping in through the galleries had no effect.

In résumé, these proofs show the possibility of discovering, by observation of spontaneous polarization, a virgin deposit of pyrite, provided it is not too deep.

CONCLUSION

It is not yet possible to be sure of the services that the various methods of prospecting described are capable of rendering in their present form. Certain conclusions cannot be made until after many experiments have been followed by exploration work. Nevertheless, the great adaptability and wide application of the methods discussed should be noted. There is reason to suppose that, among the innumerable problems presented by the mining industry, hydraulic researches, and studies of the earth's crust, certain ones will present themselves in a favorable manner, to be solved conveniently. I add, that the studies I have undertaken since November, 1919, and which are not explained here, have strengthened my previous optimistic opinion.

Electrical processes of prospecting will probably never give certain and precise results. Their domain is to furnish indications, serving as a guide for the orientation of researches by drill, shaft, or gallery. This rôle of auxiliary should be of interest. Underground work gives exact information upon the composition of the rocks traversed, but it does not explore, so to speak, more than a sole point of the deposit, and the deductions that are made therefrom have the disadvantage of being extrapolations; its execution is slow and costly. Electrical prospecting seems to present the opposite properties: lack of precision, but the possibility of studying wide space rapidly and economically, and of giving a view of the terrain in its entirety.

These opposite and complementary characteristics are affirmed at other points. The current reveals well the vertical heterogeneities (faults, veins, and tilted strata) which escape drill holes so easily. It seems, on the other hand, to be nearly powerless to aid in the study of horizontal sedimentary strata (coal beds, potash deposits, and like formations), which the drills cut with a minimum of hazard.

As far as the depth attainable is concerned, I think that the electric method retains a wide field of application, even if the investigation beneath the surface is but of slight depth, not exceeding, for example, twenty meters. Many deposits or rock arrangements at present unknown are masked by only an insignificant covering of alluvium or soil, especially in equatorial countries or regions of only slight relief.

The present study constitutes merely a beginning. Perfections of detail and other analogous methods seem to merit serious investigation.

When one thinks of the formidable sums wasted every year in useless search, especially in metal mines, one hopes that important efforts will be undertaken to discover and perfect methods of prospection at a distance, even if their field of action be limited to depths of only a few meters.

Cooling and Humidifying Roaster Gases for Cottrell Treaters

At the tenth annual meeting of the Columbia section of the A. I. M. E., J. M. Schuettenhelm, metallurgist of the Bunker Hill smelter, at Kellogg, Idaho, described the steps which have been taken to secure a more efficient operation of the Cottrell treater at that plant. The blast furnace and lead refinery gases are freed of fume in a baghouse, but the gases from the Dwight and Lloyd sintering machines are too hot and contain too much sulphur dioxide to be handled in that manner, so the Cottrell process is used. The treater is of the downdraft type, has 256 pipes, 12 in. in diameter and 16 ft. long, and operates at 80,000 to 100,000 volts.

Owing to the lack of sulphur trioxide in the gas, it was necessary to cool and humidify it. Experiments showed that precipitation of the fume was best when the temperature was 110 deg. F. and the relative humidity 50 per cent, whereas the temperature usually varied from 200 to 300 deg. F. A large chamber was therefore built in which the gases could be sprayed with water. Short-circuiting troubles then developed. The insulators supporting the grid for the wires were originally outside the treater in sheet-iron boxes. In cold weather, moisture precipitated rapidly in these boxes, which, with the dust, formed a layer of mud on the insulators. This difficulty was solved by moving the insulators inside the treater and closing up the opening to the boxes.

All of the outside iron parts were also attacked by the moisture and gas, and the steel outlet flues rapidly corroded. These were replaced with wooden flues, and most of the iron doors in the treater were also replaced with similar wooden substitutes.

Owing to an enlargement of the plant, the volume of gases passing through the treater was found too great for efficient precipitation of the fume. Experiments showed that with the temperature and humidity constant, the fume precipitation varied with the gas velocity in the pipes. With a velocity of 7 ft. per second, practically all the fume would be precipitated in a 16-ft. length of pipe. If the velocity be higher, the remaining fume may be precipitated by passing the gases through another treater of the same size, providing the velocity of the gas is not more than twice the 7 ft. per second. Two such treaters could be operated in parallel, also, but the advantage of running them in series is in the cooling of the gas. If the temperature is not low enough in the first treater, it will be lower and the humidity higher in the second.

Alaska Noted for Its Gold Mines

During forty years of mining, the gold output of Alaska has amounted to $311,665,000, of which $218,000,000 is to be credited to the placer mines. The first notable impetus to gold mining in the territory was given by the discovery of the Nome placers in 1898 and by their rapid development, which reached its maximum in 1906. Meanwhile the placer gold from the Fairbanks district, which was first developed in 1903, helped to swell the output of gold to a maximum production in 1909.

Much the larger part of the placer gold recovered in these two fields, as well as in most other placer districts, such as Iditarod, Hot Springs, and Koyukuk, has been taken from relatively small and very rich or so-called bonanza deposits, rather than from larger bodies of gravel containing less gold. The production of placer gold has therefore been maintained by the exploitation of new bonanzas rather than by the installation of larger operations in the developed districts. Since 1911, however, there has been a gradual improvement in methods of mining, notably by the use of gold dredges, which have won gold amounting in value to more than $20,000,000.

A careful estimate, based on investigations made by the U. S. Geological Survey, indicates that the value of the placer-gold reserves of Alaska, including only those which have been adequately tested, is at least $360,000,000. The gold content of the gold-bearing quartz veins cannot be estimated, but the veins are widely distributed, and the outlook for the development of an auriferous lode mining industry is generally regarded as favorable.

Oils vs. Chemicals as Flotation Agents

Flotation practice in Australia and America is radically different, explained T. M. Owen in a short paper prepared for the A. I. M. E. recently. Here, there are any number of oils and oil mixtures to work with, but in Australia, the oil from the eucalyptus tree is practically the only one which is economically suitable for flotation purposes. As a result, experimenters in that country have built up their practice by the use of chemicals, which are aided in some cases by small amounts of oil.

As a general rule the use of chemicals increases the cost of flotation but produces cleaner concentrates. On this assumption, Mr. Owen suggested, as a general principle, that the use of oils should be stressed where gangue is not an undesirable element in the concentrates. Copper ores, as a rule, come within this class, as 10, 20, or 25 per cent of gangue material is not unwelcome. But where it is necessary to produce a relatively pure concentrate, such as is usually the condition with zinc and lead ores, careful and thorough tests should be made with many different kinds of chemicals, either alone or used in conjunction with oil, before concluding that the best commercial results are being obtained.

Marie Sklodowska Curie and the Story of Radium

By Dr. Robert Abbe
Senior Surgeon to St. Luke's Hospital, New York City

MARIE SKLODOWSKA'S father was professor of physics and chemistry in the University of Warsaw. She was born in that city on Nov. 7, 1867, and studied there until her graduation by the Gymnasium. The magnetic pull of the renowned Paris University, where science had its highest and purest atmosphere of research, brought her with scores of others from different countries to that institution.

Fired by the spirit of work, Marie Sklodowska was welcomed by Prof. Antoine Henri Becquerel in the Department of Physics, and by Prof. Pierre C. Curie in Chemistry, as a clear mind and a gifted student. The former permitted her to assist in his problem of uranium research, a search to see whether on exposure to sunlight its absorption would make it luminous.

An experiment was prepared with a photographic plate inclosed in a thick black paper. But the sun was hidden for a fortnight, and the plate with the piece of uranium was laid away in a drawer. Two weeks of dull Paris days passed. It was thought wise to test the freshness of the plate by developing it. To the surprise of all, a dark spot appeared beneath the mineral. Some unsuspected rays had gone through the black paper. This was the startling beginning of the discovery. "Becquerel rays" became the new wonder.

Mme. Curie herself took the next great step—the deciding step. She went to the mines near Carlsbad, Bohemia, where for a century the mineral pitchblende had been mined to extract the uranium. Pitchblende had long been known as a composite ore containing a dozen different elements in addition to the uranium. On examining the fifty tons of mine refuse, Mme. Curie found to her surprise that it was four times as strong in "Becquerel rays" as was the uranium extracted from it. The startling fact then stared her in the face, that something unknown existed in that refuse.

By chemical methods she proceeded to dissolve out all the lead and the other elements known to be present. With each succeeding elimination the quality of radioactivity appeared greatly strengthened. At last she obtained a small residue that could contain but two known elements, yet it was sixty times stronger than uranium itself. This remnant glowed in the dark. There could be but one conclusion: she was face to face with a mysterious, unknown force.

Two years later she was able, by ultra-chemical resources, with the help of her teachers and her husband (for Professor Curie had meanwhile offered himself and been accepted in marriage), to announce to the world in 1898 the demonstrated discovery of a new element—radium.

It was Marie Curie's beautiful tribute to science that an impersonal name "radium" was given, because the element emitted rays. Knowledge and not fame drew her. She industriously extracted all the radium from her small store, and after devoting another year to its study, offered it to the medical world.

In 1903 these first quantities of radium were released, and Americans were able to purchase the first morsel for New York. A quarter or more of that historic bit which proved that radium gives out heat continuously came quickly to America.

Mme. Curie's small store of the Bohemian refuse, however, was quickly exhausted, and all the radium to be had in the world was, for some time, made in Germany. That also we could buy, but at much higher prices.

It is the privilege of the women of the United States to choose this time to lay this tribute at Mme. Curie's feet—a gift of radium instead of a wreath of laurel—with which she can and will give back to them a thousand-fold in value, a hoped-for revelation of its medical power when its forces can be guided and directed to the cure, perhaps to the elimination, of that dread scourge—cancer—which she now intends to study.

With this essential aid to her further studies, Mme. Curie will return to France bearing also medals in gold from the U. S. National Academy of Sciences, the Wolcott Gibbs medal of the American Physical Society, and other tokens that she will treasure with her Nobel prizes of 1903 and 1911. Before she leaves us, however, she will, on May 23, confide to the custody of the College of Physicians of Philadelphia, the original quartz-piezoelectric apparatus devised many years ago by Professor Curie and used by both herself and her husband in the earliest determinations of the radioactivity of the first radium salts they studied. The accompanying photograph shows Mme. Curie before a similar instrument. Her willingness to part with a cherished relic of her historic radium researches reveals her sentiments toward the country that honors itself by confiding its finest medical tool to her capable hands.

MADAME CURIE AT WORK

BY THE WAY

Prohibition Creek

Those intrepid explorers who go into the prospective oil region around Fort Norman, in northwestern Canada, this summer may wonder at the etymological reason for Prohibition Creek, should they happen to run on to that small stream. It was so named, said a speaker at the recent C. I. M. M. meeting at Montreal, because it was dry at the mouth.

Petroleum the Pus of the Octopus

A correspondent sends us an oil report by Dr. J. M. Gregory of Arkansas. Apropos of the discussion concerning "Only a correspondence school mining engineer," our correspondent would like to know "What kind of a geologist is Dr. Gregory?" To which we reply, without hesitation: Dr. Gregory is a wonder. He is in the same class as Stephen Leacock, who wrote "Nonsense Novels"; or the author of "Bab Ballads"; or Lewis Carroll, who wrote "Alice in Wonderland"; or Frank Baum, who wrote "The Wizard of Oz"; only he heads the class. With difficulty we refrain from publishing his whole report: it is fascinating, exhilarating. We should like to publish his complete works. But we restrict ourselves unwillingly to his theory of the origin of petroleum, which is incorporated in this private report and also was published in the *Arkansas Oil and Mineral News* for Jan. 21, 1921:

> Petroleum is a product derived from vegetable and animal fats. All the vegetable and animal fats are used on the land until they serve the purpose they were intended to serve; but sooner or later they find their way to the little fish of the branches.
>
> The filth of the large cities, the carcasses found dead in the forest, in fact, all the refuse of the earth is washed down into the little streams and consumed by the little fish. And in time they are eaten by the larger fish, and in time they are eaten by the porpoises, sharks, whales, etc.: and in time the whales and such things are compassed about by the large parasites, generally called octopuses.
>
> After surrounding a whale with their numerous feelers they will retire to the bottom of the great waters. Sometimes it takes as long as twelve months to finally consume, by absorption, their victims. But everything has an end, and so do these great parasites. At their end and when their life is no more, and at a depth of about four thousand feet, they being a conservation of about ninety per cent fat: and it does not take long to become pus or oil.
>
> It is a fact that at a depth of about one thousand feet or more, in salt water, nothing rises to the surface: and the habitation of these mighty parasites being the bottom of the mighty ocean, naturally this rendered oil could not rise to the surface, owing to the salt of the salt water. Owing to the fact that the moon, by some mysterious force, controls the motion of the water, at the bottom of the deep, never-ceasing, everlasting finally puts the oil in motion, and being so pushed it finds its way out along the crevices of the rock, and along with it the salt water.
>
> If this theory of the manufacture of oil is not correct, then who is the man who can explain the presence of salt water in all oil fields?

Our Own "Main Street"

Participating in the great national indoor sport the other evening we took in one of the local "movie" palaces. Consistent with good advertising practice, the management includes, as a part of the regular program, a forecast of the features to be exhibited, showing a few hundred feet of each "feature"—obviously that portion which will appeal to the most lukewarm fan. Among these we saw "Colorado"—a Western mine thriller of the deepest dye. Slowly the descent was made in the realistic studio-prepared cage, the hero and his sweetheart clad in oilskins, of course, finally reaching the bottom of the mine shaft. A few flickers, and we see them in a drift—water dripping everywhere—and we fancy that our next view will be of the vein—native gold or some such thing. Suddenly, in the background a vast stream (estimated at 5,000 gal. per minute) issues from the side of the drift, rushes towards us, and envelopes John and Mary. The rest is left to our imagination, for at that moment we read that "the complete picture will be shown Wednesday and Thursday eve. and matinee." We count the hour not lost. however, for directly behind us sat a comfortable looking soul, who whispered to her husband, "Tell me, Will, why on earth are those two down in the sewer?"

By P. A. Robbins, San Francisco

MOVIE OF A GOLD-MINE OPERATOR CONTEMPLATING HIS INVESTMENT

CONSULTATION

Is Hardening Copper a Lost Art?

"Can you give me any information about the hardening of copper by heat treatment? I have assumed it to be a lost art, but recently have come in contact with a man who claims to be able to do it. Any information that you can give me on this matter or any references will be greatly appreciated."

We are indebted to E. E. Thum, associate editor of *Chemical & Metallurgical Engineering*, for the following information:

Copper, together with other ductile metals, may be hardened to a considerable extent by cold work. Thus, electrolytic copper as deposited has a Brinell hardness number of about 60, whereas hard-drawn trolley wire ordinarily has a hardness of 110. The hardness of ancient tools of copper and bronze is due mostly to this cause. Far from being a "lost art," ordinary bronze of today can be made as hard as any, in fact harder than most, bronzes of prehistoric times, by simple hammering alone. Dr. Petrie has also satisfactorily shown that the ancient Egyptian tools of copper, supposedly able to cut granite, were really metal holders for flints or other substances of great natural hardness.

The hardening property of iron has been held by many excellent scholars to be due to the fact that iron possesses certain allotropic modifications. That modification stable at ordinary temperature is soft, while another, stable at high temperature, is supposed to be hard. If, now, steel be quenched from high temperatures, the hard modification is fixed before it has time to revert to the softer modification stable at lower temperature, and the result is hardened steel. For copper to possess any analogous properties of hardening on quenching, copper would have to possess allotropic modifications, but Benedicks and also Burgess and Kellberg agree, as the result of precise experimentation, that pure copper possesses no such transformations.

Copper may also be hardened by alloying it with a small amount of another metal, or another chemical element. Zinc, tin, aluminum, and iron are the common additions. The alloyed metal should no longer be referred to as "copper," but should be named according to the chief alloying constituent. Copper with a sizable percentage of zinc is better known as brass; of tin, as bronze. Another favorite method of hardening copper appears to consist of so manipulating the melting—perhaps unwittingly on the part of the experimenter—that the resulting melt is impregnated with oxide. Cuprous oxide is soluble in molten copper, and alloys with it in exactly the same sense that metals do. Copper hardened in this way is considerably harder and more brittle than is the pure metal, but is unsuitable for most of the purposes to which copper is used.

It is difficult to say whether there is any probability that a process of hardening copper, analogous to the processes now used when hardening steel, may at some future time be developed. If more were known about the real nature of steel hardening, one might be able to prophesy with some degree of precision. A late and interesting hypothesis leads to the belief that there might be some validity along this line. I refer to the "Critical Dispersion" theory, which postulates that when a metal or alloy acquires relatively great hardness, it is due to the presence of a hard substance dispersed in the original crystals in what might be called a critical size and distribution. This dispersed material may be a pure metal or a compound. The particles must be scattered closely throughout the crystal, and act by interfering with that property—the ability to deform by the development of a few large slips—in two ways: first, they prevent the initiation of slips between crystalline layers as would billions of tiny staples in the leaves of a book; second, the slips, once started, despite this hindrance, do not get far, because of the internal friction against the little anchors. Thus the presence of these tiny particles, possibly crystals containing only a few atoms and therefore of ultramicroscopic or colloidal size, harden and strengthen the metal grains containing them by increasing the inherent capacity of a crystal for resisting change under external force. It is understood, of course, that plastic flow in a ductile metal takes place largely by development of relatively large slips along crystallographic planes in the metallic grains.

How does this theory apply to the hardening of steel? We are fairly sure, for instance, that at ordinary temperatures mild steel consists of crystals of pure alpha iron and crystals not of carbon, but of a chemical compound between iron and carbon which has been named cementite. Now, if this steel is heated to about 900 deg. C., the alpha iron absorbs the carbide cementite, which appears to diffuse itself uniformly throughout the iron—it actually goes into solution, even though the metal is far from its melting point. The resulting solid solution has been called "austenite." If this austenite be cooled, the tendency is for the cementite to reappear in crystals, observable under the microscope. This is because it is insoluble in iron at lower temperatures. However, if the cooling is relatively rapid, the accumulation of carbide particles is not large enough to become visible under the microscope; in other words, the tiny crystals of insoluble cementite are submicroscopic. As iron carbide is much harder than the crystals of iron, the result is an intense hardening of the resulting alloy, caused by a relatively small amount of carbon, existing not as carbon but as a hard chemical compound with iron.

Now, it is not inconceivable that at some time in the future some chemical compound will be discovered which is quite hard, and which is soluble in copper at a high temperature and less soluble at a lower. When this compound is found and introduced successfully into the metal, a heat treatment analogous to that for steel will produce a true hardened copper.

Such a thing has actually been done for aluminum. The new alloy called "Duralumin," which was used with such great success for airplane parts, and is now being adapted to light metallic manufacturing where strength is required as well as lightness, may be hardened by virtue of the fact that the small amount of copper in the aluminum forms a compound $CuAl_2$, which is more soluble as the temperature rises. Quenching at a correct rate allows this then insoluble material to accumulate in the correct sized particles, and hardness and great strength result.

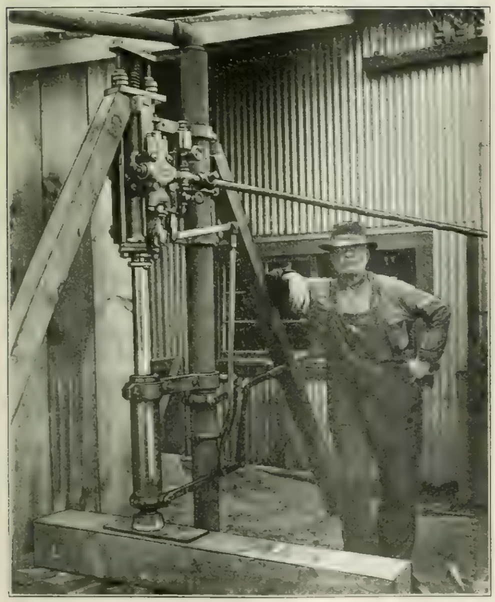
HANDY KNOWLEDGE

Shop Hammers

Written for *Engineering and Mining Journal*

In most mine blacksmith and tool-sharpening shops small compressed-air hammers are used. The usual arrangement is a piston drill with the rotating mechanism removed and mounted upon a vertical standard. The valve is controlled by a foot lever, and the force of the blow is regulated by the air valve. As a rule, the length of stroke cannot be varied.

Andrew Riley, master mechanic of the Plymouth Consolidated Gold Mines, Ltd., at Plymouth, Cal., recently devised a shop hammer which utilizes the control used upon the steam hammer and makes possible close control of the length of the stroke and the force of the blow. The arrangement is clearly depicted in the accompanying cut, which shows the hammer and its valve-driving mechanism. The hammer shoe is replaceable, and is held in a heavy hammer head which passes through the guide shown just above the operating handle. This guide contains a feather which projects into a feather-way in the hammer head, thus preventing the reciprocating parts from turning on their vertical axis. The operating lever can be clamped at any position upon the sector by a wing nut and bolt. The hammer operates smoothly, and the force of the blow is controllable from nothing up to the maximum possible with the air pressure. Mr. Riley is shown in the photograph standing by his latest novelty.



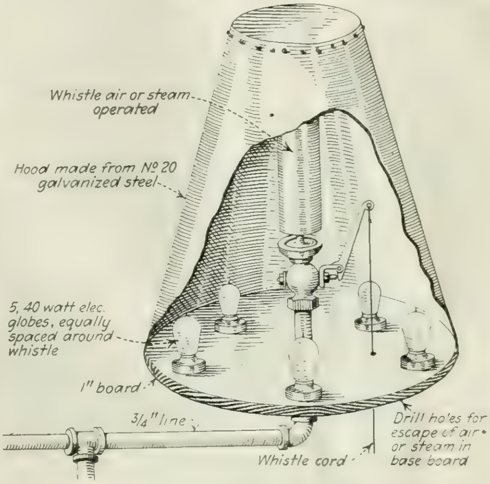
LENGTH OF STROKE AND FORCE OF BLOW CAN BE CLOSELY CONTROLLED IN THIS SHOP HAMMER

Preventing Air Whistles From Freezing

By Roy H. Poston

Written for *Engineering and Mining Journal*

Small air and steam whistles used for signal purposes around mines may be kept from freezing in moderately cold weather by means of an electrically heated hood. No attention is required beyond that of keeping good globes in the sockets at all times. The sound is, of course, somewhat deadened, but it may easily be heard by the hoistman, if the whistle is properly placed.


Whistle air or steam operated
Hood made from Nº 20 galvanized steel
5, 40 watt elec. globes, equally spaced around whistle
1" board
3/4" line
Drill holes for escape of air or steam in base board
Whistle cord

ELECTRICALLY HEATED HOOD FOR PREVENTING AIR WHISTLE FROM FREEZING

Power Threading of Pipe

Written for *Engineering and Mining Journal*

A power device for threading pipe from two to four inches in diameter was rigged up by E. S. Teal at the Darrow cyanide plant near the Argonaut mine, at Jackson, Cal. A similar device could be extemporized where

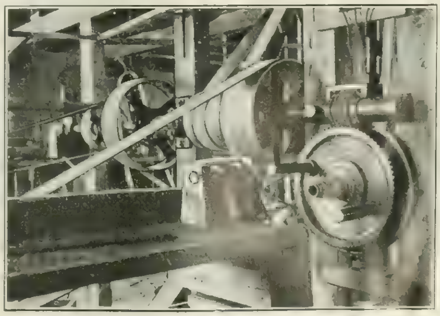


FIG. 1. POWER DEVICE FOR THREADING PIPE

there is a large amount of such work to be done, and its use would save time and labor. The arrangement at the Darrow plant consists of a worm gear, ratio 1:80, supported in a vertical plane and driven from a countershaft. To use it, a pipe is supported on a vertical post placed on one side of and at the height of the center of the large gear wheels. This post can be moved to a limited extent in an arc lying in a vertical plane parallel with the gear wheel. To permit this, the foot of the post is bolted as shown in Fig. 2.

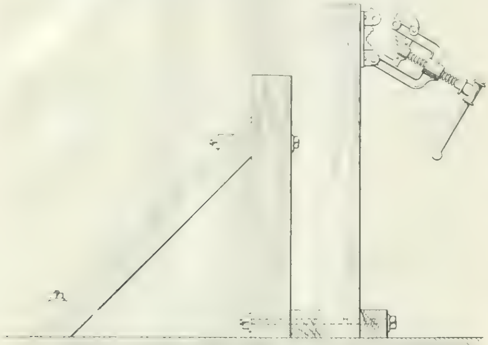


FIG. 2. VISE USED WITH POWER DEVICE FOR THREADING PIPE

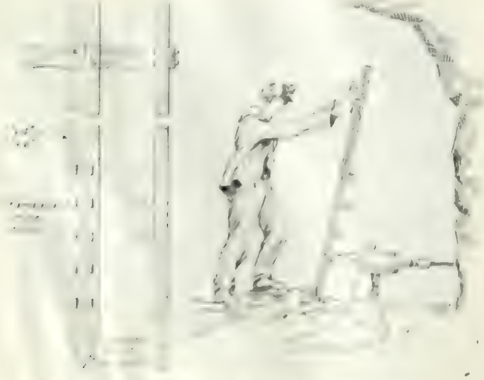
The pipe vise is of the ordinary hinged type. The pipe-threading dies are rotated by the two pins shown in the face of the large gear, Fig. 1. Bushings are screwed on the shaft of the gear and support the end of the pipe while it is being threaded. A bench to support the pipe is shown in Fig. 1. The pipe is held in its proper position on the bench by wooden blocks.

Support for Hammer Drills

By Roy H. Poston

Written for *Engineering and Mining Journal*

The device shown in the accompanying illustration may sometimes be used to advantage when drilling with hammer drills. The drawing is self-explanatory and shows only one dimension, that of the support itself, for obvious reasons.



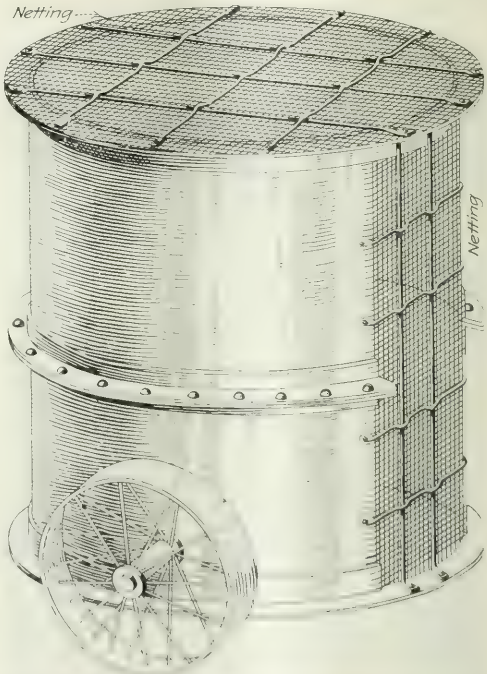
SKETCH OF SUPPORT FOR HAMMER DRILL

A Safeguard for Surface Blasting

Written for *Engineering and Mining Journal*

A blasting "tank" which was used when putting through an approach to the Missabe Mountain mine of the Oliver Iron Mining Co. at Virginia, Minn., is illustrated herewith. The cut was near one of the company's locations, and it was decided that if proper care were used the work could be done without inconvenience or danger to the tenants.

The ground was composed principally of glacial till, which ordinarily offers little resistance to the steam shovel. Most of the work, however, was done in the winter, under extreme temperature conditions, and as the frost extended to a depth of six feet in places, it was necessary to drill blasting holes ahead of the shovel.



BLASTING "TANK" FOR SAFEGUARDING SURFACE WORK

Before blasting the tank was rolled over the holes, which prevented frozen chunks, small boulders, and dirt from being thrown.

The tank, which was mounted on iron wheels, was made from one of the blasting or shelter houses used in open pits on the Mesabi Range to provide safety for the men. They are circular in shape, made of steel plate, provided with a conical roof, and are ordinarily placed at various points so that workmen may take refuge in them during blasting. To convert the shelter into a blasting tank the conical top was removed, quarter-inch mesh iron screen substituted for it and 1½-in. bars were bolted to the outer rim. Similar bars, threaded and bolted on the outside, were placed about a third of the way down from the top, these serving to reinforce the tank. Screening, also reinforced, was placed over the entrance of the former shelter.

THE PETROLEUM INDUSTRY

The Oil Bore at Roma, Queensland

Special Correspondence

Efforts to remove an obstruction, at a depth of 3,705 ft., in the state oil prospecting drill hole at Roma, Queensland, have been continued, but so far without success. Two attempts were made to raise the obstructing tools by attaching them, by means of a casing spear, to the casing (first to 6-in. and afterward to 8-in. tubing) and forcing the tubing upward. The first effort raised the obstruction three feet, when the 6-in. casing broke. When a greater strain was applied, the stouter tubing also broke off just above the jammed tools.

During an outburst of gas in the bore some months ago, the escaping gas forced the broken bit and stem upward 450 ft. from the point at which they had jammed, and it is now proposed, as a last resort, to release the gas, which has since been brought under control, in the hope that the obstruction may be forced further up the hole and possibly be removed altogether. If this fails, it is probable that attention will be given to a scheme for the utilization, on a commercial basis, of the gas and its petrol contents.

March Petroleum Production Greatest Ever Recorded

During March the United States produced, according to the U. S. Geographical Survey, the greatest quantity of petroleum ever recorded for any one month, amounting to 40,802,000 bbl., and, although the daily rate of consumption increased slightly, stocks of crude oil were increased by more than 8,000,000 bbl. The daily average production of 1,316,193 bbl. increased 53,765 bbl. as compared with February, and 160,354 bbl. as compared with March a year ago. For the first quarter of 1921 preliminary figures show a production of more than 114,000,000 bbl., which is an increase of over 11,000,000 bbl. as compared with the first quarter of 1920. Substantial increases in daily average production during March are reported for Oklahoma, Texas, California, and Kansas, and smaller increases are recorded for Illinois, West Virginia, Kentucky, Pennsylvania, New York, and Colorado. Decreased daily average production during the month is reported for Louisiana, Wyoming, Montana, Ohio, Indiana, and Tennessee. Ten thousand barrels are reported as having been received at refineries from Arkansas during March, which constitutes the first commercial shipment of petroleum from that state.

Imports for March, amounting to 12,303,114 bbl., show a falling off in daily average as compared with February of 9,705 bbl. However, for the first three months of the year imports increased more than 19,000,000 bbl. as compared with the similar period of 1920.

Stocks of all grades increased, except North Louisiana and Rocky Mountain grades, the gains being distributed as follows: Net pipe-line and tank-farm stocks east of California, 5,650,000 bbl.; California grades, 1,330,000 bbl.; and Mexican petroleum held in the United States by importers, 1,049,000 bbl. Since the first of the year stocks have increased more than 17,000,000 bbl.

The accompanying figures, compiled from company reports to the U. S. Geological Survey, show the quantity of petroleum removed from producing properties. Oil consumed on the leases is not included. This item and net changes in producers' stocks at the beginning and end of the year are obtained by annual canvass and are included in the final statistics of production. Oil consumed on the leases is not included.

Cat Creek Field Production Increasing

Special Correspondence

The thirtieth producing oil well has been brought in in the Cat Creek field, in central Montana, and ten more are expected within the next month. The construction of a second pipe line to the Cat Creek country is nearing completion. This will be a six-inch system, as compared with the present four-inch line. About twenty railroad carloads of oil are being shipped daily from the Cat Creek field, but this amount now is being increased in consequence of an increased demand recently.

PETROLEUM PRODUCED IN THE UNITED STATES IN FEBRUARY, 1921, MARCH, 1921, AND MARCH, 1920

(Barrels of 42 U. S Gallons)

	February, 1921 (*a*)		March, 1921		March, 1920	
State	Total	Daily Average	Total	Daily Average	Total	Daily Average
California (*b*)	9,184,000	328,000	10,482,000	338,129	8,570,000	276,452
Central and Northern Texas	5,774,000	206,214	6,692,000	215,871	5,405,000	174,355
Coastal Texas	2,566,000	91,643	2,980,000	96,129	1,868,000	60,258
Oklahoma	7,919,000	282,821	9,602,000	309,742	8,689,000	280,290
Kansas	2,478,000	88,500	3,005,000	96,936	3,328,000	107,355
Northern Louisiana	2,172,000	77,572	2,128,000	68,645	2,546,000	82,129
Coastal Louisiana	156,000	5,571	165,000	5,323	152,000	4,903
Wyoming	1,497,000	53,464	1,614,000	52,065	1,316,000	42,452
Illinois	785,000	28,036	963,000	31,064	993,000	32,032
Kentucky	695,000	24,821	779,000	25,129	719,000	23,194
West Virginia	634,000	22,643	756,000	24,387	766,000	24,710
Pennsylvania	603,000	21,536	672,000	21,678	666,000	21,484
Central and Eastern Ohio	427,000	15,250	466,000	15,032	449,000	14,484
Northwestern Ohio	175,000	6,250	193,000	6,226	192,000	6,193
Indiana	92,000	3,286	101,000	3,258	73,000	2,355
Montana	115,000	4,107	97,000	3,129	8,000	258
New York	66,000	2,357	86,000	2,774	81,000	2,613
Arkansas (*c*)		....	10,000	322	..	
Colorado	9,000	321	10,000	322	9,000	290
Tennessee	1,000	36	1,000	32	1,000	32
Totals	35,348,000	1,262,428	40,802,000	1,316,193	35,831,000	1,155,839

(*a*) Revised. (*b*) Average of figures reported by Standard Oil Co. and Independent Oil Producers' Agency. (*c*) Figures from Arkansas include only tank-car shipments to refineries.

Book Reviews

Industrial Oil Engineering. By John R. Battle. Flexible cloth; 5 x 7½; pp. 1,131. J. B. Lippincott Company, Philadelphia, Pa. Price, $10.

This book is divided into eleven sections, with marginal index so that they may be readily found. The subject matter has necessarily been collected from a variety of sources, such as the various U. S. Government publications, engineering society papers, and other reliable data. The first nine sections are devoted to the more general aspects of oils, whereas Section 10 considers the various uses in detail.

Section 1 is devoted to mathematics and useful data, and is similar to that found in almost every handbook. Section 2 deals with marketing and transportation methods. Mechanical Engineering is the title given to Section 3, which includes numerous tables, short descriptions of steam engines and turbines, use of the indicator, and a brief discussion of the most common electrical terms. Petroleum and its products are dealt with in Section 4, information being given on refining and manufacturing processes.

Fats and oils other than petroleum products are considered in Section 5, and their characteristics and uses are briefly outlined. Section 6 is devoted to the testing and properties of oils, and describes in detail the methods and instruments used in making the various commercial tests. Section 7 deals with lubrication and friction and describes the various types of bearings, together with the proper systems of lubrication for each. Comparative tests on babbitt, roller, and ball bearings are given. The equipment for properly using and storing oil is discussed in sections 8 and 9, and includes descriptions of filters and reclamation and cooling processes, together with storage systems and handling.

With this comprehensive introduction Section 10, of 500 pages, is more readily understood. The various uses for oils of every description are arranged alphabetically and cover an almost unbelievable range of subjects from Air Compressors and Automobiles, through Core Binders, Cutting and Drilling Operations, Flour Mills, a very good division on Heat Treating Processes, Marine Engines and Oils, Printing Plants, Rust Prevention, Shoe Factories, Textile Operations, Steam Turbines and finally a division on Water Wheels. Though this list contains only a few of the subjects considered, it will serve to reflect the scope of the section.

The last section, 11, is devoted to Industrial Oil Specifications, and discusses lubrication tests and reports, together with U. S. Government specifications for various grades of lubricants and motor gasolene. Last, but by no means least, is a very complete index covering sixty-five pages.

In each subdivision of Section 10 is a blank form to be used for listing the names, prices, and specifications of oils which have been found suitable for the parts under consideration. Another feature, possibly unintentional, is the blank space on many of the pages below the text. These form convenient places for notes.

The subject of liquid fuel is only briefly discussed, but the author announces in the preface that an additional section, covering this important subject, is now being prepared.

The print is clear and legible, the illustrations, drawings, and curves are many and good, and the subject matter is generally well arranged, so that this should prove a valuable work for those interested in oil in any of its numerous uses. T. M. R.

Handbook of Mexican Properties and Securities. Compiled by J. S. Curtiss. Paper; 6 x 9; 350 pp. Published by J. S. Curtiss & Co., El Paso, Tex. Price, $5.

This book will be valuable to all of those who are interested, either as investors or operators, in Mexican mining or agricultural properties. The list of mines is arranged by states and seems to be complete. In general the officials are given, together with a short description of the property, including its capitalization and brief mention of the securities issued. Another extensive list gives the names of the proprietors of all of the ranches in Mexico, together with their addresses. Several pages are devoted to the mining laws of Mexico and to the new constitution of that country. A dictionary showing the American equivalents of the Spanish mining terms is an attractive feature.

Glass Sands of Kentucky. By Charles H. Richardson. Cloth; 6 x 9; pp. 145; 23 illustrations. Kentucky Geological Survey, Series 6, Vol. 1, Frankfort, Ky., 1920.

Though the glass-sand industry of Kentucky is small, the report shows that excellent sands, together with other important glass constituents such as lime and fluorspar, are available, and also natural gas for fuel. The author visited sixty-six glass factories to obtain authentic data on manufacturing processes and raw material requirements. The first sixty-seven pages of the book contain a discussion of the properties, history, classification, raw materials, colorizers and decolorizers of glass, the preparation of sand, and processes of glass manufacture. Forty-one pages are devoted to descriptions of sand deposits in Kentucky, and twenty-seven pages of analyses. A summary and glass-sand bibliography follow.

The concise discussion of the glass industry is a commendable feature of a work on glass sand. The book is to be regarded as a valuable addition to the literature of this important and somewhat neglected subject. O. B.

Technical Papers

Drill Steel Standardization—The *Bulletin* of the Institution of Mining and Metallurgy for February, 1921 (No. 1 Finsbury Circus, London, E. C. 2, England), contains twenty pages of discussion of the paper recently presented by E. A. Wright on "The Standardization of Materials Employed in Mining and Milling Plants." Most of the discussion was on the subject of drill steel, but lack of data prevented the reaching of any definite conclusions.

Oil—A preliminary report by Robert W. Ellis, professor of geology in the State University of New Mexico, and State Geologist, entitled "The Oil Situation in New Mexico," outlines the result of a series of reconnoissance trips made by the author during the summer of 1920 for the purpose of securing data on the conditions having to do with oil production in the state. Oil prospecting has been of recent date, and up to the time of the report about fifty wells had been started. None of these can be said to be producing, although some have produced a few barrels for a limited time. It is stated that the Seven Lakes region in McKinley County has become the most encouraging field. The geology of several counties is reviewed and a summary of explorations in each is given.

Phosphoric Acid Determination—J. E. Clennell gives the details of an improved practice which he has developed for the estimation of phosphoric acid by the molybdate method in the *Mining Magazine* for March (Salisbury House, London Wall, London, E.C. 2; price, 1s 6d.; 3 pages).

Alaska—Bulletin 714-B, of the U. S. Geological Survey, Washington, D. C., eighty-two pages, obtainable upon request, contains chapters on lode mining in the Juneau and Ketchikan districts; the Salmon-Unuk region; and water-power investigation in southeastern Alaska.

Mining Costs—"Notes and Records of Mining Costs" is the topic of a seventeen-page paper in the March *Bulletin* of the Institution of Mining and Metallurgy. (No. 1 Finsbury Circus, London, E.C. 2; price, 1s. 6d.) The data cover operations in the Witwatersrand gold fields of South Africa and give detailed costs for the Simmer & Jack Proprietary Mines, Ltd. Reasons for varying costs are carefully detailed, and the method of applying general principles of cost analysis is explained.

Idaho Mineral Resources—U. S. Geological Survey Bulletin 713, 152 pages, obtainable upon request to the Survey at Washington, D. C., is descriptive of the geography, geology, mineral, and water resources of the Fort Hall Indian Reservation, Idaho. The principal minerals are phosphate rock and placer gold.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Copper Producers Must Take More Interest in Marketing, Says Walter Douglas

Legislation To Permit Stabilization of Prices of Refined Copper Also Held To Be Advisable

More intimate co-operation between copper producers, fabricators, and marketing agencies, and a modification of the Sherman and Clayton acts so that a combination of producers could be formed with the purpose of stabilizing prices were the two methods proposed for improving the copper industry, by Walter Douglas at the regular monthly meeting of the New York Section of the A. I. M. E., at the Machinery Club, Wednesday night, May 4. Mr. Douglas is president of the Phelps Dodge Corporation. Other speakers included Edwin Ludlow, president of the A. I. M. E.; S. D. Warriner, president of the Lehigh Coal & Navigation Co., and C. E. Lesher, editor of *Coal Age*. The subject for discussion was "Lessons to Be Learned From the Present Depression in the Mining Industry."

Although President Ludlow had not expected to be called on to address the meeting, his short opening talk was particularly well received and was much to the point. Mr. Ludlow spoke of having just returned from a trip through the West. Everywhere, he said, a higher tariff on the material in which local interest centered seemed to be the one thing most desired. In the Northwest an increased duty on lead was the sine qua non; in Tulsa, Okla., a duty on crude petroleum was considered necessary to protect local producers from Mexican competition. Mr. Ludlow, however, felt little sympathy with these purely local and selfish ideas, and thought that the good of the country as a whole should be considered first. He said, "I cannot see that building a tariff wall around the country is going to help matters much." Foreign nations cannot pay their debts to us in cash; the only way is by the work of their hands. Our goods must be exported, and must generally be paid for by the importation of manufactured articles.

Walter Douglas first took up the question of how the producers could have prevented the present copper depression. He explained that the United States Government had given instructions to produce copper at the maximum rate during the war, and that these instructions continued in force for two months after hostilities ceased. About 700,000,000 lb. was produced or in process of transit when curtailments were finally permitted. Then the producers, in an effort to gage future requirements, tried to estimate the amount of secondary or scrap copper available. It was almost impossible to obtain any information of value on this point, so they had to guess and guessed low. They also did not count on the long delay in the peace negotiations, which has postponed the rehabilitation of Europe, and the great depreciation in foreign exchange which has acted to prevent foreign buying. Although 100,000,000 lb. less copper was produced in 1919 than in 1918, still the market was flooded.

The history of the copper market in the United States was then developed by Mr. Douglas, who went back to Civil War days. Two or three attempts had been made to regulate production and prices, the last in the late 80's, but all were short-lived. The dependence of the copper industry on export demand for prosperity was emphasized. A major defect in the present marketing scheme was held to be the fact that producers do not reach the ultimate consumer. By the time copper reaches the public four or five profits have been added. This is something which has been called to the attention of readers of the *Engineering and Mining Journal* in numerous editorials. Mr. Douglas mentioned these, and said that to the extent that they laid the blame on the original fabricator he thought they were unfair, as the blame should rest on the jobber and distributor.

Copper producers can derive consolation, said Mr. Douglas, from the fact that producers have taken steps to curtail, and also that no new ore deposits of importance have been discovered in the last ten or twelve years. There is a big potential demand in Europe.

In summing up the subject Mr. Douglas spoke of the publicity campaign which is now being formulated to advertise the merits of copper to the ultimate consumer, and recommended that producers follow the copper more closely through fabricating and marketing channels, rather than lose all interest in it the moment the crude product is sold. The extreme price variation is also a detriment to the industry, and some method of stabilizing prices at a fair figure would be of great economic benefit. To do this existing legislation would have to be so modified that producers could act in unison. It is not right, said Mr. Douglas in closing, that Europe should be able to denude us of our natural resources at less than cost.

Colorado Scientific Society held its 342d regular meeting on April 30, 1921, at Denver, Col. The members heard Arthur J. Hoskins speak on the treatment of oil shale. On May 7 he discussed its commercial features.

San Francisco Section, A. I. M. E., Hears Committee Report

Rigid Economy Urged on Institute—Decentralization Favored—Monthly Journal Rejected

Sidney J. Jennings and Charles W. Goodale surprised the members of the A. I. M. E. section at San Francisco, Cal., by dropping into the meeting on April 26 at the local Engineers' Club. About forty members were present, and as the subject of the business meeting was the final report of a committee on the locally discussed subject of the publication *Mining and Metallurgy*, the visitors from beyond the Sierras were treated to a lively time. The committee's report was accepted as read with the exception of that part recommending the continuance of *Mining and Metallurgy*. By a majority vote the section expressed disapproval of *Mining and Metallurgy* in its present form and recommended its discontinuance.

The other important recommendations of the committee, adopted by the section, were:

> Rigid economy so far as is consistent with good service should be practiced in the conduct of the Institute's affairs, and with this end in view your committee approves the plan which has been suggested for a classification of publications. Such a plan would enable each member to choose such publications as he might desire and thereby materially reduce the total expense for publication and distribution. A more careful system of editing, also, should result in the elimination of much material which for various reasons ought to be published in the *Transactions*.
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> For the purpose of securing a more democratic and decentralized system of government for the Institute, we approve the suggestions made by former president Hoover that the constitution be so amended as to make the chairmen of the local sections automatically members of the Institute Board of Directors. . . .
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> In view of the wide distribution of the sections and the distance which separates many of them from the headquarters in New York, we suggest that once a year a directors' meeting be held, to which the most important questions regarding the Institute's policies should be referred, and that an attempt be made to have present a representative of each section, even though the expense of such attendance must be met in whole or in part by the Institute or its local sections.

At the conclusion of the business meeting, Gerard B. Rosenblatt presented an interesting paper on "Haulage for Metal Mines of Moderate Size." His discussion bore particularly on the conditions favoring the adoption of trolley locomotives, and those under which the storage-battery type is preferable. An abstract follows on p. 832.

"Mining and Metallurgy" Favored by Several Sections

A recent letter from Secretary Bradley Stoughton states:

"The president and the secretary recently discussed with the local sections of the Institute of Mining and Metallurgical Engineers the magazine *Mining and Metallurgy*, with the result that in every case the sentiment was overwhelmingly favorable to the magazine. In four cases where votes were taken the expressions of opinion were unanimously in favor of the magazine. I am giving below the sections in question and the approximate number of members taking part in the vote.

"Puget Sound Section, about twenty present; Oregon Section, about thirty present; Columbia Section, about twenty present; Montana Section, about seventy present; Minneapolis-St. Paul Section, about twenty-eight present; Chicago Section, about twenty-five present."

Minnesota Engineering Societies Organize a Federation

After a year of effort, the engineers of Minnesota have effected a federation of the leading engineering societies of the state. A constitution and by-laws, drawn up by a joint board appointed by the representative meeting held in June, 1920, was submitted to and ratified by the ten organizations seeking membership. A meeting held on March 11, 1921, in St. Paul, Minn., took final action to complete and perfect the federation.

The ten societies of the federation are: the Minnesota Surveyors and Engineers' Society; Minnesota Chapter, American Institute of Architects; Minnesota Chapter, American Society of Heating and Ventilating Engineers; Northwestern Section, American Society of Civil Engineers; Engineers' Club of Minneapolis; Engineers' Society of St. Paul; Minnesota Section, American Institute of Electrical Engineers; Minnesota Section, American Society of Mechanical Engineers; Engineers' Club of Northern Minnesota; Duluth Engineers' Club.

It is expected that each individual society will seek membership in the Federated American Engineering Societies.

Course in Mineralogy by Mail For Prospectors

Professor A. S. Eakle, of the University of California, is conducting a course in determinative mineralogy for prospectors and others to whom such instruction is of practical advantage. The course is conducted by correspondence, and teaches simple, practical methods for identifying minerals.

The necessary apparatus, 100 specimens and a textbook are supplied. The course is of university grade, and is offered by the University Extension Division of the University, 301 California Hall, Berkeley, Cal., to which address all inquiries should be sent.

Electric Haulage in Small Mines Offers Many Advantages

Superior Flexibility, Simplicity, and Reliability Bring Cheaper Operation —Cost Per Ton of Ore Hauled Governs Choice of System

Gerard B. Rosenblatt addressed the San Francisco Section of the A. I. M. E. meeting on April 26 on the subject of "Haulage for Metal Mines of Moderate Size." His remarks were reported in full by our correspondent, and the following condensed version has been prepared from that report:

The selection of the proper system of haulage for the metal mine of moderate output -500 to 2,000 tons of ore per twenty-four hours—deserves more careful consideration than is generally accorded it. The advantages of mechanical haulage are widely recognized, but a cost analysis of the various systems available is not generally made before deciding upon the type that will be installed. First cost is frequently given more or less careful consideration, but factors affecting the cost of operation are often overlooked.

This is not a brief for electric haulage, but I believe it will be admitted that on account of the flexibility, reliability, and comparative simplicity of electric locomotives this form of mechanical haulage will prove most applicable in the majority of operations. Gasoline locomotives and compressed-air locomotives have their particular fields of application, but these fields are rather limited. The proper field of the gasoline locomotive is for small tonnages over comparatively long distances on temporary work under conditions where it is more important to keep low the total initial investment than to secure continuity of service or economy of operation and maintenance. The particular field of the compressed-air locomotive is for large tonnages over long hauls where conditions necessitate heavy trains, but where the physical surroundings prohibit the installation of a trolley or third rail. For all other conditions electric haulage can be proved to be superior.

In selecting haulage equipment the primary consideration is that mechanical haulage is installed to help the mine make money. It makes money by saving expense. The type, size, and make of equipment that will handle a given output and will save the most expense is the logical type to install. The haulage system should not be selected on the basis of lowest first cost alone, nor should it be selected on the basis of some individual's preference. First cost and personal preference are factors entering into the problem, but they are neither the only nor even the predominating considerations. Haulage installation should be made on the basis of a complete logical analysis. And the foundation of such analysis should be cost per ton of ore hauled.

Upon the reliability of its component parts depends the continuity of service that the haulage system will render. Interruptions mean money lost. Delays in continuous service are expensive. A locomotive out of service for repairs, a train held up on account of a trolley wire down, mean money going out and none coming in. It is not just the expense of putting the locomotive back in service or of stringing up new wire that must be considered: it is interest going on, ore piling up in the chutes, and perhaps it is even reducing the mill output. Haulage equipment should be selected so that for the particular conditions time out of service will be a minimum. To do so will reduce the costs per ton hauled by keeping up the tonnage for a given investment.

Upon the selection of the proper size of locomotives will depend largely the operating labor expense. Every locomotive must have a motorman. In many states every train must have a trip-rider as well. Locomotives smaller than necessary mean more trains per given tonnage output, and, consequently, more wages per ton hauled. Trains should be made long enough to keep the number of locomotives required down to a minimum, but of such size as to keep those locomotives busy. Locomotives standing idle and motormen loafing run up the cost per ton of ore. Train length up to a certain limit means economy, but above that limit too long a train means expense, for very long trains are more subject to derailments than short ones, cause confusion at stations, and offer difficulties when loading from chutes.

Wider gages and heavier rails permit longer trains. There is an economical length—depending largely on the design of car and the capacity to be hauled. For the average small mine it is usually somewhere between twelve and twenty cars. The maximum weight of locomotive that can be used depends upon the gage and weight of rail used. Often it will pay to use a wider gage or a heavier rail than was at first selected, so as to use heavier locomotives, be able to haul longer trains, and reduce the number of locomotives required for a given output per shift.

Under maintenance expense, the upkeep of the haulage system as a whole should be considered. The upkeep of the overhead trolley wire on a trolley-operated system should be included in considering the maintenance of a trolley locomotive, just as the upkeep of the storage battery is almost invariably included in figuring the maintenance of a battery locomotive. In fact, for a fair comparison of real costs on a ton mileage basis there should be included locomotive maintenance, car maintenance, track maintenance, battery maintenance, if any; trolley maintenance, if any; motor-generator maintenance.

First cost should include consideration not only of the cost of locomotive and cars, but also of such factors as motor-generator or charging stations, trolley in place, and bonding of rails. The manner in which first costs enter into total operating costs is simply a question of business bookkeeping, and will not be discussed here.

As to safety, all haulage systems involve a certain accident hazard. The reduction of this hazard should receive major consideration. Apart from the humanitarian side of the problem, accidents are bad "business." They are costly and they tend to reduce operating morale. A safe system goes far toward reducing haulage costs. The possibility of danger from electric shock is usually the feature particularly in mind in considering the accident hazard of electric haulage systems; but there are others that should not be overlooked. They involve control and braking of the train, and protection for the motorman in case of collision. I believe as many train operators in mining service are hurt by runaways and collisions as are injured by electric shock.

The value of flexibility in a haulage system is difficult to estimate. Yet it is quite real. Haulage systems can readily have a life of ten years or more. Few mines, especially lode mines, are operated on the same basis of development over ten-year periods. Physical conditions change, managements change, engineering ideas change, and metallurgical processes advance. A haulage system that may be ideal for present conditions may be a handicap ten years, or even two years, from now, unless that system has a certain flexibility which will permit its being adapted to changed conditions likely to be encountered. This aspect is worth thinking about.

Personal preferences enter into the problem of selecting haulage equipment on account of the personal element. Haulage equipment cannot be made strictly "foolproof," and operators usually get better results with equipment which they like than with that which they do not like. Features that render inspection easy—that facilitate adjustments and lubrication—tend to lessen maintenance expense. A machine that is easy to oil is almost sure to get more frequent and more adequate oiling than one which is so constructed that periodic oiling becomes a disagreeable and troublesome chore. Men will keep an easily adjustable machine in good adjustment, and will not so readily allow it to get in such bad adjustment that it has to be withdrawn from service for repair in the shop.

Power consumption enters into the cost of mine haulage to a less extent than is usually realized. It is seldom of sufficient importance to justify the selection of any one system of haulage. In half a dozen mines on which I have reasonably accurate haulage cost data power consumption constitutes only about 5 to 6 per cent of the total haulage operating cost. Ordinarily ten kilowatt-hours will haul about seventy-five tons of ore a mile on level track under average mine conditions. At the usual figure at which a mine buys power it can readily be seen that 10 per cent higher or lower power consumption does not make a great difference in the total cost per ton of ore hauled. Efficiency of the electrical equipment, on the other hand, is a matter of considerable importance, but not so much because of power consumption as because of the effect of efficiencies on securing a well-proportioned haulage system.

As a matter of actual fact, for average mining conditions the two systems, trolley vs. storage battery, will usually not show a great difference in over-all power consumption. I know that this is contrary to general impressions, but I have found it to be the case in scores of instances which I have analyzed.

A consideration of the foregoing factors will aid in the selection of the most economical haulage system for any specific condition. No general rule can be laid down as to when trolley haulage or when storage-battery haulage can be installed to best advantage. Each problem must be investigated separately. However, a few generally applicable remarks indicating the trend of recent engineering experience may be of service.

As a simple, rugged, reliable piece of haulage equipment, the trolley locomotive is the peer of all haulage motive power. As a means of moving trains quickly, irrespective of tonnage or distance, its superiority is unquestioned. The trolley locomotive can be built for any speed that a mine track will stand. It can be subjected to almost unbelievable abuse, both mechanically and electrically; it can be plugged, derailed, "slambanged" into trains of cars, and yet stand up to the service with a minimum of deterioration. It is handicapped by just one feature, and that is that it requires a trolley wire in order to be able to move about. Trolley wires may be a menace to safety and interfere with flexibility. In heavy or moving ground and about loading chutes they may be a decided nuisance and require a considerable attendance. Also, trolley wires and rail bonding cost money to install and to keep in condition.

The modern storage-battery mine locomotive is not the delicate piece of apparatus its detractors claim it to be —in fact, it is a mighty good mining machine; but it will not stand the abuse that a trolley locomotive can withstand. Operated with reasonable intelligence, and given decent maintenance, it will perform most satisfactorily in mine service; but it does need greater intelligence in its operation and more care than a trolley locomotive requires.

Actual mining conditions usually determine whether trolley or storage-battery haulage is the better to install. For large tonnages over long hauls the trolley system will almost universally prove most advantageous. For many frequent and diversified short hauls with moderate or small tonnages—gathering service, as it is termed—storage-battery haulage will probably prove more suitable. For small tonnages over moderately long hauls, storage-battery haulage will generally prove more economical, particularly as the investment and maintenance charge of the trolley wire and rail bonding for a trolley system must be divided among a comparatively few tons of ore hauled.

Long straight adits, in which high haulage speed is permissible and desirable, will always favor trolley haulage. Poor roof conditions, on the other hand, cause storage-battery locomotives to show up most favorably, because bad roof means trouble in keeping up the trolley wire, and a trolley wire down is not only a nuisance and expense, but means a haulage system tied up until the electricians are sent for and get in to clear up the trouble.

A mine system that involves constant advance of haulage drifts favors storage-battery haulage, because the storage-battery locomotive can follow development as soon as rails are laid, whereas the trolley locomotive has to wait for the stringing of trolley wire, with the attendant cleaning up of the roof and laborious realignment of the timbering.

Low roofs favor storage-battery locomotives as a matter of safety. Certain methods of stoping also are favorable to storage-battery locomotives in the haulage drifts, because many forms of chutes prohibit a trolley wire strung over the center of the track, and such chutes, unless all on the same side of the track, make trolley operation difficult.

Altogether, trolley haulage makes for speed and large output. Storage-battery haulage makes for convenience and flexibility. The variety of storage-battery locomotive types that have comparatively recently been placed on the market emphasizes the flexibility that can be attained with this form of haulage. Two or three manufacturers now sell a narrow-gage, single-motor, storage-battery locomotive that is particularly suitable for development work. This is a small, light machine weighing about 2½ tons and available for gages down to 18 in. It has a limited pulling power and a limited range of travel, but it will go almost anywhere and can displace three or four mules at a decided saving in cost of operation.

At least two manufacturers now make a midget locomotive—a small tandem affair built in halves, the leading half carrying the motor and the motorman, the trailing half carrying the battery. Each half is of such dimensions that it can be run onto the ordinary mine cage just like a mine car. It can thus be shifted from level to level in a mine with the greatest convenience. Coupled together, the two halves constitute a respectable haulage unit that will develop about 400 lb. drawbar pull at about 3½ miles per hour. The unit has short wheel base, so that it can take any reasonable curve. It is less than four feet high and so can go into low places and "snake" cars from anywhere that rails are laid. It marks about the ultimate in all-around flexibility.

A. I. M. E. Organizes Oregon and Philadelphia Sections

During the brief April trip of President Ludlow and Secretary Stoughton, of the A. I. M. E., they visited a number of the Institute's sections in the Northwest. On the evening of April 7, they also met twoscore members from Oregon, attending the convention at Portland, Ore., and assisted at the organization of the Oregon Section of the Institute under the chairmanship of Henry M. Parks.

On their return East the same two officials attended the meetings of American Engineering Council at Philadelphia, on April 16. Between meetings twenty-nine Philadelphia members presented a petition for the formation of a Philadelphia Section. A unanimous resolution then requested the directors to appoint an organizing committee with H. S. Drinker, chairman. This committee has summoned all members living within fifty miles of Philadelphia, to meet on May 16, 1921, at 1317 Spruce St., where a Philadelphia Section will be organized. May 16 is the semicentennial of the founding of the A. I. M. E. at Wilkes-Barre, Pa.

The Geological Society of Washington, D. C., held its 361st meeting on May 11, at the Cosmos Club. The colemanite deposits of California were described and their origin was discussed by W. F. Foshay. An illustrated talk on the glacial origin of the Fort Liscum landslide, given by B. L. Johnson, opened the session; and a longer, illustrated talk on "Relations of Vegetation to Geologic Formations," which was given by E. T. Wherry, brought the meeting to a close.

MEN YOU SHOULD KNOW ABOUT

Henry Krumb is in New York City on professional buiness.

C. A. Northcutt, of the South Chandler mine, Vermillion range, Minn., has gone to Denver, Col.

Herbert Hoover was made an honorary Doctor of Law by the University of Warsaw, Poland, on May 2.

Paul A. Gow, of Butte, Mont., general manager of the Tuolumne Copper Mining Co., was in Duluth, Minn., last week.

J. D. Reeside, Jr., is engaged in remapping a portion of the Ignacio, Col., quadrangle for the U. S. Geological Survey.

T. Wayland Vaughan has returned from Port au Prince, Haiti, where he has been inspecting geologic work for the U. S. Geological Survey.

Sverre Petersen, head of the technical department of Roxana Petroleum Corporation, St. Louis, Mo., was in New York City this week.

F. G. Clapp, petroleum engineer and consulting geologist, has moved his office to Room 2,025, Hudson Terminal Building, 30 Church St., New York City.

J. C. Metcalf, assistant chief engineer for Pickands, Mather & Co., Duluth, Minn., recently addressed the Ohio Section of the A. I. M. E., on Lake Superior iron mining.

W. A. Rose, chief engineer for Pickands, Mather & Co., at Duluth, Minn., has returned from Washington, D. C., where he went on affairs connected with mine income taxes.

Samuel H. Dolbear, mining engineer of San Francisco, Cal., was in New York City last week on his way to Ontario. His New York address was 1424 Aeolian Building.

Stuart St. Clair, consulting geologist, has removed his office from Chicago, Ill., to 55 Liberty St., New York City. He is now in the Oriental oil fields, where he will remain for a year.

Harvey Bassler, who has been working in South America for the Carter Oil Co. during the last year, was detained for a week at Corocoro, Peru last January, as a Chilean spy.

Karl T. Sparks, mining engineer, attached to the Fairbanks, Alaska, experiment station of U. S. Bureau of Mines, was in New York City this week. Mr. Sparks recently spent a few days in Butte, Mont.

Prof. Waldemar Lindgren, head of the department of mining and geology, Massachusetts Institute of Technology, sailed for Bolivia on May 11. He will be absent on professional business there for about three months.

A. G. McGregor, engineer, of Warren, Ariz., sailed from New York City on May 11, for Peru. He will inspect the new smelter designed by him and now under construction there for the Cerro de Pasco Copper Corporation.

F. H. Fovargue, mining engineer, of Lake Helen, Fla., formerly general superintendent for the Chisos Mining Co., Terlingua, Texas, has accepted a position as general superintendent for the Monson Maine Slate Co. at Monson, Me.

Frank W. Pugsley, metallurgical engineer, of Pittsford, N. Y., for the last fifteen years with the McKinley-Darragh-Savage Mines, Ltd., will sever his connection with that company on June 1, owing to the closing down of the mines.

H. F. Ellard, mining engineer, secretary-manager of the Morning Club, Mullan, Idaho, has resigned that position to assume direction of club and social affairs in the Panama Canal zone. He has gone to Washington for his final instructions.

Prof. Robert Peele, of the Columbia University School of Mines, New York City, has been elected an honorary member of the Institution of Mining and Metallurgy, London, "in recognition of his eminent services in the advancement of mining science and education."

Dr. John B. Porter, head of the mining school of McGill University, Montreal, and a party of students recently spent a week looking over the mines of the Oliver Iron Mining Co. and the Cleveland-Cliffs Iron Co., in the Ishpeming, Mich., field of the Lake Superior district.

J. C. Dick, consulting mining engineer, announces that he has resumed professional practice, giving special attention to technical questions in the Federal tax law involving mines and other natural resources. His address is 1502 Walker Bank Building, Salt Lake City, Utah.

Frank T. Snell, mining engineer, has resigned his position as general foreman of steam-shovel operations for the Nevada Consolidated Copper Co., Ruth, Nev., to act as engineer with the western sales division of the Trojan Powder Co. His offices are in the H. W. Hellman Building, Los Angeles, Cal. His mailing address is R.R. No. 1, Box 334, San Gabriel, Cal.

Mining and metallurgical engineers visiting New York City during the last week included: **F. C. MacKrell**, West Point, N. Y.; **H. C. Anchor**, superintendent of Dome Extension Mines Co., S. Porcupine, Ont.; **E. O. Daue**, Easton, Pa.; **Albert E. White**, professor of chemical engineering, Ann Arbor, Mich.

SOCIETY MEETINGS ANNOUNCED

The Executive Board of Federated American Engineering Societies will hold its next meeting in St. Louis, Mo., on June 3, 1921.

American Society of Safety Engineers will hold its next meeting May 27, at 8 p.m., in Engineering Societies Building, New York City. The subject of the meeting will be "Electrical Hazards and Their Safeguards," and several papers by experienced men are on the program. All interested are invited to attend.

The American Iron and Steel Institute will hold its nineteenth general meeting at Hotel Commodore, New York City, on May 27. There will be a forenoon session (10 a.m. summer time), an afternoon session (2 p.m.), and a banquet at 7 p.m. Those desiring banquet reservations should address Howard H. Cook, assistant secretary, 61 Broadway, New York City.

American Society of Mechanical Engineers meets at Chicago, Ill., on May 23 to 26. Headquarters for this spring meeting will be the Congress Hotel. For reservations or information address C. E. Davies, assistant secretary, 29 West 39th St., New York City.

The Great Lakes regional meeting of the A. S. M. E., will be held at Cleveland, Ohio, on June 13 and 14.

American Society for Testing Materials will hold its annual meeting at Asbury Park, N. J., on June 20 to 24. The tentative program at hand indicates papers on cement, concrete, and refractories, for June 22 and 23; on petroleum products and testing, for June 23; on iron, steel and non-ferrous metals, for June 24. Headquarters will be the New Monterey Hotel. Further information may be had from C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

A Philadelphia Section of the A. I. M. E. will be organized at the Engineers' Club, 1317 Spruce St., Philadelphia, Pa., by members living within fifty miles of that city, on May 16. The meeting begins at 8 p.m. and all members of the Institute are invited. Dr. H. S. Drinker, a founder, will speak on the organization and history of the Institute since its foundation on May 16, 1871. After a discussion of the future usefulness of the organization, and the transaction of formal business, there will be a social smoker. F. Lynwood Garrison, temporary secretary, Drexel Building, Philadelphia, is making the arrangements.

OBITUARY

Albert Chapman Savage, civil and mining engineer, for the last ten years in Mexico, in the employ of the Esperanza Mining Co., El Oro, Mexico, died in that country on May 3, 1921, from injuries received when thrown from a horse last summer. Mr. Savage was born in New York City on Aug. 31, 1848, and was a graduate of Columbia University. He is said to have surveyed the first railway run through Texas. Later he specialized in aërial tramway construction.

THE MINING NEWS

LEADING EVENTS

Utah Copper Denied Rehearing Before State Supreme Court

Case Will Probably Be Carried Higher—Company May Build Own Power Plant

The application of the Utah Copper Company and seventeen other large users of power for a rehearing before the Supreme Court of Utah in the controversy with the Utah Power & Light Co. over increased rates charged by the power company and fixed by the Public Utilities Commission of the state has been denied. The way is left open for appeal to the U. S. Supreme Court, and it is probable that the case will be reviewed by it.

Utah Copper and the other companies seek to bring into question the right of the Public Utilities Commission to change the terms of contracts and raise the point as to whether any portion of the contract is binding when some of the terms have been altered by the commission. All of the protesting companies hold contracts with the power company, most of them entered into a number of years ago, and antedating the creation of the commission as a body. In this connection it is of interest that there is the possibility that Utah Copper will build a steam plant for it own power supply.

Date Set for Chicago Meeting Of Mining Congress

The twenty-fourth annual convention of the American Mining Congress will open in Chicago, Monday, Oct. 17. In conjunction with it will be the National Exposition of Mines and Mining Machinery. The Chicago Coliseum has been leased for this exposition.

Kruse and Tripp Settle Royalty Suit Out of Court

By mutual agreement the suit brought by Henry J. Kruse, of Crow Wing County, Minn., against Chester D. Tripp, of Chicago, was dismissed in the Federal Court. The suit was for a sum of $219,744.31, which was claimed for damages. The plaintiff alleges that he and the defendant entered into a partnership and acquired the mineral and surface rights of certain property in Crow Wing County, Minn., which was later leased to a lumber and mining company, and that the defendant received over $200,000 in royalties, but the plaintiff was not notified of the transaction, neither did he receive any portion of the money. The case was tried first in 1914, when the plaintiff was given a verdict, but owing to later complications the litigation has been going on for seven years.

WEEKLY RÉSUMÉ

Following the announcement of a 20 per cent wage cut by the U. S. Steel Corporation, affecting also the Oliver Iron Mining Co., orders have been issued to start shipping ore on all ranges from the latter's properties. The Federal Trade Commission has made a formal complaint against the corporation and subsidiaries because of the so-called "Pittsburgh-Plus" method of fixing steel prices. In the Birmingham district, the Gulf States Steel Co. has begun hoisting ore at the rate of 400 tons daily from the Shannon property, the first deep mining project in Alabama. In Montana, the Anaconda company has reopened the Nettie and Anselmo properties to mine silver-zinc ore, which will be smelted at the Washoe works, giving employment to 500 men. The Cascade Silver company's mill at Neihart has been burned down. In Utah, the Snake Creek tunnel case, involving the ownership of water developed in driving, is to be heard by the U. S. Supreme Court. The Utah Copper Co. and others have been denied a rehearing of the power contract case by the State Supreme Court. The Silver King Consolidated, of Park City, Utah, at its annual meeting, May 16, expects to consider the advisability of venturing in oil. In British Columbia, the reservation on the iron-ore deposits at Whitewater Valley in the Clinton mining division has been removed by the provincial government. The Silversmith Mines, at Sandon, has acquired the Ivanhoe concentrator. In Alaska, the Treadwell company is sending equipment to its new property on Nixon's Fork, in the Kuskokwim Valley. In Arizona the Verde Central, at Jerome, is reported to have cut an important body of copper ore.

At Washington, H. Foster Bain has been confirmed by the Senate as Director of the U. S. Bureau of Mines. The Senate passed the bill making the assessment work year coincide with the fiscal year, but rescinded its action to improve the wording of the bill.

Men Strike at Rochester, Nev.

Tonopah and Divide Situation Practically Unchanged—Nevada Packard Resumes at Lower Scale

The Tonopah and Divide strike situation is practically unchanged, although some companies are making an attempt to resume operations by importing outside men.

The employees of the Rochester Silver Corporation, at Rochester, struck against a cut of 50c. per day on May 4, affecting 120 men. The Nevada Packard, a few miles away, resumed operations a few days before this at a reduced scale after a 60-day shut-down.

Snake Creek Tunnel Case To Go To U. S. Supreme Court

Development Company Gets Writ of Certiorari—Right to Water Tapped in Driving Involved

The Supreme Court of the United States has undertaken to review the important case in which the Snake Creek Mining & Tunnel Co. and the Midway Irrigation Co., both of Summit County, Utah, are involved. The case turns on the ownership of water encountered in the Snake Creek tunnel driven for mining purposes. In this particular instance, the value of the water is estimated as being worth only $40,000, but the principle which will be established by the decision of the Supreme Court is of the greatest importance, since similar situations exist throughout the West. The tunnel company has been granted a writ of certiorari. At the time of the trial before the District Court of Utah, the tunnel had been driven into the mountain a distance of 14,500 ft. The considerable volume of water which was encountered is of value for power and irrigation purposes. The irrigation company which claims title to all of the waters of Snake Creek, a stream which drains a valley on which the tunnel opens, alleges that the tunnel has intercepted water which otherwise would have found its way naturally into Snake Creek. The irrigation company not only asks for an injunction against any use of the water by the mining company, but also asks that the mining company be enjoined from driving the tunnel further into the mountain.

The case was first tried in 1914 in the U. S. District Court at Salt Lake City, and the verdict was in favor of the Snake Creek company. Later this decision was reversed by the Circuit Court of Appeals, which found for the irrigation company, which claimed the water as a part of the surface waters of Snake Creek.

Mining men are awaiting the outcome of the suit with interest, as the question is one of vital importance to the industry, inasmuch as waters developed in the course of tunnel work may often be turned to profitable account in mining and milling operations, or revenue derived from the sale of such waters may be used to help defray the heavy expense of the work. On the Snake Creek tunnel, when work was stopped by litigation, there had been expended some $364,000. It can readily be seen that the possibility of losing any or all waters developed in tunnel work might easily act as a deterrent to the undertaking of work of this nature and thus operate to retard mining development materially.

American Zinc Institute Meets in St. Louis

E. H. Wolff, of Illinois Zinc Co., Elected President—Zinc Tarriff Not Discussed

By P. R. Coldren

E. H. Wolff, vice-president and general manager of the Illinois Zinc Co., was unanimously selected by the directors of the American Zinc Institute to head the organization for another year, at the close of a highly successful two-day session at St. Louis on May 10. A. P. Cobb, Cornelius F. Kelley, and F. C. Wallower were elected vice-presidents, Howard I. Young was chosen as treasurer, and S. S. Tuthill, of New York, was re-elected for his fourth term as secretary.

Directors selected for the term ending 1924 include: Charles W. Baker, J. H. Billingsley, P. B. Butler, Julius W. Hegeler, Cornelius F. Kelley, William A. Ogg, and H. S. Wardner. A vacancy in the 1923 group was filled by the selection of Benjamin Lissberger.

Although the attendance at the meeting was not greater than in other years, the general opinion was that it was one of the best meetings yet held. Approximately ninety members of the institute registered, about one-third of them being from the Tri-state zinc and lead district and the others from all over the country, representing zinc mining, zinc smelting, and manufacturers of zinc products.

There was no discussion as to the tariff at the meeting, this subject being dismissed with a brief statement from President Wolff, who told what had been done and expressed the opinion that tariff protection for zinc is assured in the new tariff bill.

A resolution asking the U. S. Treasury Department to use alloyed zinc for making the new 2½-cent piece which is under consideration was presented by H. T. Hornsby and passed unanimously. It bases the request on "grounds of economy, efficiency, and the encouragement it will extend to a key industry."

Charles T. Orr, past president of the institute, was toastmaster at the annual dinner held on Monday evening, at which Dr. W. F. Gephart, dean of commerce and finance at Washington University, was the principal speaker. He sounded a note of encouragement as to the financial outlook and expressed the opinion that the world may fairly expect to go into the year 1922 near normal and with a period of unprecedented prosperity immediately ahead. Other speakers at the dinner included A. P. Cobb, vice-president of the New Jersey Zinc Co.; C. E. Siebenthal, Dorsey A. Lyon, and President Wolff.

Among the papers of note read at the meeting was one by Frederick Laist, in charge of the electrolytic zinc plant of the Anaconda Copper Mining Co. Mr. Laist said that the electrolytic process has made remarkable progress in the six years in which experimental work at the existing plants has been carried on. "From a war baby," he said, "it has grown into an industrial process which has demonstrated its ability to produce zinc in competition with older processes and unquestionably has come to stay." However, he declared that it lacked much of mechanical perfection and that great improvements can be and will be made.

The present output of electrolytic zinc was given by Mr. Laist as 125,000 tons per annum. He stated the record production at the Great Falls plant was made last July, when a total of 11,801,662 lb. was drawn. He predicted that the future will see electrolytic zinc plants operating on high-grade ores and actually producing their power by the combustion of coal, oil or gas. He said that the amount of labor required for producing a ton of electrolytic zinc is not more than one-third of that required to produce the same amount by the furnace method, and that the total investment will be little if any greater than for the distillation method.

In his paper on "Increasing the Consumption of Zinc," W. H. Hendricks, of the New Jersey Zinc Co., suggested that this may be accomplished by reestablishing old markets at the earliest possible date; by increasing the consumption of zinc in the present consuming industries; by discovering new uses for present products; by development of new products for present needs; and by developing new products and creating new needs.

One interesting suggestion made by Mr. Hendricks was the substitution of a mixture of zinc chloride and zinc oxide for plaster of paris for patching cracked plaster walls. He also suggested that mention should be given to the matter of improving the use of zinc chloride for wood preservation.

J. J. Rutledge, in charge of the Mississippi Valley Experiment Station of U. S. Bureau of Mines, told of some of the things that are being planned for the purpose of aiding the mining industry, and asked for further suggestions. His request was supplemented by an appeal from Dr. Lyon. A lively round-table discussion, led by Arthur Thacher, of St. Louis, followed.

During this discussion the matter of getting accurate figures of production and consumption for the industry was gone into, and the point was made by the mining men that the smelters should be willing to give up such valuable information if the ore producers were expected to do so. The smelter men present intimated they would be willing to co-operate fully.

Other subjects that came before the meeting were as follows: "Zinc Roofing and Building Products," by C. H. Stewart, of the American Zinc Products Co.; "Uniform System of Cost Accounting for Mines," by George W. Potter, of the Eagle Picher Lead Co.; "Value of Trade Papers in Relation to the Zinc Industry," by G. F. Creveling; and report on the zinc producing fields by Otto Ruhl, Charles Bocking, A. M. Plumb, Howard I. Young. A resume of the general zinc situation was made by the secretary, S. S. Tuthill.

The board of directors, after adjournment, passed a resolution asking the Commissioner of Indian Affairs to act immediately on the matter of Indian leases in the Tri-state field and "to promulgate a set of rules liberal enough to enable the zinc industry of Oklahoma to adjust its business and to conserve the orebodies of that district for future profitable use."

There were no exhibits of zinc products at the meeting other than zinc shingles or tile, made by the Illinois Zinc Co. and the American Zinc Products Co. It was voted to hold the next meeting at St. Louis.

Reserve Removed on Iron Ore in Whitewater Valley, B. C.

Provincial Government Takes Action Following Adverse Report on Deposit by Vancouver Engineer

A considerable section of the Clinton mining division of British Columbia, known to contain iron-ore deposits of importance, was placed under reserve by the Provincial government about a year ago, it being thought that investigation might prove that these deposits could be made to play a vital part in the development of an iron and steel industry. This reservation was removed recently on the recommendation of the Minister of Mines, the report of the government mining engineer, made in 1919, after a brief and superficial examination, having failed to receive the substantiation of F. J. Crossland, a mining engineer of Vancouver, B. C., who went into the district last summer. He was properly outfitted, made an early start, and so was able to prospect all the limonite ore occurrences and to furnish what may be accepted as a good approximation of the tonnage available.

Mr. Crossland's report deals with an area of fifteen square miles of the upper part of Taseko Valley. He finds the ore is a secondary limonite and that it occurs as surface deposits following the present contour of the ground. The deposits are patchy and vary from 1 ft. to 5 ft. in thickness. Eight widely separate deposits are described. The McClure Mountain deposit is referred to as one of the chief among those of appreciable size. It contains nearly half a million tons of "positive ore." Whale Mountain contains half a million tons of "probable ore." The total of "positive ore" in eight deposits is placed at 672,741 tons and "probable ore" at 911,250 tons. The ore is homogeneous and of good grade, averaging 50 per cent iron, with no impurities that would affect its value as a supply for blast furnaces. The deposits consist of a number of widely separated aggregates.

It would appear from the report that the tonnage of ore in the area placed under reserve is not sufficient to warrant installing the equipment necessary for working the deposits. The scattered nature of the deposits and the difficulties of transportation make exploitation impracticable.

To Aid Prospectors in Obtaining Powder

The "bona fide mineral prospector" is to be assisted by the government of British Columbia to obtain cheap powder for the development of mineral properties. The last session of the Legislature appropriated $10,000 for this purpose, and William Sloan, the Minister of Mines, has approved of rules to govern the distribution of this fund. Twenty-five per cent of the legitimate cost of the powder at the point of purchase is to be granted in the form of a rebate. Applicants must prove to the satisfaction of a mining recorder or a mining engineer employed by the government that they are "bona fide mineral prospectors."

Rebates will be allowed on a basis of not more than ten cases of powder to each applicant in one year, except where "exceptional circumstances" are proven and on the "written recommendation of a resident engineer of the Department of Mines." Applicants are required to sign declarations, upon forms supplied by the Department of Mines, setting out the legal definition of the ground on which powder has been used and the number of cases of explosives actually used in prospecting such ground, and an invoice of the powder purchased must be furnished. To make the conditions clear: if powder is bought in centers where it is comparatively cheap, the rebate or subsidy will be based on such cost; if it be bought at outlying points at a higher price, the percentage will be figured on the higher cost. This is considered to be better than a straight rebate.

Steel Corporation Must Answer As to "Pittsburgh-Plus" Plan

The Federal Trade Commission has at last issued a formal complaint against the United States Steel Corporation and eleven subsidiary companies relative to the plan of making prices known as "Pittsburgh Plus." This action was due to the petitioning by 2,700 fabricators of steel in the Chicago, Birmingham, and Duluth districts. About two years ago the Federal Trade Commission was requested to assume jurisdiction on this matter, but failed to do so after a careful survey. Since then the personnel of the commission has changed, and the present commission voted 3 to 2 to issue the complaint, which allows until May 31 for an answer, after which the case will be brought to trial on its merits.

American Delegates at Portland for Tariff Increase on Lead and Zinc

In the account of the recent mining convention at Portland, Ore., that was published in the *Engineering and Mining Journal* of April 23, it was stated that strong opposition developed to the convention putting itself on record regarding an increased tariff on lead and zinc and that the matter was dropped. Thus far the report was correct, though incomplete. The convention, being international in character and including Canadian delegates, did not take action regarding a tariff, but at a separate meeting the United States delegates passed the following two resolutions bearing on the matter:

1. Whereas the lead and zinc industries of the United States have been seriously affected by the lack of adequate tariff upon foreign ore and bullion, thus leading to a condition leading to the suspension of the entire production of Missouri and two-thirds of the production of all the western states; and,

Whereas, without a substantial protective tariff the lead and zinc industries of the United States cannot survive: Now, therefore, be it

Resolved by a special convention of the United States delegates held during the Third International Mining Convention assembled at Portland, Ore., April 5-9, 1921, that the Congress of the United States be, and hereby is, respectively urged to adopt such changes in the duties upon lead in ores and its products as will provide for a tariff equal to 2c. per lb., and that an increase in the tariff on spelter and zinc ores be provided in conformity with the recommendations of the American Zinc Institute.

2. Whereas the Idaho Mining Association, through intelligent work at Washington, has done much to impress upon Congress the necessity for increase in the present protective tariffs upon lead and zinc; and

Whereas, such increased tariffs are essential to the preservation of the industries and therefore to the prosperity of all the West: Now, therefore, be it

Resolved that delegates to a special convention of the United States delegates held during the Third International Mining Convention, assembled at Portland, Ore., April 5-9, 1921, extend thanks to the Idaho Mining Association and particularly commend the work of Jerome J. Day, president, and Ravenel MacBeth, secretary of that organization.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Assessment Work Year Made Same as Fiscal Period

But Senate Promptly Rescinds Action To Perfect Wording of Bill—Measure Likely To Pass

After passing a bill to change the assessment work year to a fiscal year basis, the Senate rescinded its action to permit of perfecting the language of the bill. As the bill passed by unanimous consent, it is very evident that the measure can be passed at any time that it is brought forward again. There always has been widespread objection to the calendar year basis for assessment work. The general tendency is to wait as late in the year as is possible before performing the assessment work on mining claims. Since weather conditions are adverse in most of the mining regions of the country during the latter part of the calendar year, it is generally agreed that a fiscal year basis is better.

The bill, which was passed and subsequently recommitted to the Committee on Mines and Mining, contained the expressed proviso that it was not to interfere in any way with the extension to July 1, 1921, of the privilege of doing the 1920 assessment work. Nor was it to be construed that the performance of the 1920 work was to be excused. Senator Poindexter, the chairman of the Committee on Mines and Mining, has expressed himself as being unalterably opposed to any further suspension of assessment work. Several bills have been introduced providing for the suspension of the 1920 assessment work, but it is generally believed that such bills will not pass and that the 1920 assessment work will have to be performed prior to July 1.

Brass and bronze rods to the extent of 953,000 lb. have been offered for sale by the Ordnance Salvage Board. Sealed bids are to be received until 11 a.m. May 31.

War Mineral Claimants Hopeful of Further Allowances

Favorable Report on Shortridge Liberalizing Bill Brightens Outlook—If Passed, Will Reopen All Claims

The favorable report made to the Senate by the Committee on Mines and Mining on Senator Shortridge's bill liberalizing the War Minerals Relief Act and the possibility that the new Secretary of the Interior may approve this legislation have given rise to hope among claimants that there will be a material increase in the amounts allowed on war minerals claims.

Since an identical bill passed the Senate at the last session, it would not be surprising were the Shortridge bill to go through the upper house without objections. The difficulties with which the legislation will meet will be in the lower house. The principal argument which probably will be used against the bill is the contention that an additional appropriation of from $8,000,000 to $10,000,000 will be required.

The Shortridge bill is an effort to remove what is generally regarded as an inequity. Under the act, as it stands, claims can be considered only when there was a personal request or demand from the Government. This is amplified in the Shortridge bill, so as to include those who were induced to undertake the development of war minerals by published statements emanating from Government officials. This liberalization, it is stated at the office of the War Minerals Relief Commission, means that every claim will be reopened. This includes the claims on which awards already have been made, since it means that an earlier date of stimulation may be shown.

The aggregate of the amount claimed, under the act, is $18,000,000. Of that amount, the War Minerals Relief Commission has discarded some $12,000,000 worth of claims. If the law is allowed to stand as it is, some $4,500,000 of the original appropriation will be turned back to the Treasury. It is calculated that liberalization, as provided in the Shortridge bill, will call for $2,000,000 worth of additional awards on the claims on which payments already have been made, in that it will extend the period of stimulation. In addition, some $10,250,000 would be required to make payments on claims which had been disallowed under the existing act. Thus, additional payments of $12,250,000 probably would be made possible if the Shortridge bill should become a law. It would not be necessary to appropriate all that amount, as $4,500,000 of the existing appropriation remains available. To the amount of the claims must be added the administrative expense of the commission.

Bain Confirmed as Director of Bureau of Mines

Has Returned From Extended Tour of Mining Camps—Finds Conditions in Copper Country Significant—Zinc Smelters Seeking To Better Practice

Dr. H. Foster Bain was confirmed by the Senate as Director of the U. S. Bureau of Mines on May 10. After nearly a month spent in several important mining regions, Dr. Bain he returned deeply impressed with the business depression. He regards it as significant that the Calumet & Hecla mines have been forced to shut down. The company was particularly proud of its record of having maintained continuous production for more than half a century, despite depressions or other adverse economic factors.

The suspension of mining in the copper region is having the incidental effect of causing the immigration of English miners. Much of the early success in this region is attributed to the ability of the district to draw a material portion of its help from the professional miners of Cornwall and other parts of England. A number of years ago the type of immigration changed and it became necessary to recruit miners largely from among Finns and Sicilians. Though many good miners have been developed from these nationalities, the general tendency of these peoples is toward agriculture. As a result, there is a very large turnover among the working forces in the mines. More than that, they are not miners by profession and consequently must be trained. Since the war there has been a considerable influx of Cornish miners. The closing of the mines is making it impossible to encourage an increase in this type of immigration.

Though business prospects in Missouri's zinc mining region are more gloomy than ever before, Dr. Bain sees one hopeful tendency. The zinc smelting industry has come to realize some of the weaknesses of its present smelting practice and is taking advantage of the depression to do research work. One of the matters being taken up is the combustion problem in the plants using natural gas. In that and other problems Dr. Bain expects the Bureau of Mines to be able to extend material assistance.

Another phase of the zinc smelting problem in which the bureau is now receiving the active co-operation of the interests concerned is the matter of preventing waste and extending the life of the natural gas fields.

After a careful personal survey of the situation, at the southern experiment station of the bureau, which is operated in connection with the University of Alabama, the conclusion has been reached that one of the main studies at that station is to be on byproduct coke, especially with reference to its use in blast furnaces. There is great difference of opinion as to just what physical characteristics have a bearing on the quality of coke. The claim is made frequently that much of the byproduct coke is inferior. When coal is treated for the sole purpose of making coke, every attention is given that one product, with the result, it is claimed that a superior and more uniform coke is made. In the byproduct ovens, chief attention is given to products other than coke, which results in an inferior coke, some declare. This has accentuated the need for more definite knowledge as to the physical characteristics which add to or detract from the quality of coke that is manufactured.

NEWS BY MINING DISTRICTS

Special London Letter

Values Falling at Depth in Lonely Reef and Vein Flattening — Easing the Nigerian Tin Situation—Southern Van Ryn Reef in Need of Funds

By W. A. Doman

London, April 29—Next to the Globe & Phoenix the Lonely Reef is the premier gold mine of Rhodesia. The gold content of the ore is high, as will be gathered from the fact that the ore reserves at March 31 last, amounting to 200,555 tons, have a value of 19.98 dwt. This compares with 199,739 tons at Dec. 31, 1919, averaging 23.54 dwt. The fall in the value is pretty substantial. A high yield is required, seeing that expenses are high, and are greatly increased by the royalty paid to the British South Africa Co. For instance, last year 59,270 tons was milled, yielding 64,408 oz. of gold. The working costs were £156,636 or 52/6 per ton crushed, and the royalty raised them to 60/1 per ton. The cost per ounce was £2/76. In 1919 the expenses both in London and Rhodesia were 45/5 per ton, and the royalty 9/2, making the total 54/7. The per ounce figure was £2/10. As showing how working profits are eaten into it may be mentioned that from the surplus last year of £198,983, royalty claimed £22,412, and British and Rhodesian income tax £42,039, together 32.4 per cent. Of the balance of £134,500 shareholders received in dividends £111,190, or 50 per cent less income tax.

The ore in the lower levels of the mine maintains a good width—from 31 in. to 60 in., but values are falling off. Between the 20th and 21st levels reserves have a value of 26.49 dwt.; between the 21st and 22d the value is 19.96 dwt., and between the 22d and 23d 13.58 dwt. Only a small tonnage is so far opened up below this horizon, and the assay is 7.97 dwt. A point worth mentioning is that from the 15th level downwards the reef shows a gradual reduction in dip. This is a rather serious matter, as it involves longer crosscuts at each level. At the 24th level the crosscut is 229 ft. long. This entails much expense and a new incline shaft close to the reef is to be sunk from the 24th level.

Further attempts are being made to revive interest in tin mining in Northern Nigeria. Government regulations are being relaxed and hopes are entertained of a substantial reduction in railway rates.

The Burma Corporation deal with the Associated Lead Manufacturers is not to go unchallenged. It is alleged that the notice convening the meeting at

SURFACE PLANT OF STATE-OWNED EINASLEIGH COPPER MINE, QUEENSLAND, AUSTRALIA

which the arrangement was made failed to disclose one or two important matters. As a result, Lord Harris, as representing the Consolidated Gold Fields; Sir Henry Strakosch, for the Union Corporation, and several representatives of the Stock Exchange are conferring with certain members of the Burma Corporation board on the matter.

An example of the difficulty experienced by some mining companies in obtaining capital is that of the Southern Van Ryn Reef, which owns a property in the Far Southeast Rand. The directors are offering 2,000 six-year 10 per cent notes of £50 each, a premium of £50 to be paid on redemption. Funds are required to complete a plant capable of treating 7,500 tons a month. Repayment requires £200,000, and the interest during the period would be £60,000. At the rate of 7,500 tons monthly six years would consume 540,000 tons. To cover the note service only each ton would have to yield a profit of approximately 10/—. Seeing that the property is only just being opened up, and the bulk of the plant has to be obtained, the prospect of the notes getting their 100 per cent premium is far from bright. The Consolidated Gold Fields had the management of the mine at one time and gave it up.

The Cam & Motor treatment plant does not yet appear to be working satisfactorily. For March 10,052 tons were crushed by ball mills, the screen value being 43/9 per ton, or a total of £21,988. The total concentrates won were 1,142 tons, value £9 13s. per ton, or, say, £11,020. There is consequently much to be done to improve the extraction.

KOREA

Unsan — The April cleanup of the Oriental Cons. was $97,000, against $108,500 in March. The Tabowie mine fire is still burning, though the volume of gas and smoke is decreasing.

Australia

Queensland

Chillagoe State Smelters Down—Development at State-Owned Einasleigh Copper Mine Continued—Cobalt Mine Near Selwyn To Install Concentrator

Brisbane, March 26—The continued fall in the price of metals is having a disastrous eeffect on mining in Queensland, in common with the other Australian states. The three large copper-producing and smelting companies in the Cloncurry district are still idle, and work on copper properties in that field has ceased except for a small amount of development at some of the best mines. A few miners are, because there is nothing else for them to do, still "gouging" and storing their product. Tin mining is also affected, though in lesser degree. Mining for wolframite and molybdenite has ceased altogether. Fortunately, Mount Morgan is, with the assistance of its gold production, still going, but the company has just announced that it must curtail operations. It is now the only company mining and treating copper in Queensland, or, with one exception, in Australia.

Apart from Mount Morgan, the only smelting concern that resumed operations after the Christmas holidays in Queensland was the Chillagoe State smelters, and now these have shut down. The Minister for Mines was, up to two or three weeks ago, hopeful that he would be able to keep these works going, and thus avoid increasing unemployment in the district, but miners would not send in their ores at the ruling prices, and the smelters simply had nothing to work upon, and there was no alternative but to close down until the markets improve.

The government, however, has decided, to keep some men employed, to go on with development at the Einasleigh, a copper mine with an extensive body of low-grade ore situated in the Etheridge field on the Copperfield River, with picturesque surroundings and interesting geological features. This was the principal mine brought by the government with the Chillagoe works and railways and last year it furnished three-quarters of the ore supply for those works. During the first half of 1920 the average production was 450 tons of ore weekly, but this was increased to upward of 500 tons per week toward the close of the year. The mine still holds extensive ore reserves, and is capable of a further substantial output for a long period. Based upon the quantity and assay value of the ore developed, it was estimated that about 2,500 tons of copper would be derived from the mine during the first eighteen months the smelters were in operation. The Einasleigh, however, was the only mine in the district bought by the state that the government had power to work, and this restriction was found to impede the operation of the smelters,

EINASLEIGH TOWNSHIP AND MINE, QUEENSLAND, AUSTRALIA which never had an adequate supply of ore to keep them fully employed; consequently a special act of Parliament was passed last session giving the Mines Department power to work other mines which the government has acquired, but of course there is no inducement for a start to be made in this direction under conditions existing at present.

The cobalt mine near Selwyn in the Cloncurry district, continues to develop well, and indeed promises to assume dimensions that will give it a worldwide prominence. Since the shipment of the 50-ton parcel of ore to England about two months ago, as a trial lot, another 30 tons has been dispatched from the mine. The main shaft has reached a depth of 112 ft., and over 50 ft. of driving has been carried out on the lode at the bottom. Another shaft—the south shaft—is being sunk, and when this bottoms it will be connected with the main workings. In addition, development work is being conducted in two other shafts, and altogether twenty-one men are kept employed. As evidence that the owners of the mine have every confidence in its future, they have completed arrangements for the installation of a concentrating plant, to cost £40,000. At present a hand jig is operating on the dump.

It looks as if the newly formed company working the Mount Quamby gold mine, also in the Cloncurry field, have a good thing. The return from fifty-four tons of ore from this conglomerate deposit, sent to Charters Towers for treatment, is 28 oz. of smelted gold worth £3 13s. 4d. per oz.; ten tons of concentrates assaying 1 oz. 8 dwt. per ton, and forty tons of sands assaying 4½ oz. per ton. If this is a fair sample —and the manager of the mine says it is—the yield is quite "good enough," although not up to the predictions of some over-sanguine persons who have been busy booming the proposition. It is intended to install a battery at the mine.

CANADA

British Columbia

Silversmith Mines Acquires Ivanhoe Concentrator—Slocan Miners Vote To Accept 75-Cent Cut

Sandon—The Silversmith Mines, Ltd., has acquired the Ivanhoe concentrator from the Minnesota Silver Co., and the W. H. Yawkey estate, and will spend about $40,000 remodeling and enlarging the plant, which is to be connected with the Silversmith by an aerial tram. This acquisition will about double Silversmith's daily milling capacity and will make winter milling operations possible. The present Ivanhoe mill was constructed by the Rosebery Surprise Mining Co. in 1916 to replace the old Ivanhoe mill destroyed by fire in 1914. It has been idle over two years. Its acquisition by the Silversmith interests is taken to mean that the Rosebery Surprise management has definitely abandoned any further plans for operation of the Surprise, which for some years was the leading Sandon producer, and the Ivanhoe and Canadian groups, held and developed under option by Rosebery-Surprise for over a year. Valuable water rights are secured by the Silversmith with the mill and millsite.

In recent years work on the Noble Five mine has been confined to development of the vein system at depth, connecting the lower with the upper workings by means of a 1,000-ft. raise and establishing intermediate levels. The erection of a 100-ton concentrator was started in 1919 and completed during the summer of 1920. Other improvements include the erection of a modern bunk house and buildings. Owing to lack of labor the mill was started up on ore from one of the old dumps and the first carload of silver-lead concentrates was shipped to the Consolidated Mining & Smelting Co.'s smelter at Trail late last year.

NOBLE FIVE MILL AT SANDON, B. C.

Miners of the Slocan, in British Columbia, have voted to accept a wage reduction of 75c. per day for all classes of mine and mill labor. The new scale went into effect May 6 and ranges from $5.50 for skilled labor to $4 for roll men, jig men, muckers and common labor.

Cranbrook—The Gamble Placer Mining Co. has arrangements made for an active season's operations on Wild Horse Creek. About $20,000 has been invested in the project, a large portion of which was expended on flume construction last season.

Golden—Through efforts of the East Kootenay Prospectors' Association, capital has been interested in the Vermilion River talc property, near Castle Station, on the main line of Canadian Pacific Railway. The material is said to be in a 30-ft. vein and to be near transportation.

Greenwood—The outlook is favorable for a fairly active season in this vicinity. Morrison and Gills are driving a crosscut to tap the main vein on the Tam O'Shanter. Bombini & Co. have cut good ore carrying lead and silver in a shaft on the Vendella. Ola Loftstad is sinking a shaft on the Bonnie Bell claim, a mile from Greenwood. Chicago interests have commenced operations on an extensive scale at the Providence, which has been profitably operated under lease for some years past. Development work on the Defiance, which is close to the Providence, was started the latter part of April. Operations on the Jewel, a gold proposition, may possibly be resumed in the near future.

Stewart—Work of clearing the right of way for the aërial tramway that will connect the Premier mine, Salmon River, with tidewater is making good headway. Separate contracts have been let for practically every mile of the eleven and one-half miles, with the idea of speeding its completion. The points where the stations will be located have not been determined.

Alice Arm—The situation in this mining community is not bright. The plans of the Dolly Varden Mines, Ltd., for this summer are not known. With silver so low and mining costs comparatively but little reduced it seems doubtful whether the mine could be operated profitably.

Vancouver—D. G. Marshall, a director of the Britannia Mining & Smelting Co., is authority for the statement that plans are being drawn for a new concentrator, to replace the one destroyed by fire on March 19. He stated that, owing to the strong financial position of the company, it would be possible to go ahead with the construction work without waiting for settlement by the insurance companies. The new plant will not differ greatly, either in capacity or design, from the one that was destroyed, as the old plant gave excellent metallurgical results. It is hoped that the plant may be running early next year.

Trail—Ore shipments to the Consolidated smelter during the week ended April 30 consisted of 12,023 tons from the company's mines and 33 tons from the Sally, at Beaverdell.

Ontario

Hollinger Seeks Permission to Develop Power at Kettle Falls

Porcupine—The Hollinger Consolidated has applied to the Ontario government for the right to develop hydro-electric power at Kettle Falls, twenty-five miles north of Cochrane, on the Abitibi River. It is estimated that approximately 35,000 hp. may be developed there.

Kirkland Lake—The new mill of the Wright-Hargreaves is running smoothly, treating 125 tons of ore daily.

The offices of the Kirkland Lake Proprietary (1919) have been removed from Cobalt to Kirkland Lake.

Excavation work for the new mill is in progress at the Ontario-Kirkland.

Larder Lake—The new three-compartment shaft on the Kerr-Addison property of Canadian Associated Goldfield has reached a depth of 260 ft.

Boston Creek—To finance diamond drilling and underground exploration, the directors of the Miller Independence have decided to issue $50,000 in bonds maturing in three years and carrying 8 per cent interest. The company has reserved 150,000 treasury shares and gives the purchasers of bonds the right to exchange them for this stock at any time before maturity on the basis of three shares for each dollar in bonds.

Beaver House Lake—The Argonaut company purposes to erect a new modern mill as soon as justified by developments, which should greatly increase the percentage of recovery. One ore shoot is stated to have a length of 200 ft. and a width of 6 ft., carrying an average gold content of $15.75 to the ton.

Gowganda—There has latterly been a considerable revival of activity in this district, which has been badly handicapped by transportation difficulties and during the winter by power shortage. The Miller Lake-O'Brien, which was compelled greatly to curtail operations, has now a full supply of power and is working to capacity with three shifts. Several properties have been reopened, including the Gowganda, Enterprise, McAlpine, Powerful and Saunderson, the last named of which is getting in a small steam plant.

Quebec

Kazubazua—Gold is reported to have been found near the town of Kazubazua, in the Galienean district, about forty-five miles north of Ottawa.

Newfoundland

A new agreement has been signed between government of Newfoundland and the Dominion Iron & Steel Co. and the Nova Scotia Steel & Coal Co. covering an export tax of 25c. a ton for twenty years from Jan. 1, 1921, on all ore shipped to Nova Scotia and free exportation to all countries other than Dominion of Canada. The companies must spend $3,000,000 in the next five years in improvements and development of their plants. They are exempt from business profits tax.

CALIFORNIA

Engels Copper To Start Adit To Develop Upper Mine

Engelmine—The Engels Copper Mining Co. at Engelmine, Cal., will begin driving an 8,000-ft. adit to develop its upper mine, known as the Engels mine, at greater depth. Preliminary diamond-drill exploration has indicated the downward extension of the orebodies and the adit will enable the development of these orebodies to be carried out. When the adit is completed it will also simplify the handling of ore from the upper mine.

Keswick—The Mountain Copper Co., Ltd., will construct a wire-rope tramway from its Hornet mine in Shasta County to a point one mile south of Motion, a station on the Southern Pacific railroad. The distance is approximately 2½ miles and the vertical altitude drop 1,400 ft.

Winthrop—The Shasta Zinc & Copper Co. is proceeding with the construction of its zinc oxide and copper smelting plant at Winthrop. It will be ready for operation in a few months.

Amador City—Discovery of a narrow, high-grade orebody on the 2,600 level of the Bunker Hill mine has been announced. The Fremont Consolidated is completing the rehabilitation of underground workings.

The new wage scales of most of the Mother Lode mines approximate $4 per day for miners and machine men; $4 to $4.25 for millmen; and $3 to $3.50 for surface men. The reduction became effective May 1.

Volcano—Hydraulicking on the Mary Ives Crocker estate by O. A. Stewart is reported to have given a satisfactory cleanup, and operations on a more extensive scale will be undertaken in the near future. Ludeken Brothers are hydraulicking near Volcano.

NEVADA

Tonopah Mining Co. Examining Orleans Mine at Hornsilver

Mina—In a recent statement to stockholders the Simon Silver-Lead Mines Co. states that the mill building is completed and machinery is now being installed. The plant will be entirely completed by the time electric power is available. Active work was resumed in the mine May 1. Further development will be done on the lower levels.

Tonopah — Strike conditions in both the Tonopah and Divide districts remain unchanged, most of the companies not operating. West End tonnage for the week was 1,600. It is reported that the general offices of the Tonopah Belmont company are to be removed to Tonopah from San Francisco, the change to be made about May 15. The offices were moved to San Francisco in 1916, at which time work was being started on the Surf Inlet mine in British Columbia, the Shawmut in California, and the Belmont Wagner in Colorado. The Surf Inlet mine is now in full operation and the two latter are closed down awaiting better operating conditions.

Goldfield—The shaft of the Goldfield Deep Mines Co. has reached a depth of about 500 ft. and the larger hoist is to be installed before the end of May. No special developments are expected before a depth of 1,000 ft. is attained, when the C.O.D., Gold Bar, and Victor veins should be cut. These veins were productive of high-grade ore near the surface. Lessees in the Florence are said to be doing very well. High-grade ore has been opened up at several points, and although the width of ore is narrow there is always the possibility of widening and making into one of those bonanza orebodies for which the Goldfield district has always been famous.

Hornsilver — Engineers of the Tonopah Mining Co. are making an examination of the Orleans mine. The present lessee, J. W. Dunfee, who recently opened a promising orebody on the 600 level, has temporarily stopped work.

Virginia City—The United Comstock is making good progress in its main haulage tunnel and on other preparatory work. The tunnel has been driven about 3,400 ft. and is over one-third completed. Branch tunnels, to connect the various shafts with the main haulage, will soon be started from the Knickerbocker, Jacket, Imperial and Jacket Belcher.

Spanish Belt—The Cons. Spanish Belt Silver Mining Co., operating the old Barcelona mine, fifty miles north of Tonopah, is rapidly getting ready for production. It is engaged in completing the erection of a mill under direction of Lou Townsend. This plant consists of ten 1,050-lb. Union Iron Works' stamps, four tables, and an oil flotation unit of a capacity of about fifty tons in twenty-four hours. The heads are expected to run around $30 per ton and the ratio of concentration to be about 20 or 30 to 1. Tests show that about 60 per cent of the values can be saved by wet concentration and the remainder by flotation.

The mill is expected to be completed about June 1, when the mine will be electrified. The company has recently obtained a permit from the Federal Power Commission allowing it to connect with the Nevada-California Power Co. The five-mile high-tension power line is now completed and telephone connection has been made with Manhattan and Tonopah.

The company operates a fleet of four-wheeled drive trucks which will handle the concentrates and supplies between Tonopah and Spanish Belt. E. J. Schrader is superintendent.

Pioche—The development shaft being sunk by the Prince Consolidated entered ore at 662 ft., passing out of it at 690 ft. This bed was known to exist, and the assays checked closely the results obtained from the diamond drill cores, averaging 1.2 oz. silver and 0.7 per cent lead.

A lease has been given to John Mitchell, J. H. English, and associates on the Bristol slag dumps, at Bristol Wells, about four miles south of Silverhorn. The dumps are being sampled, and selected material will be shipped as fast as the dump can be trenched. A favorable treatment rate has been obtained from the smelter.

John F. Roeder has granted a lease on the Gypsy mine, at Stampede Gap, in the Highland mining district, to J. F. Hall, John Smith, and C. Smith.

A substantial reduction has been granted Pioche shippers on ores of higher grades. This reduction will become effective May 20. The arrangement will expire on Nov. 15, 1921, unless an extension is granted, which seems probable. The reductions are shown as follows:

Valuation	Present Rate	Rate Effective May 20
$10 to $15	$4.25	$3.75
15 to 20	5.50	4.50
20 to 25	7 00	5.50
25 to 30	7.00	6.00

Tule Canyon — The Silver Hills Mining Co. is completing its cyanide plant and expects soon to be able to make a trial run. Recent reports from the property are optimistic, work being done on some small high-grade shoots on the 100 and 200 levels.

ARIZONA

Verde Central Thought To Have Discovered Important Orebody

Jerome—Verde Central is reported locally to have penetrated the edge of an important body of copper ore. The drift is being extended into kaolinized schist and talc that samples above 8 per cent copper in native form, chalcopyrite, and covellite. A width of at least 12 ft. has been demonstrated. The material is soft and crumbling and is believed the capping for a great chalcocite ore chamber. The find was unexpected. It was made in a drift that had been started toward the southeast, at 320 ft. depth, along a slip, from a shaft that had been sunk 200 ft. below the level of the main working tunnel. This tunnel had been extended 1,000 ft. without material results, save in determining the advisability of deeper exploration. Below, quartz had been cut, but little was expected for about 500 ft. more. Recently the drift deviated from the hanging wall to secure better drifting ground, and the next round broke into the orebody.

Verde Central is the old Verde King property of twenty-eight claims, lying on both sides of Hull Canyon, half a mile from the city boundary, adjoining on the south the Cleopatra and Hull and other property of the United Verde Copper Co., with the Verde Apex on the east and the Boston-Jerome on the west.

United Verde Extension suspended smelter operation May 1, putting the operating force at work relining the reverberatory and on improvement. At the mine [illegible] men have been retained on construction and maintenance work.

United Verde on May 1 reduced wages of all employees who have received above $4.50 a day by 60c., and that of others by 40c.

Dundee-Arizona is exploring on the 500 level, intending to crosscut north and south to the boundaries. In the surface carbonate orebody 2,730 ft. of work has been done, with development of about 70,000 tons of ore averaging above 4 per cent copper. Leaching tests have been made by Joseph Irving, of Bisbee, who recommends installing a test leaching plant. This ore was being studied at the Humboldt plant of the Consolidated Arizona Smelting Co. before that company's shutdown.

Globe—In the Inspiration annual report note is made of a subscription of $60,000 to the stock of the Apache Powder Co., which, under the management of C. E. Mills, is building a dynamite factory near Benson, Ariz.

F. W. Maclennan, general manager of the Miami Copper Co., has announced a reduction of 65c. a shift for underground and 40c. for surface labor. About 1,200 men are still employed by the company, which continues to operate its mine and concentrator. Old Dominion also has posted a lower wage scale, bringing miners down to $4.50 a shift.

Mayer—Interests connected with the Farmers' Savings Bank of Bernard, Iowa, are reported about to resume production from the Buckeye O'Neill onyx quarries, adjoining the Mayer townsite. The material is of notably beautiful marking and clear texture, but its sale has been handicapped by high freight costs. Black onyx has been found on the Mogollon plateau, southeast of Flagstaff, by W. W. Durham and John Marshall.

All buildings except the engine house around the shaft of the Blue Bell mine of the Consolidated Arizona Smelting Co. have been burned. Within the past six months three fires have occurred, all believed to have been of incendiary origin.

Winslow—The Colorado Fuel & Iron Co., of Pueblo, represented by L. B. Weed, is reported to be financing development of a hematite iron body, on the Apache reservation, sixty miles south of Winslow.

Wickenburg—Eight miles southeast of this point a vanadium deposit is being developed on which a 100-ton mill has been erected by the Consolidated Vanadium Co., which now has ready a refining plant in Los Angeles.

UTAH

Silver King Consolidated To Consider Advisability of Venturing in Oil

Eureka—At the Gemini a strike of importance is reported to have been made by a lessee. Underground operations were slowed up recently for a day or two to permit of the installation of a new cable.

Stockholders of the Eureka Lilly met May [illegible] to consider the establishment of vertical sideline agreements with its neighbors, the Tintic Standard and the Provo. Action will also be taken in regard to partitioning claims held in common with the Tintic Standard.

Park City—The annual stockholders' meeting of the Silver King Coalition will be held May 16. At this time the question of undertaking oil operations will be considered. A dividend of 15c. a share was paid May 1. This amounted to $187,500.

MONTANA

Anaconda Reopens Nettie and Anselmo Mines for Silver-Zinc Ore—W. H. Jahn Elected Tuolumne's President

Butte—Anaconda resumed the mining of silver-zinc ore on May 5 on a limited scale, reopening the Nettie and Anselmo mines and taking silver-zinc-lead ore from the Hibernia property of the Davis-Daly company and silver ore from the Tuolumne company. Employment will be afforded to about 500 men. A portion of the Washoe Reduction Works will be started with ore milled there and smelted at Great Falls. Anaconda will have a zinc output of 2,000,000 lb. monthly derived from the treatment of silver ore.

William H. Jahn, of Milwaukee, has been elected president of the Tuolumne Copper Mining Co., succeeding Edward Hickey, deceased. Mr. Jahn was formerly president of the Pilot-Butte and is president of a patent leather and glove company in Milwaukee.

Neihart — The concentrator of the Cascade Silver was destroyed by fire last week, entailing a loss of approximately $150,000, a portion of this amount being covered by insurance. The future plans of the company have not been announced.

IDAHO

Armstead Mine To Have Mill This Year —May Treat Custom Ores

Talache — Definite assurance has been given that the concentrator planned for the Armstead mine will be built this year. It is indicated that the plant may be planned for handling of custom ore as well as the Armstead mine output.

Bonner's Ferry — Sluicing on the property of Idaho Gold & Ruby Co., at Leonia, is well under way, with three giants in operation. The final unit of construction, the concentrator, for treatment of material gathered from sluicing through the bed-rock flume, will be completed this summer.

Hailey—The Bunker Hill Mining & Concentrating Co. will proceed with extensive operations on the Mayflower-Bullion mine, seven miles from Hailey, and it is understood that equipment will be on the ground soon.

WASHINGTON

Four Metals Co. To Build New Mill at Oroville

Keller—Power plants are to be installed at the Jannot and Bonanza mines, in the Meadow Creek section, this spring. Equipment is arriving, but some road construction and camp building will have to be undertaken before things are in condition for operations. It is hoped to have everything ready for active underground development by fall.

Seattle—The directors of the Pioneer Mining & Ditch Co., owning valuable Alaskan placer properties, were prevented from considering the resignation of R. H. Cross, an attorney, from the board, through an injunction action in which Cross said the resignation was forced by threats against his life by Jafet Lindeberg. For years Mr. Lindeberg has been prominently identified with mining activity in Alaska. The action arose from the alleged objectionable activities of Lindeberg and W. H. Metson, an attorney, in which Lindeberg obtained the position of manager of the company's properties, and Metson was named attorney. Metson states that the difficult arose out of differences between the company and E. O. Lindblom, Alaska and San Francisco capitalist. Cross is Lindblom's attorney.

Oroville — Directors of the Four Metals Co. have decided to replace the present mill, built in 1919, with a complete modern concentrator, to be designed and built by G. A. King, designer of the Ruby mill, near Nighthawk. The old mill was not adapted to handling the mine output, and therefore represents so much loss to the company.

Spokane—At the annual meeting on May 3 of shareholders of the Standard Silver-Lead Mining Co., operating the Standard mine, at Silverton, Slocan district, British Columbia, the old directorate and officers were re-elected. The financial report showed the company to be in strong position, with a cash surplus in excess of $360,000.

MICHIGAN

Marquette Range

Oliver Company's Section 16 Mine First To Ship From Range

Ishpeming—The Oliver company is moving ore from its Section 16 mine, being the first shipper on the range this season. Ore hoisted is loaded direct, and one shovel is at work on the stockpile.

Palmer—The Steel & Tube Co. has stopped mining at the Isabella mine. The Twenty mine will continue underground exploratory and development work.

Menominee Range

Todd - Stambaugh's Zimmerman Mine Suspends

Iron River—The Zimmerman mine, operated by Todd-Stambaugh, has suspended. Pumping is being continued. One of the Davidson shafts has been closed and operation curtailed. All mines of the Verona Mining Co. are down except the Baltic and Fogarty, which are working small crews half time. The Wickwire company is working the Homer, Delta and Cardiff. The Homer is the only large producer of the three, the others being in the development stage.

Florence—The Florence and Ernst mines are operating with reduced forces on a five-day schedule. Wages have been lowered 10 per cent. These are the only two operating mines on the Wisconsin side of the range.

MINNESOTA

Mesabi Range

Boeing Mine Shuts Down—Mississippi Pumps Pulled

Ely—Ore is being shipped from shaft and stockpile at the Zenith mine, operated by the Vermillion Mining Co. Shipments from the Oliver properties have already gone to the docks.

Biwabik—The Belgrade mine, of the Pickands Mather company, has shipped its first ore of the season from stockpile. Cars are also being loaded at the shaft.

Keewatin—The pumps in the Mississippi are to be pulled by the Pickands Mather company. This property has been closed for some time.

Hibbing—The Oliver Iron Mining Co. began loading iron ore for shipment at its various properties on May 5. Ten mines on the Mesabi have begun shipments, namely, the Hull-Rust, Sweeney, Burt-Sellers, Morris, Philbin, Clark, Chisholm, Chester, Wellington and part of the Missabi Mountain pit at Virginia.

The wage cut announced last week by the Steel Corporation affects many on the Mesabi. Some companies also that reduced wages for day labor several months ago cut salaries 10 per cent May 1.

The Boeing mine, of the Mesaba-Cliffs company, was closed April 30 owing to lack of demand for bessemer ore. Stripping will continue.

ALABAMA

Gulf States' Shannon Mine Producing 400 Tons Daily

Birmingham—The Shannon mine, the first of the deep ore mining projects in Alabama and the property of the Gulf States Steel Co., is producing 400 tons of ore daily. The workings are down over 2,700 ft. Charles A. Moffett, recently elected president of the company, asserts that its ore reserves are, in the Shannon mine alone, sufficient for many years, even if the consumption of the Gulf States should be doubled or increased fourfold. The blast furnace of the company resumed operations May 8.

Independent ore mining properties in Alabama are idle, with pig-iron production at a minimum. Only eight blast furnaces are in operation in Alabama, three independent companies' furnaces on foundry iron and the Tennessee Coal, Iron & Railroad Co., (Steel Corporation) with five at Ensley on basic iron. The Gulf States company was making basic iron the past week, increasing the total number of furnaces running in the state to nine.

The fact that no mention has been made lately of the project of building a gravity aërial railway from the mines on Red Mountain to the blast furnaces of the Tennessee Coal, Iron & Railroad Co. at Ensley, a distance of about eight or ten miles, does not mean that the proposition has been abandoned.

CHRONOLOGY OF MINING

April, 1921

April 1—Anaconda, Calumet & Hecla, Phelps Dodge Corporation's Burro Mountain Branch, and a number of other copper companies closed down. Wage cuts were put into effect in many camps—A law requiring prompt settlements with mining lessees by lessors went into effect in Montana.

April 2—Mineral Separation North American Corporation's argument for admission as party plaintiff against Miami Copper Co. was heard at Wilmington, Del.

April 3—Colorado School of Mines administration vindicated by report of the State Assembly's committee.

April 4—U. S. Assay office completed occupation of new building at 25 Wall St., New York.

April 5—International Mining Convention held third annual session at Portland, Ore.

April 6—American Smelting & Refining Co. stockholders at annual meeting re-elected the Guggenheim board of directors.

April 11—Iron-ore shipping season on Great Lakes opened at Duluth, Minn. Minnesota occupational tax bill signed, laying 6 per cent tax on ores mined in state.—Silver King Coalition Mines Co., Park City, Utah, awarded extra-lateral rights in Conkling claim, by U. S. Supreme Court.

April 12—Utah Copper Co.'s concentrator at Garfield, Utah, closed down.—Newly elected directors of A. S. & R. Co. met, and adopted the Guggenheim slate.

April 15—New York & Honduras Rosario Mining Co. suspended operations temporarily.—Gold mining companies on Mother Lode, California, announced a 50c. wage cut.—International Nickel Co. cut wages 15 per cent.—American Association of Engineers held second annual southwestern convention at Phoenix, Ariz.—Apache Indian Reservation, Globe, Ariz., opened to location for asbestos.

April 16—Herbert Hoover resigned as chairman of American Engineering Council.—H. Foster Bain renominated as Director of U. S. Bureau of Mines. —Miners and mill men strike at Tonopah and Divide, Nev., following 75c. wage cut.

April 20—Bonner County Mining Association held first annual meeting at Sandpoint, Idaho.

April 21 — Methane explosion in Cyclops Tunnel, Blackhawk, Col., injured two.

April 22 — Eagle-Picher Lead Co. closed mines.

April 28—Senator Pittman (Nev.) addressed the Mining and Metallurgical Society of America on future of the Pittman Act.

April 29—Western Pacific R.R. put into effect new freight rates from Utah and Nevada points to Oakland, Cal.

April 30—Granby Consolidated M. S. & P. Co. closed Grand Forks, B. C., plant.

THE MARKET REPORT

Daily Prices of Metals

May	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
5	12.375	31.75	33.00	4.85@5.00	4.70@4.75	4.95
6	12.35@12.50	32.00	33.00	4.90@5.00	4.75	4.95
7	12.35@12.50	31.75	33.00	4.90@5.00	4.75	4.95@4.90
9	12.50	31.50	32.50	5.00	4.75@4.85	4.90
10	12.50	31.25	32.25	5.00@5.20	4.85@5.00	4.90
11	12.50@12.75	31.75	33.00	5.00@5.20	4.90@5.00	4.90

*These prices correspond to the following quotations for copper, "delivered": 12.625; 12.60@12.75; 12.60@12.75; 12.75; 12.75; and 12.75@13c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

May	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
5	72½	70½	72¼	176	178½	22½	22½	26	27¼
6	72½	71	72½	177½	179¾	22¼	22⅝	26	27¼
7	...	...	...	....	...	...	...	...	...
9	72¼	71¼	73	176	178	24	24	26	27¼
10	72	71	73	173½	175¾	24	24	26	27¼
11	72	71¼	73½	178½	180¼	24¾	24	26¼	27¼

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

May	Sterling Exchange	Silver			May	Sterling Exchange	Silver		
		New York, Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York, Foreign Origin	London
5	397	99¼	61⅞	35¼	9	397⅞	99¼	61⅛	35⅛
6	396⅞	99¼	60¾	[illegible]	10	398½	99¼	61⅜	35
7	[illegible]	99¼	62½	[illegible]	11	398⅜	99¼	60½	34½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, May 11, 1921

Copper and lead are much firmer this week, tin is virtually unchanged, and zinc, as a result of an almost total cessation of demand, is weaker. The domestic market is still governed by European conditions to a large extent, foreign demand for copper strengthening the price here, and the local price of lead being advanced because of the fact that no importations threaten at current New York and London levels. The acceptance by Germany of the Allied demands is considered to be most encouraging and is likely to have a buoyant effect on metal prices as well as foreign exchange.

Copper

The feeling among copper producers is much better, although domestic demand is still small. Foreign business during the week was excellent, in volume if not in price, and was sufficient to absorb all of the metal which otherwise would have exerted a pressure on the domestic market. The Copper Export Association is understood to have done most of its business with France and Germany at 13c delivered, equivalent to about 12.50@12.625c. f.o.b. refinery. Outside interests sold a good tonnage to British metal dealers at slightly lower prices. Most producers are now holding their copper firmly at 13c for May and June, and 13.25c for third quarter business, although several are not willing to book any forward business even at this figure.

One underlying element in the copper situation that is continually gaining strength, and which has kept followers of the market optimistic, is the effect of curtailment of production. Although a complete cessation of output, even by those companies which have announced a shutdown, has not yet been accomplished, comparative estimates indicate that mine production of copper in the United States, Alaska, and in American properties in South America, for twenty-two representative companies, will soon be at the rate of but little more than 21 per cent of the 1920 production. That is, whereas these important copper producers turned out 1,276,000,000 lb. of copper in 1920, their annual rate by the end of this month will amount to only 273,000,000 lb. In the meantime the demand has every prospect of increasing.

Lead

The A. S. & R. Co. advanced its official contract price of lead from 4.75 to 5c., New York and St. Louis, on Tuesday, May 10.

The total volume of lead sold during the last week has not been quite as great as in several recent weeks, but, nevertheless, the inquiries, aided by a sold-up condition on the part of most producers and a stiff week-end advance in London, caused the 5c. level to be reached and passed in the New York market. A feature of the business has been the insistent demand, from large consumers, for lead for immediate shipment, indicating that they have practically no stocks on hand. Electric and cable interests have possibly been the most active factors in the market.

One large producer selling in St. Louis who has not been in the market for six months or so, and has been quietly accumulating stocks for higher prices, is now freely offering at 5c. This should stabilize the St. Louis price at that figure, although it would not prevent the New York price from going to 5.50c., as the freight is approximately one-half cent between the two cities. Chemical lead in the West is now practically on a par with other kinds, although a premium, due to the freight, is asked in the East.

Zinc

The market is softer, and zinc is freely offered at 4.90c., East St. Louis. Trading has been quiet and in small volume, some of the largest producers recording but few sales. Demand for the metal has seemingly evaporated, but, at the same time, many producers are unwilling to sell at the 4.90c. price. Unlike other metals, zinc seems unable to retain the gains of the last few weeks, possibly because of the weaker financial position of some operators. No interest is reported in forward deliveries.

Tin

Tin was stronger on Thursday and Friday, weaker on Monday, and firmer again today. One sale of 99 per cent was made yesterday at 30.50c., but the seller is believed to have been misinformed regarding conditions, as this price was considerably below the market. Electrolytic has been in fair demand at ⅛@¼c. less than Straits. We quote tin for forward delivery at ¼c. less than the price for spot Straits for the week.

Arrivals of tin, in long tons: May 7th, Straits, 50; 9th, Liverpool, 25.

Gold

Gold in London: May 5th, 103s. 4d.; 6th, 103s. 4d.; 9th, 103s. 3d.; 10th, 103s. 2d.; 11th, 102s. 11d.

Foreign Exchange

Foreign exchange has generally shown a stronger tendency during the last week. On Tuesday, May 10th, francs were 8.38c.; lire, 5.175c.; and marks, 1.56c. New York funds in Montreal, 10$\frac{13}{16}$ per cent premium.

Silver

The silver market of late has been erratic, jumping to 35½d. in London on May 7, on speculative buying, but reacting on selling by Indian bazaars. The market is narrow, and owing to limited supplies moves sharply up or down on buying or selling orders. Renewal of Continental sales of coin silver has caused the market to close weaker in London at 34½d. The New York market has followed the London price, owing to lack of China buying, and closes dull with tendency uncertain.

Mexican Dollars—May 5th, 47½; 6th, 46⅝; 7th, 48; 9th, 47¼; 10th, 47; 11th, 46½.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 22@23c. per lb.; 22½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 5¼@5⅜c.; market dull. W.C.C. brand, 5¾@6¼c. per lb. Cookson's "C" grade, spot, 9⅜c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.60 per lb., 500-lb. lots.

Cadmium—Nominal, $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $4 per lb.; black oxide, $3@$3.10 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $250@$300 per oz.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 38@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—$72@$75 per oz.

Quicksilver—Nominally, $46@$48 per 75-lb. flask. San Francisco wires $48.50.

[1]**Rhodium**—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 45@55c. per long ton unit, f.o.b. Atlantic ports.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $7.45; Mesabi bessemer, 55 per cent iron, $7.20; Old Range non-bessemer, 51½ per cent iron, $6.70; Mesabi non-bessemer, 51½ per cent iron, $6.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5.80; old bed concentrates, 63 per cent, $6.70; Harmony, cobbed, 63 per cent, $6.70; new bed low phosphorus, 65 per cent, $9.50.

Manganese Ore—25@30c. per unit, seaport; chemical ore (MnO_2) $55@$60 per gross ton, lump; $70@$75 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¾@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3 $3@$3.75, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., May 7—Zinc blende, per ton, high, $26.70; basis 60 per cent zinc, premium, $26.50; Prime Western, $26@$25; fines and slimes, $23@$21; average settling price, all zinc ores, $23.62.

Lead, high, $56.10; basis 80 per cent lead, $57.50; average settling price, all lead ores, $53.46 per ton.

Shipments for the week: Blende, 5.337; lead, 1,535 tons. Value, all ores the week, $209,780. Some sellers are asking $27.50 basis Prime Western and are holding their ore. With this tonnage reserved from the market, buyers are getting only around 4,000 tons per week, with a demand for 4.500 to 5,000 tons. With the reserve of slab zinc diminishing, sellers are expecting the metal market to advance soon, with a favorable reaction on ore. Three blocks were closed down at one Henryetta, Okla., smelter last week, and this will reduce the supply of slab zinc.

Platteville, Wis., May 7—Ore price, $27.50 for 60 per cent zinc, and $52 for 80 per cent lead ore, but operators refused to sell. Shipments for week: Blende, 41; lead ore, 109 tons. Shipments for the year: Blende, 11,461; lead ore, 659 tons. Shipped during the week to separating plants, 715 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $2,000@$3,000; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7 per long ton, f.o.b. Cartersville, Ga. Small lots as low as $5.

Bauxite—High-grade French bauxite, $8@$10 per ton, Atlantic ports. American quotations the same. Consumers generally well supplied. Prices vary according to grade. Crude, unground, $16.50 per ton; ground, $22; calcined, ground $35; unground, $45, f.o.b. plant.

Chalk—English, extra light, 5@5½c. Domestic light, 4½@5c.; heavy, 4@4½c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$10; washed, $10@$12; powdered, $15@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $15@$20, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $15@$25, f.o.b. American ports; powdered, $35@$45, f.o.b. New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c. f.o.b. New England points.

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[1] Furnished by Foote Mineral Co., Philadelphia Pa

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$25 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $15, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $32, New Mexico, Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines. Market is improving in western ground acid grades for glass and enamel manufacture.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 7½@8c. per lb.; chip, 6@6½c.; dust, 4@4½c. No. 1 flake, 7c.; amorphous crude, ¾c.@2¼c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$2 per net ton; 1½ in., $1.50@$2. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined—Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead - Burned — $38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$100 per ton (depending upon quantity); ground roofing mica, $2[illegible]@$70, all f.o.b. New York.

Monazite — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports, 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $7.35; 68 per cent, $6.85; 68@66 per cent, $6.60.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 14c., c.i.f. Atlantic seaport; furnace size, 14c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 12 @ 14c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$40, talcum powder grade. Southern talc, powdered, carload lots, $10@$14 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 7¾@8c. per lb. in carload lots.

Sodium Nitrate—$2.75@$3 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; $33@$35 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.75@$1.80 per unit, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 15c. per lb. of chromium contained; 4 to 6 per cent carbon, 16@17c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $83@$85, f.o.b. furnace; resale, $90, delivered; English, $83@$85, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $32, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $50@$55; 50 per cent, $80@$85; 75 per cent, $145@$150.

Ferrotungsten—Domestic, 70 to 80 per cent W, 50@55c. per lb. of contained tungsten, f.o.b. works. Foreign, 60c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$5@$6 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 20½@20¾c. per lb.; wire, 15c.

Lead Sheets—Full lead sheets, 7¾c.; cut lead sheets, 8c. in quantity, mill lots.

Nickel Silver — 33½c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets 18¼c.; sheathing, 17¼c.; rods, ⅝ to 3 in., 15¼c.

Zinc Sheets—$11 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $35@$50 per ton, f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $75 per net ton, shipping point; arches, keys, wedges, $80; splits, soaps, $90.

Fire Brick—First quality, 9-in. shapes, $40@$50 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $40@$50.

Magnesite Brick—9-in. straights, $90@$95 per net ton; 9-in. arches, wedges and keys, $100; soaps and splits, $110.

Silica Brick—9-in., per 1,000: $45@$55 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, May 10, 1921

From the partial report of steel ingot production in April made by the American Iron and Steel Institute, interpreted with the aid of certain trade estimates, it is seen that production of steel in April was at 30 or 31 per cent of capacity, the Steel Corporation probably producing at 40 or 41 per cent and the independents at 22 or 23 per cent. Thus far this month the industry's rate has been approximately the same, but the difference between the Steel Corporation and independent rates has narrowed somewhat. No material change from the general rate is to be expected until there is a decided change in fundamental business conditions.

Pig Iron—The $23, Valley, quotation on basic iron has been nominal for several weeks, and the trade regards the market now as $22.50, there having been a few sales at that figure, and $22 is rumored as obtaining in one sale. Bessemer is nominal at $25, Valley, and last week's reduced price of $24 on foundry could possibly be shaded.

Steel—There are scarcely any sales of semi-finished steel, but prices are maintained at $37 for billets, $38 for slabs, $39 for sheet bars and small billets, and $48 for rods.

Coke

Connellsville—Furnace, $3.25@$3.75; foundry, $4.50@$5.

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*Foote Mineral Co., Philadelphia, Pa.

The Principal American Copper-Mining Companies And What Becomes of Their Copper

BY EDWARD H. ROBIE

COPPER commonly passes through four distinct processes before it reaches the manufacturer. First the ore must be mined, then concentrated, then smelted, and lastly the crude copper must be refined, not only to secure the highest efficiency for electrical and other uses, but to remove the precious metals therein contained. As the metal progresses along this scale, the business becomes more and more centralized. There are thousands of mines in the country—if we are not particular what we call a mine—hundreds of mills, and scores of smelters, but the refineries can be counted on the fingers and toes if one counts that way. Selling, too, is in the hands of relatively few agencies, almost entirely situated in New York City. There has been no secrecy about the various channels through which American copper passes, but no reference chart has ever been prepared, so far I know, to give this information in a handy form. As questions regarding the disposal of a certain company's product often come up, the data presented on the reverse side of this page should be valuable.

Under "Name" is given the name of the company which owns the mine or mines, and it was the intention to include all of the more important producers of the Western Hemisphere. In general, companies producing less than a million pounds per year were not considered of sufficient importance to list. Doubtless some companies whose production normally exceeds this figure have been omitted, however, as information concerning many Mexican and South American companies is scanty. Compilation of the list has been aided by reference to Weed's "The Mines Handbook." The name generally given is that of the controlling interest rather than that of the subsidiary operating company.

The second column is intended to give the approximate production in millions of pounds for 1920, or, if the property did not operate throughout the year, for the last full year of operation. The production figure represents only the copper produced from the company's own mines, and does not include custom business or copper produced by subsidiary companies which is otherwise reported. The figure is intended to represent the amount of refined copper finally recovered. This and the information given in succeeding columns was in most cases courteously supplied by the individual companies.

The third column, "Mills," usually implies a concentrator, although in some operations, notably those of Chile, New Cornelia, and Kennecott, the ore is wholly or in part leached, thereby eliminating concentrating and smelting. Further particulars as to smelting and refining equipment may be found in the *Engineering and Mining Journal* for Jan. 17, 1920, p. 117.

Selling agencies occasionally change, but, so far as is known, the chart shows the arrangement now in effect, or which was in effect when the property in question closed down, if it be now closed. In addition to the names given, the Copper Export Association, New York, sells the copper of many producers to foreign buyers. A list of such producers is given on pp. 84 to 87, inclusive, of "The Mines Handbook" for 1920. In a few instances there is no regular selling agency, but matte or concentrates are sold in the market to the highest bidder.

By far the largest tonnage of copper is marketed by Guggenheim Bros., representing the Hayden-Stone-Jackling interests, this agency being the outlet of about 500,000,000 lb. annually at last year's rate of production. This is largely from the so-called porphyries, and from Chile, the largest producer of them all. Until 1920 all of this copper was sold through the American Smelting & Refining Co. Second comes the United Metals Selling Co., representing the Rockefeller-Ryan-Anaconda group, with about 350,000,000 lb., chiefly from Montana. Third, the Phelps Dodge Corporation, whose properties are in the Southwest, with about 200,000,000 lb. Fourth, the American Metal Co., which owns no copper mines of importance, but which is an active selling interest, and is the outlet for about 150,000,000 lb. at the 1920 rate. Fifth is the Calumet & Hecla Co., the largest of the Michigan native copper producers, with about 100,000,000 lb. to market.

To indicate those properties now closed down has been found impossible in view of the wholesale curtailments and suspensions made in the last few months. Some of those companies which are known to have been closed down at the first of the year are indicated, but there are doubtless others. So far as known, no "dead" companies—those which do not expect to resume operations unless copper gets back to 35c.—are included.

Copper is not sold by brand to the extent that zinc, tin and lead are. This applies particularly to electrolytic copper, which varies little in purity. Furthermore, the product of any refinery is usually made from a mixture of blister from various sources which are constantly changing. Often the purest copper is used for casting wire bars because of the particularly deleterious effects of slight impurities on electrical conductivity. The following list, compiled from "Metal Statistics, 1921" shows the producer and brand of most of the copper marketed in this country.

BRANDS OF COPPER

Lake

Ahmeek	T.O.
Allouez	T.O.
Calumet & Hecla	C.L.; T.O.; C.&H.M.Co.
Lake Superior Smelting Co.	S.R.
Copper Range	C.R.
Franklin	F.M.Co.
La Salle	S.R.
Mass	Mass.
Michigan	M.C.
Mohawk	M.M.
Osceola	T.O.
Quincy	Q.M.Co.
Superior	S.R.
Victoria	V.C.
White Pine	S.R.
Winona	W.A.
Wolverine	W.

Electrolytic

American Smelting & Refining Co.	P.A.
American Smelters Securities Co.	Tacoma
Anaconda Copper Co.	B.M.
Arizona Copper Co.	A.C.C.
Balbach Smelting & Refining Co.	Bb.
Baltimore Copper S. & R. Co., (A.S. & R.Co.)	B.E.R.
Boston & Montana Co., (Anaconda)	B.&M.
Chile Copper Co.	C.C.C.
Denn Arizona Copper Co.	A.L.S.
East Butte Copper Mining Co.	Pittsmont
Granby Consolidated Mining & Smelting Co.	L.N.S.
Lake Superior Smelting Co.	T.O.
Miami Copper Co.	N.E.C.
Missouri Cobalt Co.	M.C.Co.
Nichols Copper Co.	Triangle: L.N.S.
Orford Copper Co. (International Nickel)	O.E.C.
Phelps Dodge Corporation	C. * Q.
Raritan Copper Works (Anaconda)	N.E.C.; A.B.S.
Shattuck Arizona Copper Co.	A.L.S.
U. S. Metals Refining Co.	D.R.W.
White Pine, Superior, La Salle	S.R.

Casting

Balbach Smelting & Refining Co.	N.B.C.
Baltimore Copper S. & R. Co.	B.C.W.
Boston & Montana Co. (Anaconda)	M.A.
Chicago Copper Refining Co.	C.C.R.
Duquesne Reduction Co.	D.R.C.
Nichols Copper Co.	C.N.C.
Phelps Dodge Corporation	P.D.Co.
Tottenville Copper Co.	C.T.C.
U. S. Metals Refining Co.	D.S.
White & Bros., Inc.	C.C.

In some cases the copper is secondary metal, and the producer is therefore not given in the chart on the next page (p. 848).

Principal American Copper-Mining Companies and What Becomes of Their Copper

[illegible]	[illegible]	Smelter	Refinery	Selling Agency
[illegible]	[illegible]	Afterthought, Ingot, Cal.	American Smelting & Refining Co., Tacoma, Wash.	American Smelting & Refining Co., New York
[illegible]	[illegible]	Calumet & Hecla, Hubbell, Mich.	Calumet & Hecla, Hubbell, Mich.	Calumet & Hecla Co., New York
[illegible]	[illegible]	Calumet & Hecla, Hubbell, Mich.	Calumet & Hecla, Hubbell, Mich.	Calumet & Hecla Co., New York
[illegible]	[illegible]	Various A. S. & R. in Mex., Tex., Utah, Ariz., Wash., Neb., N. J.	A. S. & R., Baltimore, Md., Tacoma, Wash., Maurer, N. J.	American Smelting & Refining Co., New York
[illegible]	[illegible]	Anaconda, Washoe, Anaconda, Mont.	Anaconda, Great Falls, Mont., Perth Amboy, N. J.	United Metals Selling Co., New York
[illegible]	[illegible]	Int. Smg. Co., Miami, Ariz. & Old Dominion Globe	Anaconda, Perth Amboy, N. J., Nichols Copper Co., Laurel Hill, N. Y.	Phelps Dodge Corporation, New York
[illegible]	[illegible]	Ariz. Cop., Clifton, Ariz.	Anaconda (Raritan Cop. Wks.), Perth Amboy, N. J.	United Metals Selling Co., New York
[illegible]	[illegible]	B. & T., Casapalca, Peru	U. S. Metals Ref. Co., Chrome, N. J.	American Metal Co., New York
[illegible]	[illegible]	Boleo, Santa Rosalia, Baja Cal., Mex.	American Smelting & Refining Co., Tacoma, Wash.	American Smelting & Refining Co., New York
[illegible]	[illegible]	Braden, Sewell, Chile	American Smelting & Refining Co., Baltimore, Md.	Guggenheim Bros., New York
[illegible]	[illegible]	B. A. N. Corp., Nickelton, Ont., Canada	B. A. N. Corp., Deschenes, Que., Canada	B. A. Nickel Corp., Ottawa, Canada
[illegible]	[illegible]	Calumet & Arizona, Douglas, Ariz.	Nichols Copper Co., Laurel Hill, N. Y.	Phelps Dodge Corporation, New York
[illegible]	[illegible]	Calumet & Hecla, Hubbell, Mich.	Calumet & Hecla, Hubbell, Mich.	Calumet & Hecla Co., New York
[illegible]	[illegible]	Consol. Mng. & Smg. Co., Trail, B. C., Canada	Con. M. & S. Co., Trail, B. C., Canada	Consolidated M. & S. Co., Montreal
[illegible]	[illegible]	Catemou, La Poza and Chagres, Chile	U. S. Metals Refining Co., Chrome, N. J.	American Metal Co., New York
[illegible]	[illegible]	Calumet & Hecla, Hubbell, Mich.	Calumet & Hecla, Hubbell, Mich.	Calumet & Hecla, New York
[illegible]	[illegible]	Central C. C. Co., Panucillo, Chile	Various	Matte sold to various buyers
[illegible]	[illegible]	Cerro de Pasco, La Fundicion, Peru	U. S. Metals Ref. Co., Chrome, N. J.	American Metal Co., New York
[illegible]	[illegible]	Michigan Smelting Co., Houghton, Mich.	Michigan Smelting Co., Houghton, Mich.	Copper Range Co., New York
[illegible]	[illegible]	None	Chile Copper Co., Chuquicamata, Chile	Guggenheim Bros., New York
[illegible]	[illegible]	American Smelting & Refining Co., El Paso, Tex.	American Smelting & Refining Co., Baltimore, Md.	Guggenheim Bros., New York
[illegible]	[illegible]	Consolidated Ariz., Humboldt, Ariz.	U. S. Metals Refining Co., Chrome, N. J.	American Metal Co., New York
[illegible]	[illegible]	Nevada Con., McGill, Nev.	Anaconda (Raritan Cop. Wks.), Perth Amboy, N. J.	United Metals Selling Co., New York
[illegible]	[illegible]	C. M. & S., Trail, B. C., Canada	Consol. M. & S. Co., Trail, B. C.	Consolidated M. & S. Co., Montreal
[illegible]	[illegible]	Michigan Smelting Co., Houghton, Mich.	Michigan Smelting Co., Houghton, Mich.	Copper Range Co., New York
[illegible]	[illegible]	A. S. & R. Tacoma, Wash. and at Liverpool, Eng.	Various	Corocoro U. C. M., Paris
[illegible]	[illegible]	East Butte, Butte, Mont.	Anaconda (Raritan Cop. Wks.), Perth Amboy, N. J.	W. P. Todd, New York
[illegible]	[illegible]	Democrata, Can., Cananea, Son., Mexico	U. S. Metals Ref. Co., Chrome, N. J.	American Metal Co., New York
[illegible]	[illegible]	Ducktown, Isabella, Tenn.	Nichols Copper Co., Laurel Hill, N. Y.	Nichols Copper Co., New York
[illegible]	[illegible]	East Butte, Butte, Mont.	Anaconda (Raritan Cop. Wks.), Perth Amboy, N. J.	W. P. Todd, New York
[illegible]	[illegible]	American Smelting & Refining Co., Garfield, Utah	A. S. & R. Co., Baltimore or Maurer, N. J.	American Smelting & Refining Co., New York
[illegible]	[illegible]	Michigan Smelting Co., Houghton, Mich.	Michigan Smelting Co., Houghton, Mich.	Franklin Mining Co., Boston
[illegible]	[illegible]	American Smelting & Refining Co., Hayden, Ariz.	A. S. & R. Co., Baltimore or Maurer, N. J.	American Smelting & Refining Co., New York
[illegible]	[illegible]	Granby, Anyox, B. C., Canada	Nichols Copper Co., Laurel Hill, N. Y.	American Metal Co., New York
[illegible]	[illegible]	Greene-Cananea, Cananea, Son., Mexico	Anaconda (Raritan Cop. Wks.), Perth Amboy, N. J.	United Metals Selling Co., New York
[illegible]	[illegible]	Calumet & Hecla, Hubbell, Mich.	Calumet & Hecla, Hubbell, Mich.	Calumet & Hecla Co., New York
[illegible]	[illegible]	American Smelting & Refining Co., Tacoma, Wash.	American Smelting & Refining Co., Tacoma, Wash.	American Smelting & Refining Co., New York
[illegible]	[illegible]	International Smelting Co., Miami, Ariz.	Anaconda (Raritan Cop. Wks.), Perth Amboy, N. J.	United Metals Selling Co., New York
[illegible]	[illegible]	International Nickel Co., Copper Cliff, Ont., Can.	U. S. Metals Ref. Co., Chrome, N. J.	American Metal Co., New York
[illegible]	[illegible]	International Smg. Co., Miami, Ariz.	Anaconda (Raritan Cop. Wks.), Perth Amboy, N. J.	United Metals Selling Co., New York
[illegible]	[illegible]	Calumet & Hecla, Hubbell, Mich.	Calumet & Hecla, Hubbell, Mich.	Calumet & Hecla, New York
[illegible]	[illegible]	Amer. Smg. & Ref. Co., Tacoma, Wash.	American Smelting & Refining Co., Tacoma, Wash.	Guggenheim Bros., New York
[illegible]	[illegible]	Amer. Smelting & Refining Co., Hayden, Ariz.	Amer. Smg. & Ref. Co., Baltimore or Maurer, N. J.	Magma Copper Co., New York
[illegible]	[illegible]	Mason Valley, Thompson, Nev.	Amer. Smg. & Ref. Co., Baltimore or Maurer, N. J.	Mason Valley Mines Co., New York
[illegible]	[illegible]	Quincy, Hancock, Mich.	Quincy Smelting Wks., Hancock, Mich.	Mass. Consol. Mining Co., Boston
[illegible]	[illegible]	U. S. Metals Refining Co., Chrome, N. J.	U. S. Metals Refining Co., Chrome, N. J.	American Metal Co., New York
[illegible]	[illegible]	Mazapil, Concepcion del Oro, Coa., Mexico	Amer. Smg. & Ref. Co., Baltimore, Md.	Amer. Smelting & Refining Co., New York
[illegible]	[illegible]	Metalurgica Mexicana, San Luis Potosi, Mexico	U. S. Metals Refining Co., Chrome, N. J.	American Metal Co., New York
[illegible]	[illegible]	International Smelting Co., Miami, Ariz.	Anaconda (Raritan Cop. Wks.), Perth Amboy, N. J.	Adolph Lewisohn & Sons, New York
[illegible]	[illegible]	Michigan Smelting Co., Houghton, Mich.	Michigan Smelting Co., Houghton, Mich.	Mohawk Mining Co., New York
[illegible]	[illegible]	Mond, Coniston, Ont., Canada	Mond, Clydach, Wales	Mond Nickel Co., London
[illegible]	[illegible]	Mountain Copper, Martinez, Cal.	A. S. & R. Co., Baltimore, Md.	Jardine, Matheson & Co., New York
[illegible]	[illegible]	Soc. d. Mines d. C., Naltagua, Chile	A. S. & R. Co., in U. S. or in France	Soc. d. Mines d. Naltagua, Paris
[illegible]	[illegible]	Nevada Con., McGill, Nev.	Am. Sm. & Ref. Co., Baltimore or Maurer, N. J.	Guggenheim Bros., New York
[illegible]	[illegible]	10 per cent Calumet & Ariz., Douglas, Ariz.	New Cornelia, Ajo, Ariz.	United Metals Selling Co., New York
[illegible]	[illegible]	Anaconda (Washoe), Anaconda, Mont.	Anaconda (Raritan Cop. Wks.), Perth Amboy, N. J.	United Metals Selling Co., New York
[illegible]	[illegible]	American Smelting & Refining Co., Garfield, Utah	Am. Sm. & Ref. Co., Baltimore or Maurer, N. J.	American Smelting & Refining Co., New York
[illegible]	[illegible]	O. D., Globe, and International, Miami, Ariz.	Nichols Copper Co., Laurel Hill, N. Y. & Raritan, Perth Amboy, N. J.	Phelps Dodge Corporation, New York
[illegible]	[illegible]	Calumet & Hecla, Hubbell, Mich.	Calumet & Hecla, Hubbell, Mich.	Calumet & Hecla, New York.
[illegible]	[illegible]	Penn, Campo Seco, Cal.	U. S. Metals Refining Co., Chrome, N. J.	American Metal Co., New York
[illegible]	[illegible]	Phelps Dodge "Copper Queen," Douglas, Ariz.	Nichols Copper Co., Laurel Hill, N. Y.	Phelps Dodge Corporation, New York
[illegible]	[illegible]	Various in Chile, U. S. or Great Britain	Various	Company Sells Ore and Concentrates
[illegible]	[illegible]	Quincy, Hancock, Mich.	Quincy, Hancock, Mich.	Quincy Mining Co., New York
[illegible]	[illegible]	American Smelting & Ref. Co., Hayden, Ariz.	Amer. Smg. & Ref. Co., Maurer, N. J.	Guggenheim Bros., New York
[illegible]	[illegible]	American Smelting & Refining Co., Hayden, Ariz.	Amer. Smg. & Ref. Co., Maurer, N. J.	E. P. Earle, New York
[illegible]	[illegible]	Calumet & Arizona, Douglas, Ariz.	Nichols Copper Co., Laurel Hill, N. Y.	Shattuck Arizona Cop. Co., New York
[illegible]	[illegible]	S. A. C. S., Aroa, Venezuela	U. S. Metals Ref. Co., Chrome, N. J.	H. D. Boret, London
[illegible]	[illegible]	Tennessee, Copperhill, Tenn.	American Smelting & Refining Co., Baltimore, Md.	Adolph Lewisohn & Sons, New York
[illegible]	[illegible]	Michigan Smelting Co., Houghton, Mich.	Michigan Smelting Co., Houghton, Mich.	Copper Range Co., New York
[illegible]	[illegible]	Anaconda (Washoe), Anaconda, Mont.	Anaconda, Great Falls, Mont. & Perth Amboy, N. J.	United Metals Selling Co., New York
[illegible]	[illegible]	U. S. S. R. & M., Kennett, Cal.	U. S. Metals Refining Co., Chrome, N. J.	U. S. Smelting, Ref. & Mng. Co., New York
[illegible]	[illegible]	United Verde, Clarkdale, Ariz.	U. S. Metals Refining Co., Chrome, N. J.	American Metal Co., New York U. S. Smelting, Refining & Mining Co., New York
[illegible]	[illegible]	United Verde Ex., Clemenceau, Ariz.	Nichols Copper Co., Laurel Hill, N. Y.	Phelps Dodge Corporation, New York
[illegible]	[illegible]	International Smg. Co., Tooele, Utah	Anaconda (Raritan Cop. Wks.), Perth Amboy, N. J.	United Metals Selling Co., New York
[illegible]	[illegible]	American Smelting & Refining Co., Garfield, Utah.	Amer. Smg. & Ref. Co., Baltimore or Maurer, N. J.	Guggenheim Bros., New York
[illegible]	[illegible]	Quincy Smelting Works, Hancock, Mich.	Quincy Smelting Wks., Hancock, Mich.	Calumet & Hecla Co., New York
[illegible]	[illegible]	International Smelting Co., Tooele, Utah	Anaconda (Raritan Cop. Wks.), Perth Amboy, N. J.	United Metals Selling Co., New York
[illegible]	[illegible]	Calumet & Hecla, Hubbell, Mich.	Calumet & Hecla, Hubbell, Mich.	Calumet & Hecla, New York
[illegible]	[illegible]	Michigan Smelting Co., Houghton, Mich.	Michigan Smelting Co., Houghton, Mich.	Wolverine Copper Mining Co., New York

d Information partially from unofficial sources, and possibly inaccurate. (*x*) Now closed down (Jan., 1921).

COMPANY REPORTS

Nevada Consolidated Net Profit 12c. per Share

A report of operations of Nevada Consolidated Copper Co. for 1920 states that a net profit from all sources of $235,904 was earned (about 12c. per share, compared with 61c. in 1919). The following statement gives operating results:

Operating revenue:		
Copper produced—48,311,985 lb. @ 17.767 f.o.b. Atlantic seaboard	$8,583,356 99	
Gold and silver produced	483,668 46	$9,067,025 45
Operating expenses		9,261,443 83
Net loss from operations plus depletion		$194,418 38
Miscellaneous income:		
Dividends on investments—Nevada Northern Ry. Co.	$350,000 00	
Interest and miscellaneous income	80,322 81	430,322 81
Total income from all sources—to surplus account		$235,904 43
Surplus from operations:		
Balance Dec. 31, 1919		8,160,533 02
Net income and proceeds of depletion		235,904 43
		$8,396,437 45
Capital distributions	$1,499,592 75	
Additional income and excess profits tax, 1917	358,242 46	1,857,835 21
Balance Dec. 31, 1920		$6,538,602 24

CURRENT ASSETS AND LIABILITIES

Assets	Dec. 31, 1920	Dec. 31, 1919
Metals on hand and in transit	$7,017,301 57	$8,129,985.98
Accounts and notes collectible	417,441 72	650,720 92
Deferred accounts	96,708 37	95,252.00
Materials and supplies on hand	1,860,558.70	1,781,539.04
Cash	553,413.14	1,589,173 94
Total current assets	$9,945,423.50	$12,246,671 88
Liabilities		
Current accounts	$694,134 03	$1,126,585 92
Treatment charges on metals (not due)	548,240 43	825,411 03
Total current liabilities	$1,242,374.46	$1,951,996.95
Surplus quick assets	$8,703,049.04	$10,294,674.93

Current assets do not include stock of the Nevada Northern Ry. Co. amounting to $2,000,000 par value. Net cost of production was 17.28c. per lb. of copper, compared with 16.14c. for 1919. Capitalization: $9,997,285, in shares of $5 par value.

Utah Consolidated Shows Deficit

Copper-Lead; Utah

A report of the Utah Consolidated Mining Co. for the year 1920 states that 3,187,492 lb. of copper, 9,999,350 lb. of lead, 273,730 oz. of silver, and 4,697 oz. of gold were produced. A net loss of $196,140.08 is shown by the following income account:

EXPENSE	
Exploring and development	$374,569.86
Mining, including operating aerial tramway	730,199.40
Smelting	475,835.65
Refining and selling	54,384.86
Administration, including taxes	38,692.57
Legal and professional charges	6,028.65
Litigation expense	49,058.79
Depreciation	79,199.10
Total	$1,807,968.88

INCOME		
Sales of metals		$2,023,579 28
Deduct decrease in value of metals on hand:		
Inventory at beginning of year	$924,178 45	
Inventory at end of year	430,348 29	493,830 16
		$1,529,749 12
Rentals and miscellaneous receipts		28,492 02
Interest		20,587 66
Dividends on Anaconda Copper Mining Co. stock		33,000 00
Balance, net loss		196,140 08
Total		$1,807,968.88

Surplus on Dec. 31, 1919, amounted to $1,459,295.22; on Dec. 31, 1920, to $1,263,155.14. Metals on hand are valued at $430,348.29.

Anaconda Earned $1.15 per Share in 1920

A report of operations of the Anaconda Copper Mining Co. for 1920 states that production was as follows:

Plant	Copper (Lb.)	Zinc (Lb.)	Lead (Lb.)	Silver (Oz.)	Gold (Oz.)
Copper reduction	155,339,575			7,113,659	32,530
Zinc	2,173,080	101,332,458(*a*)	12,536,088	2,073,349	6,151
International Sm.	9,909,763		46,137,752	4,182,881	22,593
Miami Smelter	165,791,986			378,090	5,380
Int. Ld. Ref. (*b*)			49,173,237	3,438,371	11,897

(*a*) Also 5,255,452 lb. of zinc dross. (*b*) Includes 23,457.4 tons of lead bullion from International Smelting Co.

Consolidated income account shows a net income of $2,691,661 derived as follows:

Expense:	
Metals in process and on hand at beginning of year	$28,705,375.47
Mining, including development	17,943,878 52
Ore purchases	13,813,410 19
Reduction, including transportation of ore	19,248,563 22
Refining and selling, including transportation of metals	4,963,639 08
Cost of manufactured products and merchandise sold	5,664,682 26
Administration, Federal taxes and loss on Government securities sold	1,935,451 94
Balance carried down	8,020,165 93
	$100,295,166 61
Sales of metals	$53,227,278 08
Sales of manufactured products and merchandise	7,716,975 88
Royalties, tools, rentals, etc	6,814,729 76
Metals in process and on hand at end of year	32,536,182 89
	$100,295,166 61
Amount charged off this year for depreciation and obsolescence of mining plants, smelters, refineries, etc	$4,300,349 22
Interest	2,343,243 34
Balance, net income	2,691,660.62
	$9,335,253 18
Balance brought down	8,020,165.93
Income from investments in sundry companies	1,315,087 25
	$9,335,253.18

Surplus balance Dec. 31, 1919, was $89,055,552, plus net income of $2,691,661 and minus dividends paid amounting to $6,993,750, giving a surplus Dec. 31, 1920, of $84,753,463. Capitalization, 2,331,250 shares of $50 par.

Ray Consolidated Income Declined

A report of operations of Ray Consolidated Copper Co. for 1920 states that net income, exclusive of Federal taxes, amounted to $911,675, or 58c. per share, compared with $1,666,270, or $1.05, for 1919. Operating statement follows:

Operating revenue from metals produced:		
Copper produced—47,062,030 lb. at 17.502c.	$8,236,782 71	
Silver produced—4,365.29 oz. at $1.0045	4,384 19	
Gold produced—642.73 oz. at $20.00	12,854 62	
		$8,254,021.52
Operating expenses:		
Mining and milling	$5,129,950 01	
Treatment, refining and freight	2,153,745 24	
Selling commission	57,277 12	
Mine development extinguishment	256,594 50	
		7,597,566 87
Net income from operation plus depletion		$656,454.65
Miscellaneous income:		
Net miscellaneous income		255,220 59
Balance to surplus account		$911,675 24
Surplus from operations:		
Balance—Dec. 31, 1919		14,929,732 27
Net income and proceeds of depletion		911,675 24
		$15,841,407 51
Dividends	$184,596 66	
Capital distributions	1,392,582 34	
		1,577,179 00
Balance Dec. 31, 1920		$14,264,228.51

Total current assets on Dec. 31, 1920, were $9,152,742, a decrease of $1,555,457 during the year. Current liabilities were $8,166,276, a decrease of $739,945. Net cost of production was 15.565c. per lb., compared with 14.94c. in 1919, which includes all credits. Capitalization, $15,771,790 (par $10). Surplus on Dec. 31, 1920, was $14,271,384, compared with $14,932,937 for the previous year.

MINING STOCKS

Week Ended May 7, 1921

COPPER

Stock	Exch.	High	Low	Last	Last Div.	
Adventure	Boston	¾	¾	¾	....	
Ahmeek	Boston	55½	52½	52½	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	½	7/16	½	....	
Allouez	Boston	23	22	22	Mar. '19	1.00
Anaconda	New York	42⅜	41	42	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2¾	2½	2½	....	
Ariz. Com'l.	Boston	9½	9½	9½	Oct. '18,	.50
Big Ledge	N. Y. Curb	5/16	¼	5/16	....	
Bingham Mines	Boston	..	..	9¾	Sept. '19, Q	.25
Calumet & Arizona	Boston	52¾	52	52	Mar. '21, Q	.50
Calumet & Hecla	Boston	257	253	253	June '20, Q	5.00
Canada Copper	N. Y. Curb	....	....	*13	....	
Centennial	Boston	10	9¾	10	Dec. '18, SA	1.00
Cerro de Pasco	New York	30⅞	29	30	Mar. '21, Q	.50
Chile Copper	New York	12⅛	11⅝	12	....	
Chino	New York	25¼	24½	25⅝	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*29	*25	*29	....	
Con. Arizona	N. Y. Curb	....	....	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	..	..	1⅛	....	
Copper Range	Boston	36¾	34⅛	35½	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*35	*28	*29	....	
Davis-Daly	Boston	7	6½	6¾	Mar. '20, Q	.25
East Butte	Boston	9½	9	9⅜	Dec. '19, A	.50
First National	Boston Curb	*85	*75	*85	Feb. '19, SA	.15
Franklin	Boston	....		2¼	....	
Gadsden Copper	N. Y. Curb	....	....	*25	....	
Granby Consol.	New York	23½	21⅞	23	May '19, Q	1.25
Greene-Cananea	New York	25½	24½	25	Nov. '20, Q	.50
Hancock	Boston	3	3	3	....	
Howe Sound	N. Y. Curb	....	....	2¼	Jan. '21, Q	.05
Inspiration Consol.	New York	37⅛	36	36⅞	Oct. '20, Q	1.00
Iron Cap	Boston Curb	6⅝	6½	6⅝	Sept. '20, K	.25
Isle Royale	Boston	22½	21⅛	22½	Sept. '19, SA	.50
Kennecott	New York	22¼	20½	21¾	Dec. '20, Q	.50
Keweenaw	Boston	....	....	1¼	....	
Lake Copper	Boston	2½	2½	2½	....	
La Salle	Boston	....	....	2⅛	....	
Magma Chief	N. Y. Curb			*21	....	
Magma Copper	N. Y. Curb	22⅛	21⅝	22	Jan. '19, Q	.50
Majestic	Boston Curb	....		*9	....	
Mason Valley	Boston	....	....	1¼	....	
Mass Consolidated	Boston	2⅞	2½	2½	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	4½	4¼	4½	....	
Miami Copper	New York	23½	22½	23¼	Feb. '21, Q	.50
Michigan	Boston	3½	3¼	3½	....	
Mohawk	Boston	55	51	53	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5½	4¾	5½	....	
Nevada Consol.	New York	12¼	11⅞	12¼	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3	....	
New Cornelia	Boston	16¼	15⅞	16	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....	....	*5	....	
North Butte	Boston	11¼	10⅞	10⅞	Oct. '18, Q	.25
North Lake	Boston	....	....	½	....	
Ohio Copper	N. Y. Curb	....	....	3/16	....	
Old Dominion	Boston	22½	21	21	Dec. '18, Q	1.00
Osceola	Boston	32	30½	31	June '20, Q	.50
Phelps Dodge	Open Mar.	†160	†140	....	Apr. '21, Q	1.00
Quincy	Boston	43	40	42	Mar. '20, Q	1.00
Ray Consolidated	New York	14⅜	13⅞	14⅜	Dec. '20, Q	.25
Ray Hercules	Boston Curb	...	...	*35	....	
St. Mary's Min. Ld.	Boston	40	38	38½	June '20, K	2.00
Seneca Copper	Boston	17¼	16½	17⅛	....	
Shannon	Boston	1	1	1	Nov. '17, Q	.25
Shattuck Arizona	New York	6¼	6	6¼	Jan. '20, Q	.25
South Lake	Boston			1½	....	
Superior Copper	Boston	4½	4	4	Apr. '17,	1.00
Superior & Boston	Boston	1¼	1¼	1¼	....	
Tenn. C. & C. cfs.	New York	10½	9¼	9¼	May '18, I	1.00
Tuolumne	Boston	*69	*44	*57	May '13,	.10
United Verde Ex.	Boston Curb	28½	26½	27½	Feb. '21, Q	.50
Utah Consol.	Boston	4½	3¾	4⅛	Sept. '18,	.25
Utah Copper	New York	56	53¼	54¼	Mar. '21, Q	1.00
Utah Metal & T.	Boston	1¼	1¼	1¼	Dec. '17,	.30
Victoria	Boston	*[illegible]	*40	*55	....	
Winona	Boston	*[illegible]	*45	*[illegible]	....	
Wolverine	Boston	1[illegible]	11½	11½	....	

NICKEL-COPPER

Stock	Exch.	High	Low	Last	Last Div.	
International Nickel	New York	17	16	16½	Mar. '19,	.50
International Nickel, pf.	New York	85	84½	85	May '21, Q	1.50

LEAD

Stock	Exch.	High	Low	Last	Last Div.	
National Lead	New York	81	7[illegible]	[illegible]	Mar. '21, Q	1.50
National Lead, pfd.	New York	108	[illegible]	[illegible]	Mar. '21, Q	1.75
St. Joseph Lead	New York	12¼	11	11[illegible]	Mar. '21, Q	.25
Stewart Mining	Boston Curb			[illegible]	[illegible] '15	.05

ZINC

Stock	Exch.	High	Low	Last	Last Div.	
Am. Z. L. & S.	New York	9[illegible]	[illegible]	[illegible]	May '20	1.00
Am. Z. L. & S. pfd.	New York	28[illegible]	2[illegible]	[illegible]	[illegible] '20, Q	1.50
Butte C. & Z.	New York	[illegible]	[illegible]	[illegible]	[illegible] '18	.50
Butte & Superior	New York	1[illegible]	13	[illegible]	[illegible] '20,	1.25
Callahan Zn-Ld	New York	[illegible]	[illegible]	[illegible]	[illegible] '20, Q	.50
New Jersey Zn.	N. Y. Curb	127	12[illegible]	[illegible]	[illegible] '21, Q	2.00
Success	N. Y. Curb	*3	*2	[illegible]	[illegible]	.03
Yellow Pine	Los Angeles	*[illegible]	*[illegible]	*[illegible]	Sept. '20, Q	.03

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

GOLD

Stock	Exch.	High	Low	Last	Last Div.	
Alaska Gold	New York	¾	¾	¾	....	
Alaska Juneau	New York	1¼	1⅛	1¼	....	
Carson Hill	N. Y. Curb.	15½	14¾	14¾	....	
Cresson Consol. G.	N. Y. Curb	1⅝	1⅜	1½	June '20, Q	$0.10
Dome Extension	Toronto	....		*60½	....	
Dome Mines	New York	20	18¼	18⅞	Apr. '21, Q	.25
Golden Cycle	Colo. Sprgs.	*76½	*74	*74	Dec. '20, Q	.02
Goldfield Consol.	N. Y. Curb	*8	*6½	*8	Dec. '19,	.05
Hollinger Consol.	Toronto	7.30	7.22	7.25	Feb. '21, M	.05
Homestake Mining	New York	57	56	57	Sept. '19,	.50
Kirkland Lake	Toronto	*54	*50½	*50½	....	
Lake Shore	Toronto	1.38	1.29	1.34	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	2.03	1.99	2.03	Jan. '21, K	.05
Porcupine Crown	Toronto	*28	*27½	*27½	July '17,	.03
Portland	Colo. Sprgs.	*63	*60	*63	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*4	*3	*4	May '19,	.05
Silver Pick	N. Y. Curb	*6	*4	*5½	....	
Teck Hughes	Toronto	*18	*16¼	*16½	....	
Tom Reed	Los Angeles	0.90	0.83	0.83	Dec. '19,	.02
United Eastern	N. Y. Curb	2¾	2⅝	2 11/16	Apr. '21, Q	.15
Vindicator Consol.	Colo. Sprgs	*33	*31	*33	Jan. '20 Q	.01
West Dome Consol.	Toronto	*7¼	*7⅛	*7¾	....	
White Caps Mining	N. Y. Curb	*6	*5	*6	....	
Yukon Gold	Boston Curb	.		*70	June '18,	.02½

SILVER

Stock	Exch.	High	Low	Last	Last Div.	
Arizona Silver	Boston Curb	*27	*17	*19	Apr. '20, M	.03
Batopilas Mining	New York	¾	⅝	¾	Dec. '07, I	.12½
Beaver Consol.	Toronto	*34¼	*34¼	*34¼	May '20, K	.03
Coniagas	Toronto	1.80	1.75	1.75	May '21, Q	.12½
Crown Reserve	Toronto	*12½	*12½	*12½	Jan. '17,	.05
Kerr Lake	Boston	3½	3⅜	3⅜	Apr. '21, Q	.12½
La Rose	Toronto	.		*23	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*17	*17	*17	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.00	1.00	1.00	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	5	4½	4½	Apr. '21, Q	.15
Ontario Silver	New York	5⅞	5	5⅜	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	2	1½	2	Jan. '12,	.10
Peterson Lake	Toronto	*6½	*6½	*6½	Jan. '17,	.01½
Temiskaming	Toronto	*20	*20	*20	Jan. '20, K	.04
Trethewey	Toronto	*19	*16	*16	Jan. '19,	.05

GOLD AND SILVER

Stock	Exch.	High	Low	Last	Last Div.	
Atlanta	N. Y. Curb	*1	*½	*1	....	
Barnes-King	Butte	‡ ..	....	1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*66	*62	*64	....	
Cashboy	N. Y. Curb	*6	*4	*6	....	
El Salvador	N. Y. Curb	¼	¼	¼	....	
Jim Butler	N. Y. Curb	*10	*8	*9	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*7	*6	*7	June '16,	.05
Louisiana Con.	N. Y. Curb	.	....	⅛	....	
MacNamara M. & M.	N. Y. Curb	*31	*14	*26	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1½	1⅜	1½	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1¼	1⅛	1⅛	....	
Tonopah-Extension	N. Y. Curb	1[illegible]	1 1/16	1⅛	Apr. '21, Q	.05
Tonopah Mining	N. Y. Curb	1 9/16	1 7/16	1 9/16	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	1 1/16	1 1/16	1⅛	Dec. '19, SA	.05

SILVER-LEAD

Stock	Exch.	High	Low	Last	Last Div.	
Caledonia	N.Y. Curb	*12	*10	*12	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake			.15	Dec. '20,	.15
Chief Consolidated	Boston Curb	2⅜	2½	2½	May '21, Q	.05
Consol. M. & S.	Montreal	17	15	15	Oct. '20, Q	.62½
Daly Mining	Salt Lake			2.50	July '20, Q	.10
Daly-West	Boston	2½	2½	2½	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb			2½	Apr. '21, K	.05
Electric Point	Spokane	*7½	*7	*7	May '20, SA	.03
Federal M. & S.	New York	9	9	9	Jan. '09,	1.50
Federal M. & S., pfd.	New York	26	25	25½	Mar. '21, Q	1.00
Florence Silver	Spokane		.	*16	Apr. '19,	.01½
Grand Central	Salt Lake			*07½	June '20, K	.03
Hecla Mining	N. Y. Curb	4¼	4 1/16	4 3/16	Mar. '21, Q	.15
Iron Blossom	N. Y. Curb			*15	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake			3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*11	*[illegible]	*10	....	
Prince Consol.	N. Y. Curb	¼	3/16	3/16	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*[illegible]	*5	*5	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*14	*10½	*12	....	
South Hecla	Salt Lake			*65	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	3/16	3/16	3/16	Oct. '17,	.05
Tamarack-Custer	Spokane	1.75	1.70	1.70	Jan. '21, K	.04
Tintic Standard	Salt Lake	2.[illegible]	2.45	2.50	June '20, Q	.10
Utah Apex	Boston	[illegible]	2 5/16	2 5/16	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*4½	*[illegible]	*4	Nov. '17,	.01

QUICKSILVER

Stock	Exch.	High	Low	Last	Last Div.	
New Idria	Boston			*50	Jan. '19,	.25

VANADIUM

Stock	Exch.	High	Low	Last	Last Div.	
Vanadium Corp.	New York	40¼	35½	38½	Jan. '21, Q	1.00

ASBESTOS

Stock	Exch.	High	Low	Last	Last Div.	
Asbestos Corp.	Montreal	61	58	60	Apr. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	8[illegible]	80½	82½	Apr. '21, Q	1.75

MINING, SMELTING AND REFINING

Stock	Exch.	High	Low	Last	Last Div.	
Amer. Sm. & Ref.	New York	44¼	41¼	42	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf.	New York	79	77	77¼	Mar. '21, Q	1.75
Am. Sm. pf. A	New York	70	70	70	Apr. '21, Q	1.50
U. S. Sm. R. & M.	New York	34	33	33½	Jan. '21, Q	.50
U. S. Sm. R. & M. pf.	Boston	42	40½	42	Apr. '21, Q	.87½

INDUSTRIAL NOTES

New Uehling CO_2 Recorder Aids Fuel Saving

The soaring price of fuel is causing plant owners and operators to use the available means for reducing fuel waste, notably CO_2 recorders, to a greater extent than ever before.

The greatest single waste of fuel is heat discharged up the chimney, which represents over 35 per cent of the fuel in the average boiler plant. Continuous CO_2 determinations enable firemen and engineers to co-operate in burning fuel with the most efficient proportion of air. They also show up other causes of boiler inefficiency, so that wasteful practices may be "nipped in the bud."

The Uehling Instrument Co., 71 Broadway, New York, has introduced a new model CO_2 recording equipment, known as style U, which embodies important improvements over the superseded model. Chief among its advantages are quick action, accessibility and simplicity, and the combination in one machine of determinations simultaneously from any number of boilers up to six.

A single unit Uehling CO_2 equipment for one boiler consists of three principal parts, namely: the meter proper, the recorder, and the auxiliary boiler front indicator. The meter is placed wherever most convenient. Its function is to actuate the boiler front indicator and recorder in the engineer's office.

The CO_2 meter consists essentially of a cylindrical regulator on which is mounted the analyzing mechanism. This regulator maintains constant the suction created by the aspirator, thereby eliminating all changes in tension except those caused by absorption within the absorbent carton chamber which takes up the CO_2. The latter's changes in tension are given by the indicator and recorder.

The recorder operates on the hydrostatic principle, by which all springs, levers and joint movements are avoided. It makes a continuous, (not intermittent) record of the per cent CO_2, furnishing an autographic history of the operation of each boiler for every second of the day, showing when fires receive attention; when and how often furnace doors are opened; fires cleaned; dampers regulated; and giving the fireman a square deal.

The boiler front indicator guides the fireman in supplying just the right amount of air to burn the fuel with the least loss of heat up the chimney.

Largest Welded Tank Completed at Birmingham, Ala.

What is believed to be the largest welded tank ever built was recently completed by the Welded Products Co. at Birmingham, Ala., for the Liquid Carbonic Co. The tank is 22 ft. in diameter and stands 30 ft. high. It was made of $\frac{1}{4}$-in. steel plates, joined at the seams by oxy-acetylene welding. The tank has satisfactorily withstood the required tests and has been found to be gas-tight in all of the welded seams under excess pressures.

The Welded Products Co. uses oxy-acetylene with remarkable success in tank construction, and has for some time specialized in this field of welding, having built many large tanks for gasoline storage and other uses in the South. The welded construction has been proved thoroughly satisfactory and much cheaper than riveted tanks of the same capacity. The welded tank has a distinct advantage also in the fact that it is not so susceptible to rust as the riveted tank. The company has a well-equipped welding plant and uses the latest improved Oxweld apparatus throughout. Linde oxygen is supplied to the blowpipes through a system of shop piping. The company is now estimating on the gas holders for the new plant of the Linde Air Products Co. at New Orleans, and if awarded this contract there will soon be a new "largest welded tank" to take its rank in the welding field and, incidentally, to open up an entirely new outlook for the industry.

LARGEST WELDED TANK BUILT BY WELDED PRODUCTS CO.

New Diesel-Driven Ore Boat Runs Eleven Knots on Nine Tons of Oil Daily

An unusual type of vessel with internal-combustion engines has just been launched at Gothenburg, Sweden, for the Grangesburg Ore Co., according to a writer in *The Times Engineering Supplement*, London, April, 1921. The new vessel has been specially designed for the transport of ore, and the decision to adopt Diesel motors for propulsion was made only after careful investigations. Owing to the shorter engine room and the absence of cross bunkers, the distribution of cargo is better than in a steamer, and the separate ore heaps may be made much lighter, thus diminishing the stresses on the hull. The vessel is 385 ft. long between perpendiculars and is capable of carrying 8,000 tons. Two Diesel engines of 1,300 indicated horsepower will give a speed of eleven knots, and the total fuel consumption will be about nine and one-half tons per day. The oil bunker capacity is about 500 tons.

The engine room is placed amidships, allowing three large cargo holds forward, and three aft, all served by electrically operated winches. Five ships of the same size and type are being constructed in Gothenburg by the Gothenburg Shipbuilding Co., and a contract has been made for eleven similar vessels. It has not yet been decided whether steam or internal-combustion machinery shall be installed in these latter craft, but in all probability they will be equipped with oil engines.

Although these boats are far smaller than the great American ore carriers, they may comprise some instructive and utilitarian innovations worthy of careful study.

Shale Treatment Plant for Nova Scotia

The Nova Scotia Oil Shale Fields, Inc., Harold C. E. Spence, president, has closed a contract with the Carbonization Co., Ltd., of Pittsburgh and New York, for the Arthur L. Pearse process for treating oil shale. The company will begin the erection of a plant near New Glasgow, N. S., at once and may be at work by Christmas.

Progress in Applying Electricity to Mining Illustrated by Recent Engineering Accomplishments of the Westinghouse Company

The most notable engineering achievements of the Westinghouse Electric & Manufacturing Co. for the past year have probably been those in connection with business obtained from many of the most important customers, because of the great business activity through which we have passed. In the mining industry attention should be called to a 1,700-hp. 25-cycle motor driving a turbine type blower supplied to the Inspiration Consolidated Copper Co.

A large number of unique motors for vibrating screens, capable of broad application in the mining and allied industries, were put out. Through close co-operation with the engineers of the Utah Copper Co. this special motor has been developed for the Mitchell vibrating screen, which promises to revolutionize the principle of handling materials wherever classification by volume is done.

A new and novel idea in the drilling of oil wells with electric motors, perfected during 1920, consists of two standard two-speed pumping motors driving the same countershaft and performing more successfully the operations incident to drilling. This arrangement promises to entirely revolutionize accepted drilling methods.

The electro-chemical and electrometallurgical field is always subject to new developments owing to the improved method of applying electricity in many of the branches of this art, and the last year was no exception. A new furnace regulator promises to give better results than any regulator yet manufactured. Ten of these regulators are now in successful commercial service. Another regulator, known as the step induction type, has been developed to take the place of the old type induction regulator. Some 30 regulators of this type are now in commercial use for controlling graphite, carborundum, zinc and similar furnaces.

The largest and most spectacular installation of Cottrell precipitating apparatus during 1920 was supplied by the Westinghouse company to the United Verde Copper Co. at Jerome, Ariz.

The past year has seen a further development of the largest installation of electric shovels in the world. This is at the mines of the Chile Exploration Co., Chile. The enormous quantities of low grade ore must be mined at low unit cost. Steam shovels, which usually cost considerably more to operate than electric shovels, were formerly used for this work. In this particular case the cost of operation of the steam shovel was even higher than usual, due to the fact that coal and water had to be hauled long distances from the company's property at the sea coast to the mountain. Five large electric Bucyrus shovels driven by Westinghouse alternating current motors were installed in the latter part of 1917, the power being transmitted at a high voltage, which is reduced to 500 volts by step-down transformers located on the rear of the shovels. The operation of these shovels was so successful and the reduction in cost so great that five more were placed in operation at these mines during 1920. The hoist motion on the shovel is driven by a 250 hp. motor and the swing and thrust motions each by a 75 hp. motor.

New Clamps Simplify Mine Trolley Set-Up

Two new trolley clamps are being manufactured by The Ohio Brass Co., Mansfield, Ohio.

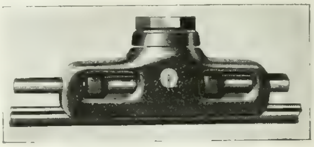

FIG. 1. O.-B. WEDGE CLAMP

O-B Wedge Clamp shown in Fig. 1, which is of a type especially popular in certain fields, embodies some new ideas.

It aligns with the wire without setting up strain in the hanger insulation. After the clamp has been screwed on the hanger and before the wedge is driven in, the jaws rotate enough to come into line with the trolley. Then, a few blows with a hammer on the wedge tightens the clamp on the wire and on the hanger.

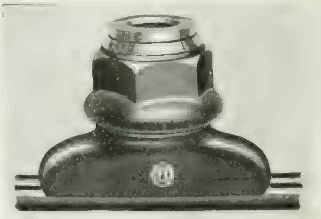

FIG. 2. O.-B. PREMIER CLAMP

Another worth-while feature is the even distribution of pressure along the whole length of the jaws.

O-B Premier clamp (see Fig. 2) is interesting principally because of its simplicity. Two jaws, the boss and the jam nut are the only parts. Hence these few pieces have been made very heavy and strong without raising the cost of the clamp out of the low price class.

One of the many oil companies that have adopted "Caterpillar" Tractors for the transportation of oil field supplies and equipment is the Cooper-Henderson Oil Co., Consolidated, of Breckenridge, Texas. The employees of the company affectionately refer to the tractor as the "Old Cat," and it has well earned their regard.

TRADE CATALOGS

Mills—The Mine and Smelter Supply Co. has recently issued two pamphlets which should be in the files of every millman and metallurgist. One (Catalog 62) is devoted to the Marcy ball mill, a thoroughly tested and widely installed machine. It gives information about all of the Marcy features, together with dimensions and data on the various sizes manufactured. It is much more complete than the old catalog. The other brochure is devoted to photographs of the new Marcy roller mill, an improved type of rod mill. Views of the original experimental unit at Anaconda are given and also pictures of the more up-to-date mills which have been designed for the Phelps Dodge properties.

Belt Conveyors. — The Stephens-Adams Manufacturing Co., Aurora, Ill., announces the publication of a new catalog, No. 26, dealing with S-A belt conveyors. The publication, which comprises more than a hundred pages, contains useful engineering and mechanical information relating to belt-conveyor practice, including tabular and graphic data. Concise descriptions of equipment, with illustrations, complete the publication, which will be sent on request.

Dust Collectors.—The Dust Recovering & Conveying Co., Cleveland, Ohio, recently distributed its bulletin No. 12, illustrating "The development of dust-collecting equipment," which has culminated in the "Dracco Perfecto" type, which has the filters between the dust source and the draft-creating fan. The result is immunity from dust explosions due to filter, and longer life for the fan.

Wilfley Tables—The Mine & Smelter Supply Co. has issued an attractive and convincing book describing Wilfley concentrating tables. The Wilfley table has been used for twenty-five years, and it has become so generally known throughout the world that the word "Wilfley" has almost assumed the status of "kodak" and "victrola" and is used as a generic term without regard to the manufacturer. A perusal of this book will show (although most of those who see it will already know the fact) that the manufacturers have not been willing to sit back and let well enough alone, but have made numerous improvements in design to keep the table abreast of the times. Many different riffle systems have been devised for different kinds of work, for example, and the buyer of a Wilfley table is by no means confined to the standard system as commonly seen. A chart giving the relative specific gravities of common minerals and metals in a handy form adds to the reference value of the book. Ask for Bulletin No. 64 when writing.

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Volume 111 New York, May 21, 1921 *Number* 21

A French-English-American Petroleum Treaty

THREE GREAT NATIONS are actively concerned over their future supplies of that most critical and most unreplaceable of all sources of power, and prosperity—petroleum. They are the United States, England, and France. From a question of prime national importance, the petroleum problem in each of these countries has developed into a matter of international import, and has been the subject for diplomatic negotiations of the first degree of political magnitude. First it was between England and France, during that trying hiatus when our own Government had practically ceased to function, after the failure of the League and Peace Treaty in the Senate. Later, toward the end of the last Administration and continuing with increasing vigor into the present Administration, the Government of the United States, through the State Department, has also been negotiating with England, looking toward a solution of the great problem.

We have no hesitation in calling this petroleum question the most basic, most vital, the most significant and far reaching of all the many problems which the United States is called upon to consider. Here is a type or test case, which, if handled wisely, will be celebrated in future history as being as powerfully activating on all time as was the signing of the compact in the cabin of the Mayflower by the little band of obscure adventurers, or the agreement between the nobles and King John as laid down in Magna Charta. Before the deep import of this opportunity, all other more transitory, even if more noisy, problems take second rank.

The fundamental fact is that the easily and cheaply accessible petroleum resources of the earth are very limited, and within a historically short period the age of petroleum will become a matter of history. But during this age, in which we now live, the possession of adequate petroleum supplies is the master key to growth, prosperity, and commercial power. Airplane, automobile, truck, tractor, tank, submarine, oil-burning navies, oil-burning merchant marine—these and many other key devices depend upon an adequate petroleum supply.

The second truth is that while Nature has distributed her mineral supplies without regard for future population and civilization, the destiny of mankind has become centered in the hands of a few great peoples occupying only a part of this petroleum-bearing earth; and that it is these peoples who use and have most vital need of those supplies which lie in waste or undercivilized places. England, with no petroleum at home, must go abroad, and secure her future supplies wherever she can dicker or deal for them. France must do likewise. The United States, rich in petroleum, has been prodigally producing and using it, and turning it over freehandedly to the world. A true "Coal-oil Johnny" of extravagance, she now perceives the plain handwriting on the wall—plain not only to geologists but to the student of simple statistics, or the observer of statistical curves—that her resources are shrinking with disconcerting rapidity. She too realizes that she must soon adventure abroad, like her great allies, England and France.

These three countries possess ties of sympathy and common purpose whose disturbance would mean a turning backward of the progress of civilization and disaster to the human race. Among them there exist political treaties, the only kind which was realized as necessary in the past twilight of our intelligence. Commercial treaties and agreements, as to the buying and selling of things, have lately become recognized as of more basic importance, although not sufficiently conceded to be so. But the ultimate basis for common understanding, maximum mutual advantage, and world comity lies in agreements on a basis of fact as to the fair distribution of those exhaustible and naturally localized mineral supplies among those people who need them most, and who are fighting the fight of the advancement of civilization. And of these mineral supplies the most critical and important is petroleum. Therefore it is that a carefully worked-out petroleum treaty, a petroleum entente, if you will, based, we repeat, on facts, and, therefore, drawn up not exclusively by diplomats but by men of business and fairness, with the full scientific knowledge of the occurrence and distribution of petroleum so lately attained—such a petroleum agreement entered into by England, France, and the United States would insure the world's peace and unity more than would the League of Nations, the International Court of Justice, Mr. Wells' World State, or all the longings of the socialists and pacifists, communists, and the rest of the impractical dreamers.

We hail the dawn of a new era, when fact and science shall be the basis for national laws and international agreements, instead of the past ignorant makeshifts of uninformed politicians and so-called diplomats, and tugs-of-war between interested but stupid parties. Such an era may well be ushered in by honest conferences of the three great friendly countries on the key problem of the allocation of petroleum supplies, not only for themselves, but, with a joint stewardship of the petroleum treasure houses, for the world; and the formation of a petroleum alliance, to which should be admitted guardedly other nations, as the situation justified, and as they signified their desire.

To quote Cleveland's oft-repeated but immortal phrase, it is a condition which confronts us—not a theory. It is either, from now on, agreement as to a fair rationing of basic world resources among great and ambitious peoples, or that fierce competition whose normal climax is war. With such agreements, the problem of reducing navies and armies becomes no longer a dream, to which we subscribe while voting for enormous increases, but a natural consequence into which we would slip without argument. The vast waste of war and the preparation for war would be applied to betterments, instead of plans for destruction, with all the undreamed-of progress of humanity that would result.

We wonder if the actors in this most historic world drama—those dealing with the petroleum problem—in England and France, and the United States—realize the gigantic rôle they are playing in the world's history, and how the episode may be taught to wondering school children a thousand years from now. We hope and believe that they realize the magnitude of the responsibility that is theirs.

Let not such an agreement be hastily made, but, by considering the full basis of fact, be rendered sound and fool-proof. Here there is work for special commissions, to be appointed from each of the three countries, each to be composed mostly of those who know, and not so much those who only dicker; and for common meetings and conferences of these three commissions (which thus would constitute an official French-English-American petroleum conference) until the best solution shall be attained, and submitted for ratification to the respective governments.

Tax Exemptions And National Income

A BILL has been introduced in the Senate by Senator Pittman providing for the exemption from Federal taxation of the net income derived from the mining of gold, or from the mining, milling, or reduction of silver. We cite the above accurately: the specific differences in exemptions of the two metals is as stated; and if the bill should be likely to become a law, a more careful phraseology would become necessary to establish what, considering the context, is very uncertain, namely, the exact field covered by the term "mining of gold," as it evidently does not include milling and reduction, specifically referred to in the case of silver.

We do not think, however, that there is any likelihood of the bill becoming a law; and no doubt it was introduced to call attention to the present inequalities and vagaries of our existing Federal tax laws. We are passing through a state of cumbersome experimenting in taxation. It has been sought to raise the enormous revenues needed for war, extravagance, and inefficiency by heavy taxes on incomes and on excess profits. These methods were, of course, popular, and such a plan was bound to be permanently in favor. The taxation of the few to support the whole is always sure of the vote of the majority, who thereby secure total exemption for themselves. The only trouble was that it did not work.

The excess-profits tax shows a startlingly dwindling return; for the net result of it is that in an increasing number of cases "there ain't goin' to be no core" in the shape of excess profits for the Government. Lack of stimulation for business enterprise, and the devising of methods to avoid excess profits, naturally resulted from this excessive form of special taxation, and the same applies to large incomes which are the result of individual earnings and enterprise. As for the really statically wealthy, whether individuals or corporations, a pre-existing hole in the law made it possible for them to become exempt: we refer, of course, to the total exemption from taxation of the bonds of states or any subdivision thereof. The great amount of such bonds in circulation has been enormously stimulated by this exemption, and a flood of state, city, town, village, school district, highway improvement, waterworks, drainage district and other tax-free bonds has been poured forth in an increasing stream. It does not pay the wealthy man and the statically wealthy corporation to invest their surplus in anything but these securities: the difference in net yield is so great as to leave no choice.

An expert, representing the public utilities corporations, testifying before a committee of Congress the other day, estimated that for incomes of more than $10,000 it did not pay to buy anything but tax-exempt securities. Expert advisers to investors take this element into consideration in suggesting what bonds to buy and what not. The result is that the very class of the rich who were the target of the unmoneyed majority who framed the scheme do not contribute; naturally the tax does not fall on the poor; and again it is Mr. Average Citizen who digs up. Unless this tremendous exemption is removed, the income tax will continue to be the national economic joke that it is at present. Therefore, Secretary Mellon has advised a constitutional amendment removing this exemption; and a bill for that purpose has been introduced by Congressman McFadden. But a constitutional amendment, requiring the consent of three-fourths of the states, takes a long time to pass; and probably many states will not agree to give up so shining a financial advantage.

And what in the mean time? How shall the money for government demands be raised, and how shall the taxation inequities and the resultant business distress be removed? Because the big investor puts his money into state and municipal bonds, he does not put it into railroads, public utilities, and other forms of private business in which the public has the main interest. The result is that these enterprises, of national significance to all of us, cannot secure funds, except in small amount and at a very high cost, from the small investor. Therefore, extensions cannot be planned: charges for service must remain high to cover costs; and both a healthy growth of vital enterprises and the process of deflation and return to "normalcy" are indefinitely postponed.

One result of the situation, pointed out by the public utility experts, is the tendency to deflect thought into the direction of public ownership of public utilities. We do not say of railroads, for the public stomach has had enough of that particular brand for the present. But why should the citizen stand the high charges and inadequate service (due to the difficulty and cost of getting funds) of privately managed corporations, when by throwing such corporations into municipal control they could be abundantly financed tax free? Therefore, there is an artificial stimulus to the trend toward state socialism which most thinking men want to tread reluctantly and cautiously, if at all.

The most immediate remedy, say the privately controlled public-utility experts, would be tax exemption on their securities, so as to give them equality with municipally controlled public-utility securities. The same remedy occurs to others: for the gold and silver mining industries, as instanced in Senator Pittman's bill, for example. Should the production of the sound basis for money be taxed, in a period of paper inflation? Certainly not. Home owners insist also that real estate mortgages should be exempt. Should the struggle to found a home be taxed? Assuredly not: a national premium should be put on this. The farmers also claim that their net income should be exempt. Should the enterprise of those who grow food for the nation be dampened? Of course not: the trend back to the farm would make us all better off, and should be stimulated as a national policy. So when we are through with our just exemptions, we shall be collecting only from those poor goats who are slow to holler, if we may use the figure.

The point is to have no exemptions; to remove at once the tax-free exemption feature of state and municipal bonds. If this cannot be done, the income tax is a monstrosity and a failure, and had better be abandoned at once in favor of something equitable and workable.

The Journal's Shaft-Sinking Medal

ABOUT A YEAR AGO—in our issue of May 15, 1920, to be exact—we announced the offer of a gold medal to be presented to the crew breaking the world's record in shaft sinking. In a subsequent issue—that of Aug. 21—we published the rules drawn up by the committee appointed to judge the records submitted, but since that time—through no fault of the committee, however—their work, as such, has been at a standstill. At first we were inclined to think that a lack of reports from the committee as to possible aspirants for the honor might indicate that there was inactivity in the shaft-sinking business, but a general review of the news from the various districts during the last year shows that almost a normal amount of that sort of work has been done. It may be assumed that the rules as set down by the committee are regarded as satisfactory, for there has been no criticism of them by our readers.

A year having passed since our original announcement, it seems a particularly auspicious time to again mention the matter of the gold medal. It will remind the industry that we have not forgotten our offer and that we still have faith that the record will be broken.

It will be recalled that the *Journal's* announcement of the offer was made directly following the report by the Van Dyke Copper Co., of Miami, Ariz., that it had beaten the world's record of 279 ft. in thirty-one days, then held by the Crown Mines, Ltd., of Johannesburg. It subsequently developed that a record of 310 ft. in thirty-one days had been made during July, 1919, by the Crown Mines, Ltd., but had not been announced in this country. However, as far as we can learn, the Van Dyke Copper Co. holds the palm in the United States, having sunk its No. 1 shaft 308 ft. in thirty-one days. A description of the manner in which this was accomplished appears in this issue, and contains many details that will be of value to those engaging in similar work.

It must be conceded that the conditions under which the work was performed at the Van Dyke shaft were exceptionally propitious and that the progress made was due largely to certain favorable features that would not be met in most mining districts. Yet there were drawbacks, such as the comparatively small cross-section area of the shaft, and sloughing and variable ground. Although there will be those who will dispute the claim of the record under the circumstances given, we are of the opinion that the claim is fairly made, and is not intended to include more than the record for linear footage. As such, and considering the performance of many details, the work was well done and with dispatch.

With the knowledge of conditions under which the footage at the Van Dyke shaft was made and the circumstances surrounding the sinking of other shafts, it would seem that the opinion expressed by the Medal Committee in stating the rules which are to govern the award was not without justification. This was as follows, and appears in the Aug. 21, 1920, issue of *Engineering and Mining Journal:* "It will be appreciated that any attempt to specify conditions as to cross-section area or shape of shaft, hardness of ground, number of men employed, or any other condition which would have bearing on the progress made in shaft sinking, would introduce complications in the judging of the contest, and such complications would undoubtedly prove to be a source of discussion and difference of opinion, to say nothing of probable dissatisfaction on the part of the contestants with the final decision of the judges. In the formulation of the rules, the question of specifying weighted values to certain conditions and making the award on the greatest number of points seemed to have possibilities, but, after due consideration, it was deemed best to hold strictly to the first announcement in its simplest interpretation, i.e., that the medal be awarded to the crew breaking the record in footage within the time limit specified."

The New Mine Tax Law Of New Mexico

THE COMING YEAR will witness the first attempt in the Rocky Mountain section to impose state and local taxes upon a valuation of mines determined on the basis of the engineer's valuation. After a long and violent controversy, the Legislature of the State of New Mexico, at its session just ended, made provision for an appraisal of the mines of the state by a professional engineer. This method, which has commended itself to many by its record in Michigan, Wisconsin, and Minnesota, will now be given a trial among the coal and copper mines of the West.

The law, as passed, does not require the state tax commission to accept the engineer's valuation as the assessed value of the mines. In fact, the act specifically states that the commission may adopt the basis of net output as a more satisfactory measure of the value of the properties if it so chooses. But the physical valuation is to be made and the results are to be a public record. If the appraisal reveals any considerable divergence from the values arrived at by the net-produced method, the state of public opinion in New Mexico will in all probability insure its adoption by the commission as the basis for the levy of the taxes.

The new law was passed over the protests of some of the most important mining interests of the state, the companies owning large reserves which have been covered by a "contiguous property clause" in the old law being especially active in their opposition. This clause, which existed in a very extreme form in New Mexico, is now eliminated, and the commission is given general power to determine "reasonable" reserves. The appraisal is limited to operating mines.

The action of New Mexico is in line with recent developments in this field. It comes as the direct result of the activity of a Special Revenue Commission established by the Legislature a year ago, headed by Ex-Governor Herbert J. Hagerman, and accords with the recommendations of the special committee of the National Tax Association which reported on this problem last fall. The results of the experiment will be followed with great interest by all who are concerned with mining in the Western states.

WHAT OTHERS THINK

The Problem of Mining Canadian Iron Ores

An article under the above heading appeared in *Engineering and Mining Journal* of April 16. In this the question was discussed: "That if the Federal or Provincial government would grant a bonus of $1 per ton of ore mined, it would give an impetus to the starting of a Canadian iron-mining industry; or, instead, if these governments would set aside a sum of $300,000 for experimenting with the low-grade magnetic iron ores, contaminated with silica, phosphorus and sulphur, of which there existed large quantities in this country, a process might be found to utilize them in the furnaces."

If the advocates of such measures would have informed themselves more accurately on this subject their assertions would not be misleading, and, consequently, no harm would have been done to either individuals or the whole country and its natural resources.

Bonusing industries is still considered by many a panacea for attracting them. This is, in my opinion, however, a doubtful stratagem of political economy; if an industry cannot stand on its own feet, it is not worth having. When I hear of concerns asking or being offered money or building sites from communities, or asking financial or legislative support from governments, I feel always as if those who ask or are offered such favors give themselves a *testimonium paupertatis*, intellectually, technically, and practically, and communities or governments that are supporting these enterprises experience frequently just the contrary of what they were expecting from them, owing to conditions that were produced, to a lack of initiative and energy in the managing of the business.

Moreover, can the governments at the present time of universal need and tightness of money afford to support industries financially? And even if they could scrape a few hundred thousand dollars together, what benefit would it be to the iron miners throughout the country, when we consider that these ores are treated only in plants of large capacity? Let us suppose we have four such plants, each concentrating one million tons a year. How much would the governments have to set aside to pay $1 per ton mined? Could they do it? Would it be fair to the other industries? But is it, indeed, necessary that an iron industry should be coddled in that fashion in this country? Are our iron deposits of such nature that they need governments' help and experts' knowledge to bring them into use? No, they are not. They possess every possible advantage; they are of immense size — enough so that we could supply the world for centuries; they do not contain elements that could not be easily eliminated; they will produce a high-grade bessemer product.

Through a considerable stretch of country the railways run right through and past these deposits, and Lake Superior is reached at short distances. Water in rivers and lakes skirts the land, and wood for every purpose is locally available in considerable quantities.

The average grade of ore is about 37 per cent iron, the concentrates or briquets run 66 to 68 per cent; phosphorus, 0.008 to 0.012 per cent, and sulphur practically nil.

We hear also from them that we have to apply to each little different grade of these magnetites costly experiments to find the right process, whereas in fact almost every existing plant uses the same method to beneficiate these ores.

If we go into the Arctic Circle north of Norway, or go to Sweden, or the eastern United States or the northeastern Mesabi, all use practically the same process, and many of these plants operate on an ore similar in type to that which we have in nearly 250 miles of deposits.

I have made many concentrating tests with a number of ores coming from Canada, but never found any difficulty in producing that which I wished or expected to find. Why, then, should it be necessary to ask the governments to vote a sum of money for experimental work? Of course if an engineer has a certain predilection for his own ideas, it is his business to determine how much he will spend to make them fit his case.

There should be no difficulty in convincing those interested in the iron industry that the beneficiation of the low-grade magnetites contained in immense deposits situated in many parts of the world is, I may venture to say, almost an economic necessity for many nations, the United States included, and they should begin to uilize them in the iron industry now. Whatever knowledge or experience that we may need in the handling, producing, and utilization in the furnaces at the present moment is a gaining of time and expenditure when we are forced to use them. We have sufficient examples and patterns to work by. We have no excuse to be over-conservative or too timid in face of what many still call a new, untried thing. Such an attitude may be expected in those who stand frigidly off toward other people's or other nations' mode of working, inventions, processes, or methods, but this does not indicate progress. F. HILLE.

Port Arthur, Ont.

The Mining Engineering Standard

It is a genuine pleasure to read such a clear-cut, outspoken editorial as that contained in *Engineering and Mining Journal* of March 26, entitled "The Mining Engineering Standard." Strange as it may seem, there is no topic which calls forth more nonsense than a discussion of mining education.

If mining engineering is a profession, and not a business, a trade, or a calling, there must be some definite and prescribed course and training required from those whose purpose it is to follow it. Among the best mining schools of the country it has long been recognized that there were certain basic sciences which were necessary.

It has often been urged by the thoughtless that because there were certain branches in the standard mining course, which were not in daily use by the practitioner, they should be eliminated. The greatest stumbling block to the shiftless and incompetent student are what may be termed the mathematical sciences, including pure mathematics, mechanics, and physics. Remove these subjects from the engineering courses, and almost any person can pass with ease; and it is these very subjects which the self-trained candidate for honors as a professional engineer knows the least about and for which he has the highest contempt.

The tendency in almost all the second- and third-rate mining schools has been to disparage the work done in the really fundamental and valuable basic sciences, and place the emphasis upon the practical stuff. To one who has been through the mill, this is not difficult to understand. With modern educational theories, which are much in vogue, it is held that the young and inexperienced student knows best what courses are necessary for his professional training; and by giving him what he thinks he wants instead of what he ought to have, one source of complaint is immediately eliminated.

As an example of how crude and poorly trained some of these graduates can be, years after leaving school, and engaged in practical work all the time, I have culled two gems from a report made by one of these men not long ago upon a copper mine belonging to one of the large copper-mining companies of the Southwest:

Under the pompous title: "General Theory of Contact Metamorphic Ore Deposits," he goes on to say:

> In the case of water heavily charged with its load of minerals, and ascending through a permeable porphyry the load may be gradually kicked out of solution as the heat and pressure are reduced, and this often takes place with no evidence of chemical action, hence a "Disseminated porphyry."

Again, under another chapter, bearing the title "General Theory of Ore Deposits Applied to ——— Limestones" he says:

> We may properly think of the two walls of a fissure as leaning against each other, and leaning with considerable weight. In case of firm rocks the impingement is greater at certain lines along the fissure. In some fissures these lines of great impingement are no more than 25 ft. apart. In others they are as much as 100 ft. apart. The ascending solutions follow the lines of least resistance. Where there is a line of great impingement the solutions will pass at one side. In case of mineralization along this fissure we would not expect the mineralization to include this strip where the impingement is very great.

I am sure that all those interested in the "Disseminated Porphyry" copper mines will be grateful for this valuable hint which this author let drop as to their correct genesis. It is unfortunate that in assuring us that "Where there is a line of great impingement the solutions will pass at one side," he did not enlighten us as to which side. But exactly what an "impingement" may be, still remains a deep, dark mystery.

It is just this kind of stuff which is inflicted upon a guileless and unsuspecting public by men of this stamp that would in large measure be eliminated if men who are in every sense of the term professional engineers would see to it that the preliminary training received in college is set and maintained at a high standard, and that a few months spent in skimming over the elementary books of some correspondence course during idle hours is not sufficient preparation to admit the candidate into the profession of mining engineer.

Mineral de El Oro, Mexico. ROYAL P. JARVIS.

The Licensing of Mining Engineers

May I call your attention to a lapsus linguae in your editorial "The Licensing of Mining Engineers" in *Engineering and Mining Journal* of May 7? The editorial says, "In New York State at present there is a movement to take away the privilege of corporations to secure a license . . ." The licensing of corporations as such has never been a question in point. The matter to which you refer is covered by a clause in the bill which reads, "Nothing herein shall apply to a corporation, partnership, or joint stock association, provided the person or persons carrying on the actual practice of engineering on behalf of such corporation, partnership, or joint stock association shall be licensed engineers." This is the crux of the dispute being fostered by the consulting engineers of New York who want to prevent any corporation from practicing engineering which has any corporate member who is not a licensed engineer.

The fact that the Governor has signed the bill against which they were protesting might seem to have settled the matter in this state. Not so, however; because the consulting engineers have given notice that they will take the matter up with the Licensing Committee of the Federated American Engineering Societies and endeavor to have Engineering Council's Model Bill, which contains a clause similar to that quoted above, amended by eliminating this clause.

The mining engineers have been rather derelict in giving the particular question of licensing engineers the attention which it deserves. Now that the New York law is on the books, and every consulting mining engineer in New York must within the next twelve months take out a license in order to continue practicing, our mining engineers are beginning to ask themselves in how many states they must take out licenses.

The registration fee in New York is $25, and if you want to do land surveying on which titles and conveyances depend the fee is $35. Fees in other states are similar. Therefore, a consulting mining engineer in New York City, in order to be prepared for the practice of his profession at any time in the West without inconvenience and delay, should consider licensing himself in advance in each state where he is likely to want to practice. Multiply this number of states by $35 and he will have an idea of what it will cost him the first year. There will be renewal fees in many states.

It seems to me the matter of licensing engineers is more serious for the mining engineer than for any other type. I see no objection to a civil engineer, whose practice is more or less confined to one locality, like that of a doctor or a lawyer, having a license, or an electrical engineer, or a mechanical engineer, who, connected with large manufacturing operations, is fixed for long periods of time in one city. The mining engineer, with his nomadic existence, bears a hardship under licensing which is not borne by any other of the professions. I am informed that in one state only civil engineers are licensed and civil engineers are defined as all engineers except mining, metallurgical, and military engineers.

The mining engineers of Nevada temporarily killed the licensing bill there, the Boston engineers did the same for Massachusetts, and the engineers of southern California killed one effort in that state. The mining engineer might well devote some of the time which is not now required in producing metals to thought and expression on this topic, which so vitally affects him.

New York. PERCY E. BARBOUR.

The Joplin Mining District's Past, Present and Future

Although Ideally Situated, a Survey of Existing Depressed Conditions Shows That Efficient Development of Mines Has Been Hampered by Geological and Industrial Factors — Increasing the Tariff May Encourage Current Wasteful Methods

BY F. LYNWOOD GARRISON
Written for *Engineering and Mining Journal*

CONSIDERATION of conditions in the Joplin district presents some phases of industrial disorder deserving of the most careful study by the mining economist, be he engineer or operator. I recently spent several months in the Joplin, Mo., district, and had an exceptional opportunity to obtain an insight into the prevailing status of the mining industry there. It is the purpose of this paper to review the situation briefly, endeavoring to point out the origin of some of the fundamental forces that have given rise to these unprecedented conditions and also to indicate their growth and their inevitable results.

The Joplin mining district is that large lead- and zinc-producing region situated in the southwestern part of Jasper County, Mo., the southeastern corner of Cherokee County, Kan., and part of the northeastern corner of Ottawa County, Okla. In Newton County, Mo., there are several small detached camps, such as Granby and Spring City, of relatively small importance. The boundaries of this mineral-bearing domain are as yet undefined and probably are undeterminable. At the present time it is more than likely that the prospected and developed region constitutes but a small proportion of the whole area.

The mines clustered in and about the city of Joplin are supposedly exhausted, or nearly so, and have ceased to produce any considerable proportion of the whole output of the district. As a rule they were never as rich as the newer deposits in the Kansas-Oklahoma field. The assumption, however, that the Joplin mines are worked out is not, in my opinion, justified, difficult or impossible as it is at present, and probably as it may be for years to come, for them to compete successfully with richer discoveries further afield.

The mineralization of this great area is a matter of supreme interest, and should be of the first importance to the operator. It is, however, a highly technical subject, not yet wholly understood, although it has been intensively studied by geologists and mining engineers for the last fifty years.[1] Clearly to present the subject of this paper, general conclusions concerning the ore deposition may be briefly sketched.

SPOTTY OCCURRENCE OF DEPOSITS

The ores occur irregularly in sedimentary rocks having a slight westerly dip. The orebodies do not outcrop, although they are invariably near the surface, occurring from 50 to 150 ft. in depth in the eastern part of the field and from the 150 to 350 ft. in the Picher and Baxter districts. There are no surface indications of their presence, and they must be located, hit or miss, by drill holes or shafts. They may be likened to the raisins in a pudding or cake, whose presence beneath the crust is taken for granted. The limit of the pudding is that of the area of the particular rocks in which the ore occurs, and never elsewhere; but, of course, many parts of the pudding may contain no raisins, although the possibility always exists.

As the result of many years of prospecting and mining, certain almost unvarying characteristics of the orebodies have become clearly established. Thus the orebodies appear to possess a general trend or linear extension to the west and southwest, although this rule is not invariable, a peculiarity accounted for by Siebenthal[2] by their deposition in the channels of a former underground drainage through limestones of the Boone formation. This artesian hypothesis has been so well sustained by recent developments in the Oklahoma field, that little reason remains to question its soundness. Another characteristic is the intimate association of the ore with the black shales of the Mississippian rocks of the Lower Carboniferous, shales which are locally known as "soapstone," and form an impervious cover to the limestones. Undoubtedly the carbon and hydrocarbons of this formation were an important factor in the deposition of the ores.

In the Picher field the shale covers the deposits in an almost continuous sheet, preventing the underground mineral-bearing solutions from reaching the surface. Whether these solutions came to the surface in the more eastern fields at Joplin and Webb City, where the hydrostatic pressure was doubtless less, we have no means of knowing. We do know, however, that the shales are here much more patchy or spotty in their occurrence and frequently disrupted by local faulting and consequently could offer much less resistance to an upward flow. On the whole it would seem that the question of local faulting has not been given sufficient consideration by the geologists who have studied the subject.

TEMPORARY AND INDEPENDENT CHARACTER OF OPERATIONS

The ore deposition of the entire Joplin region is unquestionably discontinuous or at best loosely grouped and scattered over a large area. In consequence, the development has been spotty, each mine and mill, a small affair as metal mines go, being a separate unit or organization in itself, with a resulting duplication of overhead costs. In the course of years this system has been improved by the grouping of two or more mines under one management. No great mines and mills designed to operate on one plan over a long term of years exist in the district, the estimated life of any one deposit not being considered sufficiently great to warrant the expensive equipment which the refinements of modern mining and milling would require.

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[1] [illegible] and now [illegible]

[2] Bull. 606, U. S. Geological Survey. This publication is about the last word on the subject and is one of the best treatises that have appeared. Though the author has drawn freely from previous publications, he sticks consistently to his own thesis, which appeals to the technical reader familiar with the subject as sound and logical.

The fact that the lead and zinc deposits are so near the surface, and are scattered in spots over such a large area of flat prairie land, well provided with transportation, and certain other favorable living and economic conditions, combine to make the Joplin district pre-eminently a poor man's mining country. A few hundred dollars will suffice to drill some shallow holes, and a few thousand to provide a shaft from which to hoist ore, once it has been found in promising quantities.

An old type of mill cost four or five thousand dollars, and a lease on a 10 per cent royalty could be easily picked up for little or nothing; consequently, a Joplin miner or a group of miners could easily begin in a small way and often lay the foundations of a fortune. An even simpler beginning might be had with a horse-whim and a hand jig. As a poor man's country, Joplin is unrivaled, and may it long so continue!

The district, however, has had several booms, and it is questionable if on the whole they have been beneficial for the industry. Its fame for cheap opportunity was proclaimed world wide, with the result that all sorts and conditions of mankind floated in, only to drift out again after experiencing disaster in attempting a mining game that looked easy but which is actually hazardous to the ill-equipped in funds and practical experience. It is truly a poor man's camp only to those thoroughly familiar with the peculiarities of the district.

The present business depression is proving a terrible experience for the small operators, and unless a decided change for the better soon takes place many of them will be bankrupt. The basic conditions of the whole industry are unsound, unelastic, and must be changed if the district is once again to prosper and not cease to be a poor man's opportunity.

Leasing System Subject to Numerous Evils

Probably the most serious of the fundamentally bad conditions are some of the common practices of the leasing system. In the Joplin region the land owner is seldom an operator, although land is cheap and there is plenty of it. In the "good old days" of twenty-five or thirty years ago, the usual practice was to lease blocks of forty, eighty, and one hundred and sixty acres, to operators for periods of ten to twenty years at a 10 per cent royalty. That is, the operator paid the land owner 10 per cent of the market price of the lead and zinc concentrates which he sold, usually at the end of each week. The settlements being made in cash through the bank, were a good remuneration for the land owners and not hard on the tenant as long as the mine continued to be fairly productive.

Previous to the boom of 1897 such leases could often be had for the asking, which brought in its train a horde of speculators and established the practice of buying and selling leases, as in the oil business. Ridiculous prices were paid for leases, which at best are always a dubious asset, unless for a long term; royalties were pyramided up to 25 and even 30 per cent, and almost every outsider who came into the district during the boom days departed a poorer, if not wiser, man. Such experiences are not conducive to the good name of the place or its inhabitants, and were repeated in an even more accentuated form during the recent boom of 1915-1918, when ore prices reached the highest ever known, a condition complicated by the fact that the event was practically coincident with the discovery and development of the Oklahoma field, where nearly all the land is owned by Indians.

When the Government gave these lands to the Indians is was supposedly for agricultural homestead purposes, and the mineral contained therein was probably not considered. It cannot be said that the huge sums the Indians are now getting from royalties is to their best interests morally or in the end materially, and the uncertainties and complications involved in the mining leases granted on these lands are not conducive to the sound, healthy development of the white man's business. Much confusion and uncertainty as to title would be removed were the Government to establish a uniform, liberal policy in regard to the leasing system, especially were royalties never in excess of 10 per cent and the life of leases not less than twenty years, which leases should also contain a prohibition forbidding any increase in the royalty when or if transferred or sold.

Royalty Above 10 Per Cent Not Warranted

The average operator cannot afford a royalty above 10 per cent. He might be able to pay 25 in war times, when zinc concentrate brings $100 or more per ton, but under normal conditions the richest mines in the Oklahoma field cannot make their zinc concentrate for less than $16 to $20 per ton, and then only for short periods when the richest ore is being mined. Taking the Joplin district as a whole, it has been estimated that under the recent cost for labor and supplies, the average cost per ton of ore hoisted into the mill is about $2.40. The average tonnage of concentrate is 6 per cent of the weight of ore milled; hence $40 is the cost per ton of 60 per cent concentrate in the bin. The royalty is not included, as that is deducted from the selling price when the ore is shipped from the mill to the smelter, whereby the land owner parts with his interest in the product. The land owner is always sure of his royalty, whether the operator makes or loses on his output.

One of the results of this Government policy, or the lack of it, has been to stimulate development on non-Indian lands, especially those in Kansas immediately west of Baxter, where, geologically, conditions are precisely like those in the Picher field. In fact, it is all one area in a geologic sense. The prospecting operations now going on in this district appear to be in strong hands and to be getting good results. The drift of development is undoubtedly across the state line north and northwest from Oklahoma into Kansas, which will have the effect of making Baxter the most important mining and business center of the whole region, because it has excellent railroad connections and is an old, well-established town.

Twenty years ago it was generally believed that no ore would ever be found west of Baxter Springs. The discoveries along Tar Creek, in Oklahoma, just south of the Kansas state line, began the development in the Picher field, closely followed, if not contemporaneous with, the ore strikes at Commerce, just north of the little cow town of Miami, Ottawa County, Okla. The boom of 1917-1918 made this squalid settlement on the banks of the Neosho River one of the most modern, attractive little cities in the Middle West. We earnestly hope it will survive the present crisis, even though the drift of the mining development is trending more and more toward the north.

In writing about this interesting region, its mines, and its men, it is pleasant to be able to record the unusually cordial and mutually helpful relations between operators and employees. Strikes are unknown, no labor unions exist in the district, and the miners are almost wholly native-born Americans, mostly boys reared on neighboring farms. Negroes are conspicuous by their absence, and are not wanted in any capacity. Many of the operators and practically all the superintendents were once just common miners, who raised themselves step by step, as an intelligent native American will do when given the opportunity, freed from the trammels of restrictive unionism and the poison of specious propaganda.

The operators deserve great credit for the way they have combined to build good roads and hospitals, and especially for the considerate treatment of their men in the present industrial depression. During the last winter not a few mines were operated at an actual loss so as to keep the men from distress, and the miners in turn intelligently and willingly agreed to a considerable reduction in wages, for there was little difficulty in making them understand the situation and the need for co-operation and essential concessions in remuneration.

A dreadful disease due to the character of the rock in which the ores occur, known as miner's phthisis, or consumption, and which has been the cause of so much trouble in the Transvaal gold mines, is not uncommon in the Joplin district. The finely powdered siliceous dust, composed of sharp angular microscopic fragments of flint, enters the lungs and cannot be thrown off, resulting in time in tuberculosis. Here, as in South Africa, preventive measures have been taken, and the trouble has been minimized as much as possible, but sad cases are often found which are beyond cure. In such instances the operators and the men themselves have been most sympathetic and helpful to unfortunate victims. It is to be hoped that a well-founded sanatorium will be established ere long for the care of these miners. The men who have made fortunes in this district ought to bear this in mind, and doubtless will do so when they realize the need. Sanitary conditions and the comfort of the men cannot be expected to be as complete and efficient at the small plants common in the district as they are at great mines whose life in one spot may cover many years. The little mines and mills are here today and gone tomorrow. Tearing down and rebuilding the same mill miles away is a common practice in the Joplin district.

IMPROVEMENTS IN MARKETING AND FINANCING DESIRABLE

The great danger of the present crisis lies in the fact that so many of these mining companies are overcapitalized and have no financial resilience. They paid large prices for their leases during boom days, the royalties are now excessive, and the whole district suffers essentially from a lack of common-sense economies which sooner or later must be adopted if a large number of the operators are not to become bankrupt. A system of co-operative selling of their product, thus eliminating the pestiferous "ore buyer"; a combined agency for the purchase of supplies, and the elimination of the elusive and peripatetic "powder agent" are among the reforms most urgently required. Nor are the operators unaware of the need for these reforms. The difficulty has been to obtain co-operative action sufficiently strong to overcome the inertia of established custom and the subtle influences of personal friendships and obligations.

Upon questions of operation and technical practice a visiting engineer, even though he be a former Joplin operator like the writer, does not willingly offer gratuitous criticism. He knows from experience the difficulties of the situation; he is more sympathetic than censorious, being fully aware of the fact that there are engineers in the district more competent than he is to suggest improvements wherever conditions may seem to warrant or justify them.

At first sight, nearly all the engineering practices in the district seem and are crude. After a better acquaintance with conditions, a reason for these seemingly slipshod methods is evident. The question is, are they not carried too far? Are not the wastes and extravagances of which everybody is conscious the result of the unsound, fundamental defects that I mentioned in the beginning of this paper? Would not larger and financially stronger companies, provided with competent engineering staffs, eliminate these wastes? Undoubtedly they would, but the poor man and his little mine could not compete, and his eventual elimination might follow, which, in my opinion, would be a calamity.

JOPLIN DISTRICT ADVANTAGEOUSLY SITUATED

In quality and in quantity the Joplin zinc ores are without a world rival. As placed on the market, the concentrate averages a metallic content of 60 per cent zinc, little iron, and a large amount of sulphur, usually wasted by the smelters, to the annoyance of their neighbors and the satisfaction which some corporations seem to enjoy in squandering the gifts of a bountiful Nature.

The demand for these rich ores to "sweeten" the leaner grades of other localities ought to be, and probably is, large. European smelters are keen to have them, but were unable to import them in pre-war days, for various reasons which cannot now be discussed. At the present time their need is even greater, but the differential in exchange forbids importation. Hence with the domestic zinc market shot to pieces, the poor operator holds the bag while interest charges and natural deterioration of plant eat him up.

It seems useless to delude ourselves with the hope that the condition of the zinc industry will materially improve in the near future unless something is done to assist it. Whether anything can be accomplished with that end in view is an important question. The usual nostrum suggesting itself to the political economist in such cases is the tariff pill: that wonderful panacea for all the economic evils which afflict a hermit country sufficient unto itself, and unconscious of the needs of its fellow nations near and far. At present the zinc industry stands on all fours with copper. Facilities for the production of both metals were so stimulated by war necessities, that the zinc industry is able to produce today more metal than the normal market can absorb or is likely to need for some years.

Turning aside from these pessimistic and oppressive facts, it is pleasant to consider briefly what a truly wonderful country is the Joplin region. Rich soil, mild climate, excellent railroad facilities, good roads, a neighboring supply of coal, natural gas, some relatively inexpensive hydro-electric power, and the great oil fields of Oklahoma and Kansas but a few miles distant. In brief, it would be difficult to find a more favored region in this much favored United States.

In the face of the extraordinary advantages of location can it be maintained that the Joplin lead and zinc industry needs the stimulus of a protective duty on imported ores? Will not such an artificial incentive react in promoting and maintaining wasteful domestic practices that could not survive were it necessary to meet competition? Is it not going contrary to human nature to expect any other result? Is not our whole American protective theory based on the questionable premise that our higher scale of living and wages demands safeguarding from competition of goods produced by people living on a lower plane? There is no doubt we live in a manner which we believe to be better than that of any other nation in the world. Whether we are actually any better or happier for it is another question. At any rate in the case under discussion should not freight rates and the extraordinary natural advantages I have enumerated afford all the protection any mining, metallurgical, or manufacturing industry established in the Joplin district has any right to expect? Why burden a whole nation with the increased costs of a commodity if the only result is encouraging slipshod, wasteful practices, and providing inordinate profit to a favored few rather than as a reward of skillful, thrifty, and sound business methods?

There was a time in our national history, not so many years ago, when a high protective tariff was needed, and results, in encouraging the establishment of new American industries, subsequently justified it, but are we now, as the leading industrial nation of the world, justified in creating a new high protective tariff as a general policy? Doubtless in some cases it ought to be done, where special conditions exist against which it would be hopeless to compete. An instance would probably be that of metallic zinc smelted in Mexico and by the German smelters of Silesia and Poland. Joplin ores, however, should be beyond competition. They are incomparable in themselves, and are produced under such favorable conditions that the mining situation of the whole district would seem to be impregnable.

The tariff is an extremely controversial subject; opinions regarding it are usually influenced by self-interest and local sentiment. But the time has now arrived when we ought to have the courage to put these questions to ourselves and answer them in what we would honestly consider to be for the best interests of the whole country and for the sensible conservation of our mineral resources, irreplaceable and not limitless.

Phosphate in Tunis

By HENRY L. GEISSEL

Written for *Engineering and Mining Journal*

The production of phosphate is one of the principal industries of the French Protectorate of Tunis. According to official figures just published in the "Statistique Générale de la Tunisie," the exports of phosphate during the last few years were as follows:

	Tons	Total Value in Francs	Price per Ton in Francs
1910	1,334,000	29,354,000	22 0
1913	2,072,000	45,522,000	21.98
1915	1,170,000	26,910 000	23.0
1917	677,000	23,681,000	34.98
1919	1,075,000	48,385,000	45.01

Before the outbreak of the war the annual exports increased in quantity, though the price decreased. Exact figures for 1920 are not available, but it is safe to say that production did not exceed that of the previous year. The Tunisian phosphate industry is hampered seriously through want of laborers. For this reason Italy has to place a certain number of workmen at the disposal of the Tunisian authorities, in order to obtain sufficient phosphate for the requirements of the country.

The price for phosphate, which from 1910 to 1913 showed a declining tendency, has largely increased again, chiefly on account of the enormous increase in wages and raw materials, such as coal.

The principal importers of Tunisian phosphate were:

	France	Italy	Germany	England
	In 1,000 Metric Tons			
1910	501	350	62	175
1913	690	453	185	181
1915	342	399	...	197
1917	143	226	...	205
1919	184	335	...	242

At present the bulk of the Tunisian phosphate is shipped to France and Italy. England takes third place, although in 1918 that country received as much as France and Italy together. On account of the war, the exports to Germany have ceased entirely.

Differential Flotation Tests on Galena-Sphalerite Ores

The U. S. Bureau of Mines has recently issued an interesting bulletin (No. 205) descriptive of experimental work carried on in the Cœur d'Alenes. The general conclusions reached, which of course apply only to the lead-zinc ores of the Cœur d'Alene district in Idaho, are interesting:

1. A complete separation of the lead and zinc sulphides by differential flotation is impossible, owing to the intimate association of the minerals.

2. Fine grinding is essential to liberate most of the sulphide minerals and to permit their separation by differential flotation.

3. A better recovery is possible with an ore that has been crushed wet than with one that has been crushed dry.

4. A pulp density of about $2\frac{1}{2}:1$ to $3\frac{1}{2}:1$ (water to solids) seems to give the best differential selection and mineral recovery at normal temperature.

5. Each ore seems to require a somewhat different flotative mixture and the effect of a certain oil or chemical on one ore may differ from that on another similar ore.

6. Differential flotation effects a more satisfactory separation of the sulphide minerals than has been obtained by existing methods.

7. A better differential selection of the lead from the zinc sulphide is effected with an alkaline or neutral pulp than with an acid pulp.

8. The quantity of the chemical or flotation agents used in the small-scale tests can be reduced in large-scale tests or in practice.

9. Soda ash, sodium hydroxide, sodium silicate (water glass), salt, lime, coal-tar creosote, alcohol, gasoline, and charcoal seem to assist in the selective separation and recovery of lead sulphide in the presence of zinc and iron sulphides. Their effectiveness, however, may be modified by the gangue constituents of the ore.

10. Copper sulphate or some other copper compound, such as copper carbonate, when added to a pulp containing soda ash after the lead concentrate has been removed, seems to give good results in floating the zinc mineral in some of the ores.

11. The Bradford SO_2 process seems to be adaptable to the separation of the lead and zinc sulphides of some ores.

SHAFT-SINKING CREW AT VAN DYKE NO. 1 SHAFT, MIAMI, ARIZ.

Sinking Van Dyke No. 1 Shaft

Conditions Under Which Operations Were Conducted Permitted Good Progress, And at One Time the World's Shaft-Sinking Record Was Claimed—Plugger Drills Used as Moiling Machines—Gila Conglomerate Stated To Be Dry Formation

By E. R. Rice

Written for Engineering and Mining Journal

THE property of the Van Dyke Copper Co. is situated at Miami, Gila County, Ariz., and at the southeast end of what is locally known as the "Miami mineral zone." This area, which is the locus of the orebodies of the Miami and Inspiration mines, is a crescent-shaped zone of mineralization, and as developed to date is about two miles long and approximately 2,000 ft. in width at its widest part. The relation of the zone of mineralization to the properties of the district is shown in Fig. 1.

The orebodies of the Miami and Inspiration mines are of the disseminated chalcocite type, typical of that group of mines generally classed under the head of "porphyries." The greater part of the ore developed in the district occurs in the Pinal schist, though important orebodies are found in the Schultze granite in some places where it has intruded the Pinal schist. The depth at which the present developed ore occurs below the surface of the ground varies from 200 ft. to 1,200 ft.[1]

The eastern end of the Miami mineral zone has been faulted downward by the Miami fault, the fault limiting the main orebody of the Miami mine on the southeast. Locally the Miami fault strikes N. 22 deg. E. and dips to the southeast at an angle of 46 deg. On the northwest (foot-wall and up-throw) side of the fault occur the present developed orebodies of the district, and all geological evidence obtainable points to the probability of ore of similar character being found on the hanging-wall or down-throw side of the Miami fault to the southeast. The surface rocks to the northwest (locally) of the Miami fault consist of Pinal schist, with intrusions of Schultze granite; those to the southeast are Gila conglomerate, which has been faulted downward

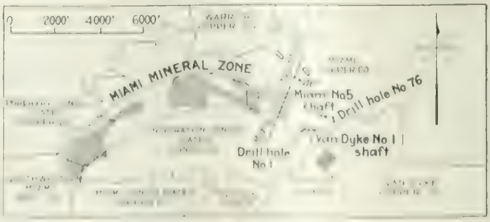

FIG. 1. MIAMI MINERAL ZONE

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[1] [illegible] information regarding the [illegible] of the Miami district [illegible] Deposits [illegible] F. L. Ransome [illegible] Geological Survey, Professional Paper [illegible]

against the schist and granite. The Gila conglomerate is of later origin than any other formation in the district and was deposited subsequent to ore deposition and the ensuing secondary enrichment. Consequently, no surface criteria are obtainable to guide one in the search for ore beneath the conglomerate.

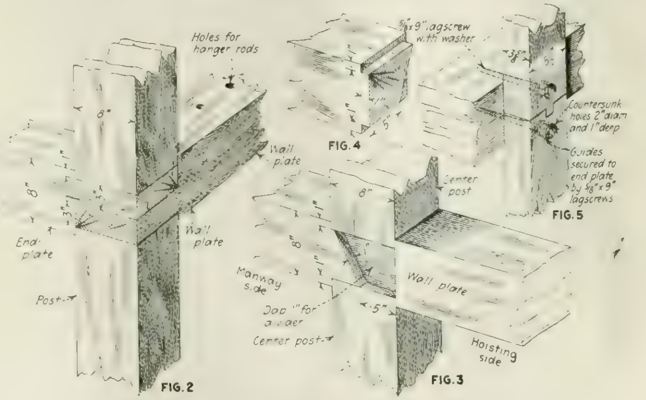
The property of the Van Dyke Copper Co. lies to the southeast of and on the hanging-wall side of the Miami fault and is in line with the probable extension of the Miami mineral zone. Drilling operations for exploration purposes were started in 1916, operations being confined to that portion of the property near that of the Miami Copper Co. At the time of starting drilling operations the thickness of the Gila conglomerate as well as the vertical displacement of the Miami fault were unknown, as drill hole No. 76 of the Miami Copper Co. was reported to have been abandoned in Gila conglomerate at a depth of 2,050 ft. Miami No. 76 drill hole is about 1,300 ft. northeast of Van Dyke No. 1 drill hole. No. 1 drill hole of the Van Dyke Copper Co. encountered an orebody of commercial grade at a depth of 1,170 ft., which continued to a depth of 1,219 ft., at which depth the hole was lost. This orebody was composed of silicates and carbonates of copper. No. 1 drill hole indicated that the thickness of the Gila conglomerate was 730 ft., although at the time of drilling this hole the evidence was not accepted as conclusive, on account of the Gila conglomerate (locally) being composed entirely of fragments of Pinal schist near its base.

Owing to war conditions, drilling was discontinued early in 1918, and when development work was resumed, in 1919, it was decided to sink a shaft near No. 1 drill hole and carry on exploration by underground methods. The main reasons for this decision were the high cost of drilling and the great danger of losing deep holes. The shaft which is known as Van Dyke No. 1 was started in the spring of 1919 and is intended for development and exploration purposes only. As the probabilities of this ever being used as a working shaft are remote, it was the policy of the management to keep equipment and operating expenses at a minimum.

The shaft is of two compartments, measuring 6 ft. x 11 ft. outside the timbers. Lining sets are of 8-in. x 8-in. timber placed 5 ft. center to center excepting in bad ground, where the interval was made smaller, depending on conditions. Lagging is of 2-in. x 12-in. plank, the shaft being lagged solid. Guides are of 3⅝-in. x 5½-in. clear, straight-grained Oregon pine, having a length of 15 ft. Sollars are placed every 15 ft., or three sets. Inclined ladders are used, the opening in the sollar being under the ladder above. Framing details are shown in Figs. 2, 3, 4, and 5.

To a depth of 760 ft. the shaft is in Gila conglomerate, and a novel method was employed for sinking through this formation. Locally the Gila conglomerate is composed of unconsolidated fragments of Schultze granite and Pinal schist, though near the base it is made up entirely of schist fragments. The fragments composing the Gila conglomerate range from clay and sand to boulders several feet in diameter. It is too hard to pick, and is difficult to drill, on account of the raveling and the holes. To one familiar with this formation, the term "hard-pan" comes nearer describing it than any other.

The main features in the method to be described were first used by the Foundation Co. in the sinking of the No. 5 shaft of the Miami Copper Co., which is situated about 1,000 ft. northeast of the Van Dyke No. 1. In this method the "plugger" type of drill is used as a moiling machine, and the practice of moiling out the entire shaft section is followed.



FIGS. 2, 3, 4 AND 5. TIMBER FRAMING DETAILS

In the practical application of this method, a trench or sump wide enough to hold the sinking bucket and about 18 in. deep is removed across the center of the shaft and at right angles to the long axis of it. The two benches left are then moiled off, and the operation is repeated. In the sinking of the Van Dyke shaft, the following procedure was followed: A cut was started at the point *A*, Fig. 6. This was done by the machinemen driving their bull pick bits down so as to form a V as shown in Fig. 7, and then prying up the material in the V, using their machines and steel as a prying unit. The first V would be about 12 in. deep, and this would be enlarged by successive cuts until a sump was formed at *A*, Fig. 6, about 18 in. deep and wide enough to hold the bucket. This sump would then be extended across the shaft as shown by the dotted lines in Fig. 6.

After the completion of this work benches about 18 in. high at each end were left. One machine man and one mucker worked each of these, the machine man standing on the bench and the mucker in the sump. The method of moiling off the bench is illustrated by Fig. 8. The machineman would drive his steel down about 8 in. from the face of the bench, and then, using his machine and steel as a prying unit, he would pry off the ground between his steel and the face of the bench. As he worked across the shaft, he practically had two free faces to break to at all times. The mucker shoveled directly from in front of the machine, and a large proportion of the broken muck fell on his shovel. That which did not, lay on a comparatively smooth bottom, and was easy to shovel. A machine man kept one mucker busy, so that there was no waiting. The drill was running constantly, and as soon as the machine man had pried off one bite, he immediately lifted his machine and started on another cut.

The drills used were the Waugh Clipper No. 55. To develop a more powerful blow and to save air, the blow valves and ratchets were removed from the machines and the hammers were plugged. Although no measurements were made to determine how much this increased the efficiency of the drills as moiling machines, the improvement appeared to be about 75 per cent.

WATER HANDLED BY BAILING

Sinking was started with one shift per day and was continued on this basis until the shaft had reached a depth of 700 ft. Water was struck at 300 ft., and by the time the shaft was 700 ft. deep the flow had increased to such an extent that it was decided to operate three shifts. Water was handled entirely by bailing, as it was regarded as inadvisable to install pumps while the shaft was in the Gila conglomerate. This flow of water increased from 5,000 gal. to about 10,000 gal. per day soon after the schist was reached.

When a three-shift basis was started it was decided that we had an excellent chance to break the world's record for shaft sinking, so a telegram was dispatched to the *Engineering and Mining Journal* for data and the following reply was received: "New world's record claimed at Crown Mines, Johannesburg, South Africa, where circular shaft 20 ft. in diameter was sunk 279 ft., or from 655 to 934; average speed 9 ft. in twenty-four hours, during December, 1918. Previous world's records also held at Crown Mines, where 252 ft. was made in thirty-one days at No. 14 circular shaft."

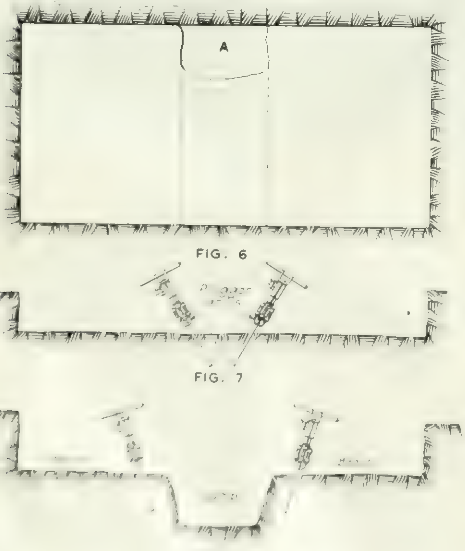


FIG. 6

FIG. 7

FIG. 8

FIGS. 6, 7 AND 8. METHOD OF MOILING

On Feb. 1, 1920, the shaft was measured by an independent engineer, and on that date we "started after" the world's record. The shaft was 755 ft. deep and in Gila conglomerate. On the night shift of February 1, the shaft passed out of conglomerate at a depth of 760 ft. and entered Pinal schist, which is of a different character than the Gila conglomerate. In places the schist was badly shattered, and moiling could be used to advantage. In other places the ground was hard and required blasting. Where sloughing ground was encountered it was necessary to use short sets and keep the timber right down to the bottom, using spilling and lacing below the bottom set.

In blasting, eighteen-hole rounds were put in, using the center V cut. The cut holes were drilled 10 ft. in depth and the squaring-up holes 9 ft. Blasting was done with delay-action detonators, using 200-v. alternating current for ignition.

WORLD'S RECORD CLAIMED

Thirty-one days after starting on this program the shaft was again measured by an independent engineer and found to be 1,063.2 ft. deep, which showed a progress of 308.2 ft. in thirty-one days. The actual working time was approximately twenty-nine and two-thirds days. We claimed the world's record, although I understand the Crown Mines now claim it with a progress of 310 ft. in thirty-one days, or 1.8 ft. more than our record.

The following figures giving footage per shift from surface to a depth of 1,063 ft. are interesting: The actual number of shifts employed in sinking this depth was 305. This gives an average progress per shift of 3.48 ft. or, considering a 93-shift per month basis, is equivalent to a progress of 323.6 ft. per month, or 10.44 ft. per day actual working time. I think we are safe in claiming the world's record for sinking 1,063 ft. in 305 working shifts. There was a total (surface and underground) of 2,296 man shifts employed to this depth, making a progress per man shift of 0.46 ft. of completed shaft. This work included framing timbers, hoisting, blacksmithing, sinking, timbering, lagging the entire shaft section, putting in guides, air pipe, sollars every fifteen feet, ladders, and other complementary work—in other words, the making of a finished shaft.

DETAILS CONDUCIVE TO SPEED ADOPTED

The shaft sinking was done on contract. In hiring men, the contractor employed only experienced shaftmen, who were paid substantially more than the prevailing rate of wages in the district. Every man had a specific duty to perform; consequently he became proficient in that particular operation. The plan also served to fix responsibility for all details of the work. A normal crew consisted of a hoisting engineer, who looked after the compressor; a top man, and five men in the bottom of the shaft, one of whom acted as jigger boss. Besides these men there was an extra man on day shift, who framed the timbers and sharpened steel with the help of the top man. Only four out of the five men worked in the bottom, excepting when timbering was being done. The fifth man rested. This allowed a man to rest 20 per cent of his time, which enabled the crew to work at top speed. Not only were they able to do this on account of the rest obtained, but they had no psychological reason for doing otherwise. In other words, they had no excuse to "taper off."

In blasting ground, the method of operation was similar to good practice elsewhere, although in this instance the moiling machine was used in conjunction with regular blasting operations. After a round had been mucked out, it was always possible to moil a foot or so of shaft below the area broken by the blasting, thereby giving an extra foot of shaft with no extra blasting and with little time and expense. This also left the bottom in good condition for drilling the next round.

All timbering operations were standardized. Each man on the job always knew what the next detail of the work would be, knew when it would start, and knew his part in the general plan. When the drilling crew was ready to timber, the men gave the engineer a prearranged signal, and two of them were hoisted about 100 ft. up the shaft, where they removed four hanger rods. (Hanger rods were left in for about 100 ft. above the bottom. In bad ground they were left in permanently; in which case, new hanger rods were sent down from surface.)

In the meantime, the other three men were getting everything in readiness for timbering. While the hanger rods were being put in the last set, the bucket was sent to surface and detached from the cable by the top man, who in the meantime had the two wall plates in readiness for lowering. The wall plates were attached to the cable by means of a large clevis, the clevis bolt being placed in the hanger-rod holes in the wall plates. As soon as the wall plates were detached from the cable, it was sent to surface, and the water bailer was attached in place of the regular sinking bucket. The bailer was of 25-cu.ft. capacity and the sinking bucket was of 13 cu.ft., consequently the former was better adapted to handling timber, blocks, and wedges on account of its greater size. It was also in position to bail the water that had accumulated during the course of timbering as soon as it was necessary to do so.

The end plates and posts were then sent down, arriving at the bottom about the time that the wall plates had been swung into position. The end plates were then put on the posts placed in position, and the set was pulled into place by the hanger bolts. The set was then lightly blocked into approximate position by means of temporary blocks. In this way it was possible to judge the exact size of the blocks to be used. These were then split to the proper dimensions, the temporary blocks removed, and the permanent ones inserted. When all permanent blocks were in place, the set was wedged to its final position.

In blocking the set, a 2-in. x 12-in. timber about 18 in. long was placed next to the set at the joint, so that the blocking pressure would be evenly distributed over the entire joint. Alignment was maintained by means of plumb lines in three corners of the shaft. After the set was blocked the divider of the set above was put in and the blocking at the center of that set securely wedged. The divider of the last set was always left out to simplify handling of the bucket and working in the bottom. The lagging was then put in place, securely blocked and filled, so that the ground could not slough more than the length of one set.

While four men were finishing up the lagging, the fifth man bailed out the water, and by the time the timbering was finished the bailer could be taken off and the sinking bucket put in place ready for the resumption of sinking operations.

In timbering, each man worked on a certain corner, while the fifth man unloaded timbers, handled the bucket, and rendered general assistance to the other men. This arrangement afforded a crew of four individual units, one at each corner, which combined to make two crews of two men each at each end of the shaft. With the same man handling the same corner all of the time, the men became very proficient, as they soon learned each other's peculiarities and methods and worked together like a well-trained team. Also, by this arrangement, it was easy to fix responsibility for any part of the work. In framing timbers, most of the framing was done by means of a 26-in. cut-off saw which was driven by a belt placed on one of the flywheels of the air compressor.

The crosshead used is shown in Fig. 9. The guide shoes extend the entire length of the crosshead, and are formed by bolting ¼-in. x 8-in. flat iron to the 4-in. x 6-in. side pieces. In sinking, the cable passes freely through the crosshead, which is carried by the clip *C* on the cable. This clip is in two halves and is clamped to the cable by bolting the halves together. It was originally a shaft coupling, and serves its function as a clip admirably. It is flat on the top, and permits the cable to rotate freely in the crosshead. This is important in sinking operations, for in most instances where the cable has broken while sinking, the point of failure has been at the place where the clip is attached to the cable.

Failure of hoisting cables is usually caused by a combination of three features of operation: First, by strain put on the cable by the clip as it comes up against the stationary crosshead resting on the bumpers; second, by bending of the cable at the point where the clip is attached—this being caused by the bucket swinging pendulum-like under the crosshead as it passes up and down the shaft, and, third, by the rotation of the cable being suddenly arrested when the clip comes up against the crosshead, which is caused by using a clip that will not allow the cable to rotate freely in the crosshead.

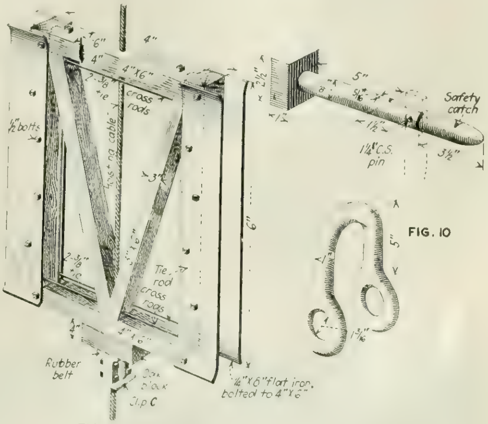


FIG. 9

FIG. 10

FIGS. 9 AND 10. CROSSHEAD AND CLEVIS

If a loaded bucket is hoisted from the bottom of the shaft, by the time the clip has reached the crosshead at the bumpers—fifteen to forty feet above—the cable is untwisting rapidly, and the heavily loaded bucket has acquired a strong movement of rotation about its vertical axis. If the clip on the cable is such that this rotation is suddenly stopped when the clip comes up against the crosshead, the effect is to place severe alternating stresses on the cable at the point where the clip is attached. My personal belief is that the third cause of failure is more dangerous than the other two combined. By using the clip described, the rotation of the cable is brought to a gradual stop and the twisting and untwisting below the crosshead, caused by using a clip that does not allow the cable to rotate, is practically eliminated. Allowing the cable to rotate freely in the crosshead, in addition to hanging the crosshead on a trigger while the bucket is being dumped, will aid considerably in preventing cable breakage. In sinking the Van Dyke shaft, about 15 ft. was cut off the cable every three or four weeks.

Fig. 10 illustrates the type of clevis and pin used to attach the bucket to the cable. A regular thimble was used in the end of the cable and was attached to it by means of four Crosby wire-rope clips.

Hoisting buckets of 13-cu.ft. capacity were used. The general arrangement of the dumping apparatus, shaft doors, and other operating devices, is shown in Figs. 11 and 12. Fig. 11 shows the position of the bucket, chute, trigger, counterweights, and doors just after the bucket has been hoisted and is ready to be lowered for dumping, and Fig. 12 illustrates their position after the bucket has been dumped. When the bucket has been hoisted, the top lander pulls the rope *R*, Fig. 11. This causes the different pieces of apparatus to take the positions shown in Fig. 12, with the exception of the bucket, which is shown in the position it assumes after having been dumped. The bucket is then lowered to the swinging chute *C*, the chain attached to the bottom of the bucket engaging in the catch *D*. The edge of the bucket strikes the block *E* which causes it to dump and assume the position shown in Fig. 12.

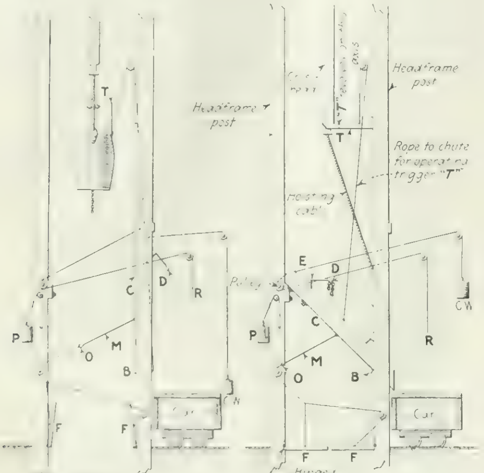


FIG 11 FIG.12

FIGS. 11 AND 12. DIAGRAMS SHOWING HOISTING AND LOWERING OF BUCKET

It will be seen from the figures that when the top lander pulls the rope *R*, the chute *C* drops into the dumping position, the doors *FF* are closed over the collar of the shaft, and the trigger *T* drops into a horizontal position so that it will support the crosshead while the bucket is being dumped. By closing the doors the danger of rocks falling down the shaft is eliminated. A little psychology is here at work, for although there is not much danger of a rock falling down the shaft if the doors are *not* closed, nevertheless one *might*. By holding the crosshead up while the bucket is being dumped serious bending strains on the cable are lessened.

After the bucket has been dumped and hoisted so as to clear the chute the top lander pulls the counterweight *CW* and the chute, doors and other parts return to their normal position shown in Fig. 11.

In constructing a dumping arrangement of this type, the main considerations are the proper weighting of the different components and the adjusting of the positions of the different ropes and pulleys. This is done best by a cut-and-try method. To anyone duplicating the arrangement shown I suggest that the angle of the chute be made at 45 deg. with the horizontal when in the dumping position. Make the catch *D* strong, preferably out of pick steel, and bend the end of the catch downward at an angle of 45 deg. Bolt the block *E* and the catch *D* securely to the chute and make the shaft or axle *B* very strong, preferably out of 2-in. shafting if obtainable. The pulleys should be of at least 4-in. diameter, and flexible light-wire cable should be used for the operating doors.

When timbering operations are going on, the chute *C* is in the position shown in Fig. 11, but it is necessary to open and close the doors *FF* for changing buckets, handling timber or other work. To simplify handling the doors, the rope *M* is provided with a ring and hook at *O*. By unhooking at this point, the rope to the doors can be connected to the counterweight *P*, which almost balances the weight of the doors, and they can then be raised and lowered at will, independent of the chute and with little effort.

RELATION OF SHAFT TO GEOLOGY OF DISTRICT

The Van Dyke shaft, being the first working to penetrate the conglomerate east of the Miami fault, is of more than ordinary interest from a geological standpoint. Although the lateral work done from the shaft is not yet sufficient to clear up all obscure points, some interesting data have been obtained. The following is a log of the shaft from collar to bottom:

0 to 760 ft. formation is Gila conglomerate.

Water struck at 300 ft., the total flow being 5,000 gal. per day at the base of the conglomerate and increasing to 10,000 gal. per day when the shaft had reached a depth of 1,100 ft.

Pinal schist entered at depth of 760 ft.

Leached Pinal schist from 760 ft. to 1,183 ft., showing small amounts of chalcotrichite.

Orebody composed of carbonates and silicates of copper extending from 1,183 ft. to 1,218 ft.

1,218 ft. to 1,430 ft. Pinal schist showing small amounts of chrysocolla, malachite, azurite, cuprite, and native copper.

1,430 ft. to 1,595 ft., Pinal schist carrying chalcocite in stringers and disseminated grains.

1,959 ft., top of primary zone. Schist carrying pyrite and chalcopyrite.

Granite (dike) from 1,610 ft. to 1,635 ft.

1,635 ft., encountered Miami fault.

1,635 ft. to bottom of shaft at 1,692 ft. consisted of fault drag composed of fragments of Pinal schist.

For several years, in fact ever since the discovery of the Miami orebody and the realizaton of the fact that probably a portion of this orebody has been faulted downward toward the southwest by the Miami fault, there has been much speculation as to the amount and direction of displacement of the Miami fault. Nothing can be learned from an investigation of the surface, as the country to the southeast of the fault is composed entirely of Gila conglomerate. The Miami Copper Co. drilled its No. 76 hole to a depth of 2,050 ft. (Fig. 1) and reported the hole in conglomerate for the entire distance.

F. L. Ransome in *Professional Paper* 115, "The Copper Deposits of Ray and Miami, Ariz.," p. 178, says, "The search for ore under the Gila conglomerate between Miami and Globe would be greatly facilitated if the direction and amount of displacement of the Miami fault were known. The present investigation gave no clew to this much-desired information, and although special study devoted to this particular problem might possibly lead to its solution, it is difficult to see what line of attack would be likely to yield definite results. One suggestion is that a careful study be made to determine the character and amount of the displacement of the Main porphyry dike in the Miami workings. This is cut off, of course, by the Miami fault, and it is as difficult to predict where its eastern continuation may be found as to determine the position of a possible continuation of the Miami orebody beyond the fault."

The collar of the Van Dyke shaft is 3,630 ft. above sea level. The elevation of the schist on the foot-wall side of the Miami fault is 3,775 ft. The elevation of the contact between the conglomerate and schist in the Van Dyke shaft is 2,870 ft. Disregarding erosion of the foot-wall side of the Miami fault subsequent to faulting, tilting of the faulted blocks, and other features, this would give a minimum throw of approximately 900 ft.

The upper limit of the chalcocite zone is found in the Miami mine (foot-wall side) at an approximate elevation of 3,500 ft. The upper limit of the chalcocite zone was struck in the Van Dyke shaft (hanging-wall side) at an elevation of 2,200 ft. Assuming the upper limit of the chalcocite zone to be horizontal, and disregarding downward migration of chalcocite since faulting, this would give a throw of 1,300 ft.

Nothing was found during the course of sinking that would throw definite light on the amount of lateral displacement of the Miami fault, if any. The answer to this problem will not be had until more extensive work has been done in the schist on the hanging-wall side. Work that promises to give an early solution to this question is now in progress by both the Miami and the Van Dyke companies, the former being engaged in deepening its No. 5 shaft and the latter doing lateral exploration on its 1,550-ft. level.

In closing, I desire to refute the statement made by a prominent engineer to the effect that the Gila conglomerate, locally, is a wet formation. In the course of extensive churn drilling, covering the district from end to end, I have invariably found the Gila conglomerate to be what is known as a dry formation. The water occurrence in the conglomerate passed through by the Van Dyke shaft may be described as typical of the entire formation.

Southern Rhodesian Mineral Production

Southern Rhodesia's mineral production for 1920 was valued at £4,450,988, as compared with the 1919 total of £3,519,375, according to the Government Mining Engineer's report. The principal increase was in gold, which, despite a decrease in weight of 40,724 fine ounces, increased in value by £557,051, from £2,499,498 to £3,056,549, which includes £680,496 resulting from the gold premium. Asbestos production nearly doubled, the 1920 output being 18,823 tons, as against 9,799 tons in 1919. The value, however, increased only from £425,240 to £459,572.

An Underground Party at Virginia City in the 70's

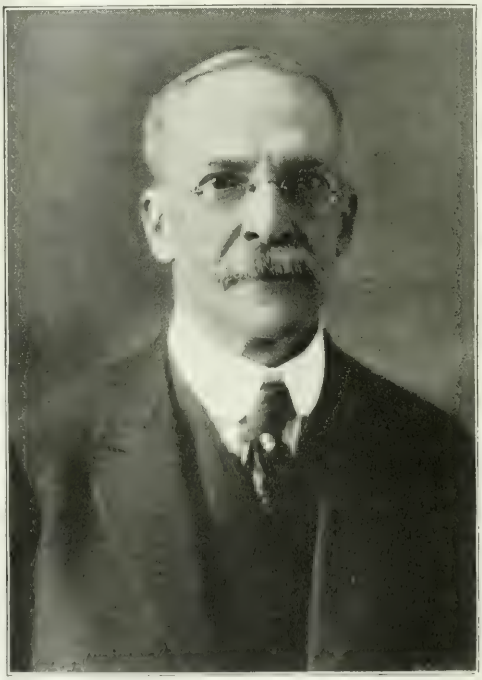
Photo by International, New York

The illustration shows General U. S. Grant and members of his party on a visit to one of the mines at Virginia City on Oct. 7, 1879. The men in the photo were among the most distinguished Americans of their day. From left to right they are: John W. Mackay, promoter of the Mackay-Bennett Cable Co. and one of California's early millionaires; Mrs. D. Gillette; U. S. Grant, Jr.; Mrs. U. S. Grant; General Grant; Mrs. James G. Fair; Governor J. H. Kinkead of Nevada, and James G. Fair.

Mining Engineers of Note

Charles Warren Goodale

THE mining engineers of the United States have set an enviable standard in technical achievement. Better than this—they have also established a character standard of American manhood. As a rule, they are strong on performance and weak on publicity. Charles Warren Goodale is no exception. Outside of his immediate circle, few know the stepping stones in his career. That he is, however, held in high esteem is shown by the recent action of the Mining and Metallurgical Society of America in awarding him its annual medal. Mr. Goodale was born in Honolulu, Hawaii, in 1854. Both of his parents, Warren Goodale and Ellen R. Whitmore Goodale, came from Marlboro, Mass. He attended the English High School of Boston and the Massachusetts Institute of Technology, graduating from the institute in 1875. He was first employed by the Boston & Colorado Smelting Co. in Boston, and in 1876 he went for the same company to Black Hawk, Col., remaining until 1880, when he became superintendent and manager of the Boston & Arizona Smelting & Reduction Co. at Tombstone. From 1885 to 1898 Mr. Goodale was superintendent of the Colorado Smelting & Mining Co. at Butte, and during the last five years of that time he was employed as consulting engineer for the Montana Mining Co., Ltd.



C. W. GOODALE

In 1898 Mr. Goodale became affiliated with the Boston & Montana Consolidated Copper & Silver Mining Co. For three years he was superintendent of the smelter at Great Falls, when he was promoted to be assistant manager. In 1912, when Frank Klepelko resigned as manager, Mr. Goodale became his successor and removed to Butte. When the Boston & Montana and other companies were merged with the Anaconda Copper Mining Co., Mr. Goodale was appointed to his present position, chairman of the Bureau of Safety of that company.

From the beginning of mining operations in Butte the companies gave attention to the safety of their men, but it was not until 1911 that safety departments were organized. At that time the Anaconda Copper Mining Co. began systematic investigation of the causes of mine accidents. Safety engineers were appointed in all departments, and safety committees co-operated with the engineers and workmen.

In January, 1915, the Bureau of Safety began the publication of a monthly paper. It was called the *Anode*, and is one of the pioneers of many similar publications. Encouragement is given the company employees to contribute articles and partake in discussions. The potent appeal of the "movie" film was not overlooked, and the Safety Department has shown about 9,000 ft. of films, telling the story of "From Ore to Metal" and weaving into this story many illustrations of bad practices and their consequences. The Butte mines are deep, the number of men employed under normal conditions is in excess of 10,000, and the tonnages handled are large, necessitating a considerable use of mechanical appliances. As a consequence the safety work is an intricate problem and greatly dependent for its success upon thorough co-operation of the men. Through the efforts of Mr. Goodale and his assistants, the improvement in conditions has been marked. During Mr. Goodale's life in Butte the ventilation of the mines has been systematized and improved. Mechanical haulage has supplanted hand tramming to a large extent. Compressed-air operation of hoists has displaced steam.

Mr. Goodale lives in Butte. In addition to his duties in improving operating conditions in the metal and coal mines of the company, and in its reduction works, he finds time to be president of the Barnes-King Development Co. He is a member of the two mining societies and of the British Institute of Mining and Metallurgy, the American Mining Congress, the Colorado Scientific Society, and the Montana Society of Engineers. He belongs to the Engineers' Club, of New York; the Silver Bow Club, of Butte; the Montana Club, of Helena; the Anaconda, and the Butte Country Club.

In the American Institute of Mining and Metallurgical Engineers Mr. Goodale has served as manager, director, and vice president. He has also contributed a number of important papers and discussions.

CONSULTATION

More Information About Iceland Spar

Engineering and Mining Journal occasionally receives inquiries requesting information about Iceland spar. The following extracts from a U. S. Bureau of Mines Report by Oliver Bowles, coupled with a reference to an article in *Engineering and Mining Journal* of July 31, 1920, will serve to inform those interested in the subject:

The most important use for Iceland spar is in the manufacture of Nicol prisms, which constitute an essential part of every polarizing microscope. The principle governing the construction of the Nicol prism is as follows: Ordinary light in passing through a crystal of calcite is resolved into two rays of plane polarized light vibrating in planes at right angles to each other, and having different indices of refraction. Thus the two rays follow different paths through the crystal. The prism of Iceland spar is cut diagonally and cemented together again with a transparent cement having an index of refraction intermediate between the two rays passing through the prism. Canada balsam is employed for this purpose. The prism is cut at such an angle that the ray having the greatest index of refraction meets the surface of the balsam at an angle greater than the angle of total reflection, and it is thus deflected to the side of the prism, while the second ray passes through. Thus one of the rays is eliminated, and polarized light vibrating in a single plane is obtained.

The behavior of polarized light in traversing various minerals is found to be a ready means of identifying them, and of studying their properties, and thus Iceland spar renders a service of inestimable value in the study of every known mineral with the possible exception of the opaque minerals, and it may be added that it is also useful in the study of certain industrial products.

Physical properties of Iceland spar that have a direct bearing on the mining methods employed are its perfect rhombohedral cleavage, a cleavage in three directions at oblique angles to each other, and its susceptibility to abrasion or scratching. The crystals cleave so readily that light blows will shatter them into fragments, and as they are soft enough to be readily scratched with a knife extreme care must be taken in handling them.

The best grade of optical spar sells at from $10 to $20 per lb. Specimen material commands a price of $1.50 to $2 per lb., and standardization spar about $1 to $2 per lb.

Crystals often show repeated twinning, the visual evidence of which consists of bands of bright rainbow colors, which appear when the crystal is viewed in transmitted light at an oblique angle, though such bands may be due also to air films in incipient fractures. The presence of defects due to twinning may in some crystals be readily tested by anyone with the aid of no equipment except a sheet of white paper. If a small clearly defined dot is placed on the paper and a cleavage fragment of Iceland spar placed over the dot, two dots will ordinarily appear a short distance apart, due to double refraction. If, however, the crystal is moved slowly back and forth, and the dots are observed closely, additional indistinct dots may also appear in certain positions. Such a phenomenon is an indication of twinning, and crystal fragments which exhibit it are defective for optical purposes, unless the individuals which constitute the twinned form are large enough for optical parts to be cut from them without passing beyond the plane along which such individuals are united (the composition face). In searching for any such evidence of twinning, observation should not be confined to one direction, but should be made in the three principal directions through the three opposite pairs of parallel faces.

The disposal of low-grade spar is a difficult problem. Small, clear crystal fragments may be sold to museums or to schools and colleges for illustration of optical properties. Also a limited quantity of pure material may be sold for use in preparing standardization solutions employed in volumetric analysis. Both of these uses probably do not require more than a few hundred pounds a year. Pure calcium carbonate is used for other purposes, as in the manufacture of high-grade glass, but for such uses its optical properties are not utilized, and any form of granular or opaque calcite of the requisite purity is equally valuable. Many limestone and marble deposits afford such a product, and consequently there is often no justification for the added transportation expense involved in utilizing spar waste. If some practical outlet could be found for the smaller cleavage fragments and the defective spar it would greatly simplify the problem of development in Montana deposits.

Optical Fluorite

In *Engineering and Mining Journal* of Oct. 30, 1920, appeared a short statement on the subject of "Optical Fluorite." The remarks made therein have been amplified by Mr. B. Malishev, a mining engineer residing in Shanghai, China, who has transmitted comments which will prove informative to readers interested in this optical material, a particular variety of fluorspar, and which treat of some details not generally known:

"The colored variety of optical fluorite does not possess as great a disadvantage as is commonly supposed. It is possible to bleach the mineral by special heating methods, as is done by the Carl Zeiss Company. Sometimes fluorite free from all common defects possesses double refraction. Such material is not suitable for optical purposes. Double refraction occurs if the fluorite was formed in the ocean under a great pressure.

"The demand for optical fluorite is limited only by its high price for big pieces; otherwise fluorite would be used on a large scale not only for the finest microscopic objectives but also for photographic lenses. Efforts have been made to obtain optical fluorite from chemically pure calcium fluorite by fusion, but these experiments have not given practical results. Better results are obtained by fusing a mixture of boric acid and calcium fluorite. This mixture possesses nearly the same properties as optical fluorite.

"Prices vary widely, and for absolutely clear material in big pieces quotations may be as high as $25 per lb. Fluorite prisms for spectroscopic apparatus sometimes command a price of a few hundred dollars.

"The Carl Zeiss Company has sent expeditions prospecting for fluorite to several parts of the world, including Siberia.

"Good optical fluorite is found in the Transbaikal region (Siberia), in the Adun Chilon Mountain, near the Mongolia frontier. Here the fluorite occurs in well-formed crystals in nests, with different other sublimation minerals such as tourmaline and beryl. The rock material of the nests is converted under weathering conditions to a soft clay, so that the fluorite crystals may therefore be easily extracted without breaking or destroying them."

HANDY KNOWLEDGE

Welding Ladle Spouts at Garfield

By E. J. HARRIS*

Written for Engineering and Mining Journal

Early in 1920 we found that the spouts of the cast-steel matte ladles at the Garfield smelter, at Garfield, Utah, were in such bad condition as to make it necessary either to buy new ladles or make substantial repairs on old ones, as the hammering action on the ladles, in cleaning out shells, had practically destroyed the spouts.

Repairs had been attempted prior to this by fitting a patch around spouts of sheet steel riveted, but with poor results. We determined before buying new ladles to try thermit welding in a new spout on one ladle as an experiment, which was done with such gratifying results that ten of these defective ladles were treated in the same manner, and we now have our matte ladles in first-class condition, at a quarter of the expense entailed in buying new ones. It may be of interest to follow this process through from beginning to end, as follows:

TEN LADLES WITH WELDED SPOUTS, GARFIELD SMELTING CO., GARFIELD, UTAH

First we built a pattern for a new spout and had a cast-steel spout made from it. We cut out the old spout, making an allowance of 1 in. between the edges of the new spout and the space occupied by the old spout. We chamfered the edges of the ladle and the spout inside and out, making the edge of both V-shaped, and bolted the new spout in place, using three bolts for this purpose. Pattern wax was then prepared and molded in place the exact shape of the weld wanted, which was 4 in. wide at the body of ladle, 1 in. for space between spout and ladle, ½ in. each side for chamfering and 1 in. each side for a collar.

In molding the wax which gave the contour of the weld, a piece of ½ in. wire was placed in the center of the wax all round the joint. When the wax was set the wire was pulled out. The space occupied by the wire gave the heat a chance to circulate and hastened the removal of the wax when it was melted out after the mold was formed. A piece of small rope is sometimes used in place of the wire for this. The ladle was then tipped at an angle of about 90 deg., with the spout down. When in this position the pouring gates, of which there are two, one at each juncture of the spout with the ladle, are on the outside edge of the ladle and spout, the riser being at the base of the spout. Care must be taken to see that the riser is a trifle higher than the pouring gates.

A brick platform or mold was then built from the ground up to within 6 in. of the spout, heavily reinforced all around to prevent the pressure of the melted thermit from forcing its way through. The 6 in. between mold and spout was then filled with a mixture of silica sand, ground firebrick and fireclay in equal proportions by bulk. In mixing, particular care was taken to see that just enough water was used to allow the mixture to hold together. The mixture was then tamped as tightly as possible between mold and parts to be welded.

A small mold of brick was then made for the inside of the ladle, and the mixture of silica sand, ground firebrick and fireclay tamped in, arrangements being made for the riser, pouring gates, and pre-heating holes. The pre-heating holes were, of course, in line with the joint to be welded, and the pouring gates and riser on top of the joint to be welded, or inside the body of the ladle. The wax was then melted out by using the pre-heating torch, and the joint brought to a red heat, kerosene being used for this purpose in the pre-heating torches.

The matte ladles weigh 13,182 lb. and cost $1,318.20 each. The new cast-steel spouts weigh 832 lb. and cost $83.20 each. Material and labor to cut out the old spout and weld in the new one cost $355.37, so we are saving $962.83 per ladle, or a total of $9,621.30 on the ten.

It will be noted from the illustration that we are also welding in patches. All these welds have successfully withstood the battering action of knocking out the shells, which was the cause of breaking of the original spouts. No doubt, in time the new spouts will go the way of the old ones, but I am satisfied that the welds will not fail, as we are watching them closely, and so far there is not the slightest indication of trouble.

LADLE IN POSITION FOR WELDING SPOUT AND PRE-HEATING UNDER WAY

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*Mechanical superintendent, Garfield Smelting Co., Garfield, Utah

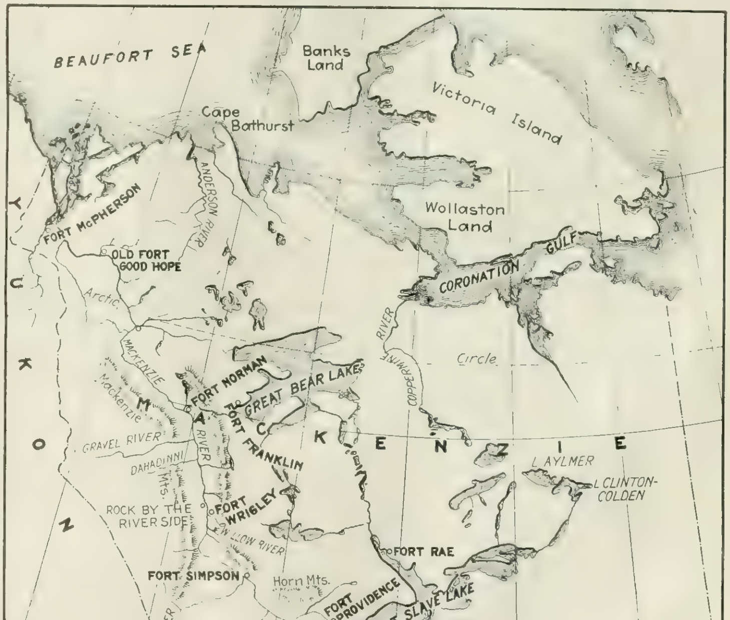
THE PETROLEUM INDUSTRY

Petroleum in the Canadian Northwest*

By Arthur H. Redfield

Written for *Engineering and Mining Journal*

THE BRINGING IN OF A WELL forty-five miles north of Fort Norman, on the Mackenzie River, by the Imperial Oil Co., Ltd., on Aug. 25, 1920, opens up to development a large and little-known region in the Provisional District of Mackenzie, Canadian Northwest Territories. It is the purpose of this paper to summarize the known data relative to the geology, manner of occurrence, and character of the petroleum of these northern regions. A certain amount of exaggeration and a lack of definite data have characterized much of the discussion of this new oil discovery. The possible petroliferous zone comprises the entire Devonian area of the Mackenzie and Great Slave basins, and is placed by the Canadian Geological Survey at 300,000 square miles. The extent of this region cannot be defined with precision, as geologic exploration has evidently been confined to the banks of the rivers and lakes, and large portions of the forest- and tundra-covered interior are still unexplored. Not all of this area may be presumed to present structures favorable to the accumulation of petroleum in commercial quantities. Frederick G. Clapp in a recent statement[1] gives a warning, based on observation of the Mackenzie territory, against over-enthusiasm concerning the possibilities of the region. Three physiographic provinces may be distinguished in the Mackenzie basin. West of the Mackenzie River rises a rugged mountainous highland, which is a continuation of the Rocky Mountain cordillera of southern Canada and the United States. It forms a belt, varying in width from 20 to 200 miles, including the outlying foothills. East of the Great Slave and Great Bear lakes, and extending eastward to Hudson Bay, is a more subdued but rocky and partly treeless plateau, which is a continuation of the Laurentian plateau that almost encircles Hudson Bay. The central area is occupied by a broad, almost level forested plain, through which the Mackenzie flows northwestward to the Arctic Ocean, fed by swift mountain streams from the west and by innumerable lakes to the east. It is this central area which gives promise of oil production.



MAP OF MACKENZIE RIVER BASIN

As the Mackenzie basin extends over seventeen degrees of latitude, its climate inevitably shows considerable variations. The summer climate of the region is not governed so much by latitude as is that of the Northland winter. Owing largely to topographic conditions, the summer isotherms run in a northwesterly direction parallel to the Mackenzie River, showing that all points in the valley have nearly the same summer temperatures. The mean January temperatures of Fort Simpson range from 33.5 to 16.2 deg. F. below zero; the mean July temperatures from 45.7 to 69.4 deg. F. The shortness of the summer season is partly compensated for by the greater length of day and increased sunlight, due to the high latitude.

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*Published by permission of the Director of the U. S. Geological Survey.

[1] Note bibliography on p. 875 of this issue; also *Eng. and Min. Journ.*, Vol. 111, pp. 553, 554, March 26, 1921.

Precipitation ranges between fifteen and twenty inches annually, and is fairly uniformily distributed throughout the basin. The winter snow in the central portion of the basin lies usually to a depth of about two feet. Though storms and blizzards occur occasionally, their force is broken to some extent by the forests.

Ice in the Athabaska and Peace rivers begins forming any time after the middle of October, breaks up between the middle and the end of April, permitting navigation for five and a half to six months of the year. The season of navigation in the Mackenzie River is about six weeks shorter.

GEOLOGICAL CHARACTERISTICS

The pre-Cambrian rocks extend westward to the Slave River and the north arm of the Great Slave Lake and thence northwestward along a series of small lakes to the Great Bear Lake. They form a northward extension of the Laurentian plateau, extending eastward to Hudson Bay, and on the west of the boundary delineated above pass under the stratified rocks. The oldest of the pre-Cambrian rocks consist of metamorphic schists, slates, limestones, quartzites, and volcanic rocks, occurring in isolated areas as erosion remnants. These rocks are intruded by granites and gneissose igneous rocks of various ages. Overlying the former group are younger rocks, not greatly disturbed, consisting of sandstone, conglomerates, shales, limestones, and volcanic rocks, referred to the Keweenawan or Animikie stage of the Algonkian period.

The formations of the Mackenzie and Great Slave basins are, however, prevailingly Devonian, comprising chiefly the middle and upper stages of that period, and resting unconformably upon the pre-Cambrian complex. They consist of a lower dolomitic series, a middle shale series, and an upper limestone series. It is true that Silurian dolomite crops out on Great Slave Lake and in the Franklin Mountains, that Cretaceous sediments overlie the Devonian unconformably at several places along the Mackenzie River, and that Tertiary beds appear near the mouth of the Great Bear River; but the Devonian occupies by far the major part of the area.

Though the Cretaceous contains the oil-bearing horizons of Alberta, to the south, and the well-known tar sands of the Athabaska basin, it is apparently barren of oil in the district of Mackenzie. So far as explored, evidences of oil in the latter area are confined to the Devonian. It is interesting to note that Bosworth suggests the Devonian of Alberta as a possible petroliferous horizon in that province.

The Devonian strata of the district of Mackenzie lie in a great geosyncline, 150 to 500 miles in breadth, between the pre-Cambrian "shield" surrounding Hudson Bay and the metamorphic Paleozoic formation of the flat-lying area characterized, especially near the Rocky Mountains, by a series of anticlinal folds trending northwest-southeast.

LABOR, FOOD SUPPLIES, AND TRANSPORTATION LACKING

Labor, skilled or unskilled, for the development of the region's resources will have to be brought into the Mackenzie basin from the other portions of the dominion or from other countries. The white population of the region is small and consists principally of fur traders, their families, and missionaries. These reside at small trading posts, scattered at intervals of 100 to 200 miles along the valleys of the Slave, Liard, and Mackenzie rivers. The Indians of the Mackenzie basin do not in all probability exceed 6,000 to 7,000 in number.

The region is sparsely populated, and no agricultural settlements are found north of the Peace and Athabaska River valleys. The sparse population of white settlers depends on the food supplies brought in by the steamers of the fur companies to the trading posts. The Indians subsist largely on the products of their hunting and fishing and on the foodstuffs obtained by barter at the trading posts.

The commercial development of the Mackenzie and Great Slave Lake oil fields hinges on the problem of transportation. The discovery well is forty-five miles from the nearest settlement, Fort Norman, and 1,600 miles from the railhead of the Canadian Northern at Fort McMurray, on the Athabaska River. The route from the well to the railroad leads 700 miles by the Mackenzie River to the Great Slave Lake, then up the Athabaska River to Fort McMurray. An alternative route is by the Peace River to the Peace River terminus of the Canadian Northern. These rivers are navigable to steamers of four- or five-foot draft, except for about sixteen miles of rapids on the Slave River near Fort Fitzgerald, where the oil would have to be portaged or locks built, and a similar series of rapids on the Peace River.

The rivers and lakes of the region are frozen during the long winter; navigation is possible for only three to five months of the year. Three steamers, those of the Hudson Bay Company, the Northern Trading Company, and the Lamson-Hubbard Company, ply the river, serving the fur-trading posts, which lie scattered 200 miles or more apart. These steamers run on no regular schedule, but make the journey at the convenience of the owners. Accommodations for either passengers or their freight are slight, as the steamers are generally filled to capacity with their owners' supplies.

An alternative shipping route is by way of Dawson and the Yukon River. A pipe line by the route has been suggested, but numerous topographic difficulties would have to be overcome.

Mackenzie District

The petroliferous formations of the Mackenzie district may be traced down the valley of the Mackenzie River from its source at the west end of the Great Slave Lake to near the head of its delta. The valley of the river extends for an average width of thirty miles. This area comprises about 24,000 square miles. Not all of the region may be presumed to present the proper structures for oil accumulation. Only a single small area near Fort Norman has been proved by the drill.

The principal indication of the presence of petroleum is the continued outcrop along the river of bituminous shales and limestones from which asphalt exudes. A series of seepages may be traced from a point five miles below Fort Norman to the Ramparts, 100 miles below the fort. Oil springs have been reported near Fort Good Hope, on the right bank of the Peel River, and at a point twenty-three miles below Grand View. The Indians formerly caulked their canoes with pitch obtained from a series of oil springs in the depths of the forest thirty miles east of Fort Simpson at the junction of the Liard and Mackenzie rivers.

Bituminous limestones, gypsum with lenses of bituminous shale, and limestones grading from pure to cherty, sandy and quartzitic, and reddish-weathering sandstones outcropping in the Bear Mountains as they cross the Great Bear River have been referred to the Niagarian stage of the Silurian, though the upper beds may be Helderbergian. Elsewhere, however, the Devonian of the Mackenzie basin rests unconformably on the pre-Cambrian rocks. The lowest member of the recognized Devonian is the Lower Ramparts shale and limestone, consisting of over 300 ft. of hard olive-green bituminous limestones and over 250 ft. of gray-green sandy shales, grading into a shaly limestone above. These are correlated as Oriskany and Onondaga. They are overlain by the Ramparts limestone (Hamilton), a compact gray limestone, definitely bedded in three or four main courses, from 100 to 300 ft. thick.

The Beavertail limestone (Tully) is thin-bedded, hard, dark-colored and bituminous; its thickness varies from 300 to 400 ft. The Beavertail limestone is overlain by 800 to 1,000 ft. of the Hope black bituminous and carbonaceous shales, in alternation with thin beds of limestones, many of which are bituminous. These have been classed with the Genesee-Portage stage. Bluish shales bearing fossils characteristic of the Portage occur along the Mackenzie River, between Fort Providence and Fort Simpson. Characteristic outcrops of the Hope bituminous shales are found at Bear Mountain, just below Great Bear River, along the Grand View River, and for a distance from a point fifteen miles below the Grand View to Old Fort Good Hope. In the last-named area, black, evenly bedded, highly bituminous shales alternate with layers burned red by accidential fires or by spontaneous combustion. It is this shale which gave the largest show of oil in the Fort Norman well. When subject to distillation, two and a half imperial gallons of oil per ton were obtained from this shale.

The uppermost member of the Devonian is the "Norman series," the lower part of which is correlated with the Chemung and the upper part with the Catskill. Its lowest formation is a bluish-green, soft, flaggy sandstone, massive in places, attaining locally a thickness of 300 ft. and in places not appearing. It is overlain by dark-blue plastic shales, 250 ft. thick. A thin-bedded hard argillaceous gray limestone occurs locally, in places attaining a maximum thickness of 50 ft. The Upper Norman shales, 1,200 ft. thick, consist of dark blue, soft, plastic shales with thin sandstone members. The highest formation is the Upper Norman sandstone, 300 ft. thick, which is bluish-green and occurs thin-bedded to massive.

The sandstones of the "Norman series," though rather fine, are soft and porous. They are generally heavily charged with oil. Along one of the creeks several hundred feet of these oil sands were traced in a distance of eighteen miles.

Cretaceous sandstones, fine conglomerates, and coarse shales are visible in places in the Mackenzie valley, unconformably overlying the Devonian. They occur in long stretches along the river below the mouth of the Dahadinni River, along the upper course of the Great Bear River, and around the west and north sides of Great Bear Lake. They outcrop also along the Mackenzie for long stretches between Fort Norman and the Ramparts, below Old Fort Good Hope, and in the basin of the Peel River.

Tertiary sediments occupy a few small areas on the Mackenzie River, notably near the mouth of the Great Bear River, where they cover a basin of about thirty to forty miles in length and twenty to thirty miles wide. They rest uncomformably on both the Cretaceous shales and Devonian limestones. They are of lacustrine origin and consist of cross-bedded sands, sandy clays, clays, and gravels, as well as seams of lignite and carbonaceous shale, attaining a total thickness of 600 ft.

Pleistocene glacial tills, sands, and gravels of varying thickness form the surface deposits of the Mackenzie basin, covering all but the higher mountains. These make the task of tracing the formations difficult, except along the rivers.

STRUCTURE MAINLY HORIZONTAL

The Devonian strata of the Mackenzie basin exhibit a remarkable horizontality; they are seldom affected by dips exceeding a few feet to the mile. Shales of the same geologic horizon as those exposed along the Hay River are visible at the Ramparts, 570 miles distant. However, striking breaks in this horizontality occur. At Rock-by-the-River-Side the beds are highly tilted. The disturbances which produced the cordillera threw up the Franklin Range as an anticlinal ridge. In the Mackenzie Mountains the folding has been on a broad scale, which has bent the strata into a series of anticlines and synclines. There is considerable close folding, some of which appears to be overturned and overthrust. The general strike of the beds of these mountains up to 65 deg. N. latitude is slightly west of north; at that point the trend to the northwestward begins. Faulting has occurred at intervals. An example of such faulting is in evidence at Bear Rock, near Fort Norman.

Low anticlines of limited extent occur at intervals all the way to the Upper Ramparts in the Cretaceous, which overlies the Devonian unconformably. The major axes of these anticlines strike north and south. The Tertiary beds near the mouth of the Great Bear River have on the whole an anticlinal attitude, but with low dips.

The main folding of the Devonian took place in pre-Cretaceous times. After the folding, a period of denudation occurred, in which the land surface was carved into a series of mountains and valleys. The Cretaceous was deposited around the mountains by seas and lakes; but the mountains themselves were probably not submerged. Later a slight folding occurred, probably along the old axes, by which the Cretaceous and Tertiary beds attained their present structure.

OCCURRENCE OF OIL

The local geology of the oil field has been described by Dr. T. O. Bosworth.[2] Three hundred feet of black bituminous limestone of Devonian age rests upon 300 ft. of black bituminous shales of the Hope formation. The shales smell strongly of oil, and are undergoing combustion at the outcrops. In some places they are hot to the touch and oxidized to a red color. The bituminous series is overlain by clay-shales and sandstones ("Norman series"). Showing of oil occurs in the sandstones. The strata are folded into long broad anticlines suitable for the accumulation of oil.

CHARACTER OF OIL

The petroleum obtained from the Fort Norman well is a dark-green, opaque oil. The first sample drawn showed a specific gravity of 0.8235 (40 deg. Bé). The average yield of the well is expected, however, to be nearer 0.8383 specific gravity (37 deg. Bé.). The base of the oil is said to be paraffinic.

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[2] Bell, Robert. "The Occurrence of Petroleum in the Northwest Territories"; *Proceedings* Canadian Institute, n.s.; Vol. 1, pp. 225, 230; 1879-1880.

The Canadian Department of Mines has made public an official analysis of a sample of crude petroleum of 0.8333 specific gravity (38 deg. Bé.) from the Fort Norman well of the Imperial Oil Co., Ltd. The laboratory test at the University of Alberta showed the following percentages:

ANALYSIS OF FORT NORMAN CRUDE PETROLEUM

Fractions	Per Cent
70—150° C. (gasoline)	23.8
150°—300° C. (illuminating oil)	38.2
300°—350° C. (light lubricating oil)	33.7
350°—375° C. (medium lubricating oil)	4.0
Loss	0.3
	100.0

In comparison with the lighter oils found in the Okotoks field, southwest of Calgary, Alberta, the Mackenzie sample has a smaller proportion of gasoline. Samples taken from the two districts, however, are much alike with regard to kerosene content.

Oil seeping from the river bed at low water, at a point twenty-five miles below Fort Norman, is reddish-black in color. It flows like engine lubricating oil, burns freely, and gives a strong smell of kerosene.

HISTORY OF EXPLORATION

Seepages of oil and asphalt along the shores of the Great Slave Lake and the valley of the Mackenzie River were reported in 1848 by Sir John Richardson in his "Journal of a Boat Voyage." The region was explored in 1875 by Prof. Macoun, of the Canadian Geological Survey, and the indications of oil were observed. The occurrence of petroleum in the Northwest Territories was the subject of a paper by Robert Bell before the Canadian Institute in 1879.

The comparative inaccessibility of the region precluded serious attempts at exploration or development for many years. Active prospecting of the Mackenzie valley began in the spring of 1914, at the time of the boom in the Alberta fields. A party headed by Dr. T. O. Bosworth explored the Mackenzie valley in the interest of a Canadian company (F. C. Lowes, of Calgary, Alberta, and associates), and staked out a number of claims. These claims were acquired by the Imperial Oil Co., Ltd., of Sarnia, Ontario, a subsidiary of the Standard Oil Co. of New Jersey. Drilling by this company began in the spring of 1920 below Fort Norman on the north bank of the Mackenzie River, and was rewarded by the discovery of commercial quantities of petroleum in the Fort Norman well.

COMMERCIAL DEVELOPMENT

A camp was established in the fall of 1919 by the Imperial Oil Co., forty-five miles below Fort Norman, where the drilling crew wintered. The test well, located on E. Proctor's claim (Lease No. 1,141) on the delta of Oil Creek, within 200 ft. of the Mackenzie River, was begun in the spring of 1920 with a Star portable drill rig, and a 6-in. casing. It is interesting to note that the strata were found exactly as the geologists had predicted. The formation was principally a shale, easily penetrated. The first showing of oil was met at a depth of 50 ft.; at 80 ft. a yield of two barrels a day was obtained from the Lower Norman sandstone. Increased quantities of oil were found at depths of 187 ft. and [illegible] ft. Water was encountered only once, at 87 ft. A light flow of gas was obtained. The well came in on Aug. 25, 1920, at a depth of 783 ft., in the crumpled and faulted Hope shales, the oil spouting 15 ft. over the top of the derrick. The well was promptly capped, until arrangements could be made for storage and transportation of the product.

Estimates of the rate of production are various and conflicting. The oil flows intermittently, due apparently to varying pressure. There were no storage tanks in which to measure the oil; the flow was shut off in thirty minutes; and allowance must be made for the customary exaggerations of preliminary press reports. The drillers' estimate of the initial output was 1,500 bbl. a day.

Great Slave District

The Great Slave Lake district embodies the western and northern shores of that lake, and possibly the south shore, as well as the basin of the Slave River. The Devonian rocks, in which petroleum is expected to occur, begin a little east of the mouth of the Slave River and continue to the west end of the lake. Along the north shore they may be traced eastward as far as the 115 deg. meridian of west longitude.

Pre-Cambrian rocks, in the same sequence as in the Mackenzie valley, outcrop around the eastern half of Great Slave Lake, east of Slave River and of the North Arm of the Lake. An Upper Silurian dolomite crops out for a limited width on the west shore of North Arm, but elsewhere the pre-Cambrian rocks are overlain unconformably by the Devonian. No distinctively Lower Devonian sediments have been observed in the vicinity of the lake shores. The Middle Devonian begins with the thin-bedded, dark bituminous, fine-grained limestones and calcareous shales of Pine Point, and has a thickness of about 100 ft. These are overlain by 200 ft. of Presqu'ile dolomites, exposed at Presqu'ile Point, at Windy Point and around Sulphur Bay, and consisting of a lower, coarsely crystalline, porous and cavernous oil-bearing dolomite, and an upper thin-bedded dolomitic limestone. Overlying the dolomites are the Slave Point limestones, which outcrop between Presqu'ile Point and High Point, on the Buffalo River, and consist of thin-bedded, dark-gray, and slightly bituminous limestones, attaining in places a thickness of 160 ft.

The Simpson shales, which form the lower member of the Upper Devonian on the Mackenzie River, do not appear on the shores of Great Slave Lake, but are believed to underlie the western end of the lake. Paleontological evidence shows that these shales correspond to the Portage formation of New York. The upper member of the Upper Devonian sediments is represented on the shores of the Great Slave Lake by the bluish-green Hay River shales and the overlying thin-bedded, hard, fine-grained, light-colored Hay River limestones. These formations have been correlated with the Chemung of New York.

The Cretaceous is not found on the shores of the Great Slave Lake, but shales of this period overlie unconformably the Devonian formations on the Hay River. The Tertiary is apparently unrepresented.

The entire region is overlain by a heavy deposit of Pleistocene glacial drift. The stream banks show in many places sections 20 to 100 ft. thick of boulder clays and gravels of glacial origin.

The strata of the Great Slave Lake shores are evidently bent in gentle undulations, as far as their structure may be traced beneath a low and swampy coast. A gentle anticline crosses Great Slave Lake from Pine Point to Windy Point. The anticlinal axis bears about west-northwest. On the south shore the apex of the anticline is shown on the east side of Pine Point; on the north shore the crest appears to lie in the erosion basin of Sulphur Bay.

As the Presqu'ile dolomites are exposed on the limits of the anticline, possibilities of finding oil in commercial quantities on the shores of the lake are not considered by Cameron[3] to be very great. If, however, the dolomite horizon can be found elsewhere in the district under a cover of impervious shales and in a suitable structure, the possibilities may be worth investigating with a drill.

Seepages are numerous at the west end of Great Slave Lake, especially along the north shore. Tar springs occur along the shores of the bay east of Big Island. Oil rises from the bottom of the lake in five feet of water, one and one-half miles offshore. In summer it spreads on the lake until dispersed by a storm. In winter it prevents the ice from forming. At Windy Point (Nintsi Point) oil exudes at the base of a limestone cliff, 100 yards offshore, from cracks in the Presqu'ile dolomitic limestone, floats on the water, gathers in pools, or is absorbed by the spongy moss of the shore. To the north of Windy Point rises a range of hills of Presqu'ile dolomite in which tar springs occur 200 ft. above the level of the lake. Oil springs are found near Fort Rae.

Bituminous shales and limestones occur at several points along the south shore. No seepages are reported.

Petroleum from seepages at Windy Point, on the north shore of Great Slave Lake, is liquid, with a smell of kerosene. It is thick and dark in the surface pools, evidently the residue after evaporation; in the dolomite rock and in the spongy beds of moss it is light yellow and very fluid. A sample of specific gravity 0.949 (17.52 deg. Bé.) analyzed by the Canadian Department of Mines, Mines Branch, gave the following results:

ANALYSES OF CRUDE PETROLEUM FROM WINDY POINT, GREAT SLAVE LAKE

	Ubbelohde Method		*Engler Method*	
Fractions	Per Cent by Volume	Sp.gr at 15.5° C.	Per Cent by Volume	Sp.gr. at 15.5° C
0°—150° C. (light oils)	0.9	.	0.9	.....
150°—200° C. (illuminating oils)	0.2		0.1	.....
200°—250° C. (illuminating oils)	0.1		1.1	.....
250°—300° C. (illuminating oils)	14.2	0.871	45.9	0.863
Residue	84.6	0.956	47.2	0.983
Loss	0.0	.....	3.8	....

The results of both distillations, especially the Engler, were considerably affected by "cracking."

A sample of black, viscous oil with an odor of kerosene was taken from Pointe aux Esclaves (Slave Point), on the north shore of Great Slave Lake. Its specific gravity was 0.957 (16.3 deg. Bé.) at 15.5 deg. C. A preliminary distillation under reduced pressure gave 60 per cent by weight, or 64.5 per cent by volume, of a distillate with a specific gravity of 0.888. This distillate when subjected to a second distillation by the Engler method gave the following analysis:

ANALYSIS OF CRUDE PETROLEUM FROM SLAVE POINT, GREAT SLAVE LAKE

Fractions	Per Cent by Volume	Specific Gravity	Per Cent by Volume of Original Crude
0°—178° C.	.		.
178°—300° C. (illuminating oils)	23	0.835	14.9
Above 300° C. (lubricants)	77	0.904	49.6

The oil contained 1 per cent of sulphur. Its calorific value, as tested, was 10,040 kilogram-calories per kilogram (18,070 B.t.u. per lb.).

The Imperial Oil Co. began drilling at Windy Point late in the spring of 1920. This well had reached a depth of 400 ft. when the advance of winter prevented further operations. Drilling will be resumed this spring.

The Aurous Gold Mining Co. was said to have a drill rig at Windy Point, with the intention of beginning a well in the spring of 1921.

BIBLIOGRAPHY

Beede, J. W., "Oil Hunting in the Arctic." *Oil, Paint and Drug Reporter*, Vol. 98, No. 23, Sec. II, p. 10, New York, Nov. 15, 1920.

Bell, Robert, "The Occurrence of Petroleum in the Northwest Territories." *Proc.* Canad. Inst., n. s., Vol. 1, pp. 225-230, 1879-1880.

Bosworth, Dr. T. O., "Oil Prospects in Alberta and the Canadian Northwest." *Petroleum Times*, Vol. 2, pp. 535-538, London, Nov. 29, 1919.

Cameron, A. E., "Explorations in the Vicinity of Great Slave Lake." Canada Dept. Mines, Geological Survey, Summary Rpt., 1917, pt. C, Ottawa, 1918.

Camsell, Charles, and Malcolm, Wyatt, "The Mackenzie River Basin." Canada Dept. Mines, Geological Survey, Memoir 108, Ottawa, 1919.

Canada Dept. Mines, Mines Branch, "Analyses of Canadian Oils." Bulletin No. 25, pt. 4, p. 65, Ottawa, 1918.

Clapp, Fred. G., and others, "Petroleum and Natural Gas Resources of Canada." Vol. 2, pt. 2, pp. 261-262, Ottawa, 1915.

Clapp, Fred. G., "Oil Possibilities of the Far North." Bulletin No. 6 of Associated Petroleum Engineers, reprinted in *Oil and Gas Journal*, Vol. 19, No. 42, pp. 61-64, Tulsa, March 18, 1921. Abstracted in *Engineering and Mining Journal*, Vol. 111, pp. 553-554, New York, March 26, 1921.

Dowling, D. B., "Oil Possibilities of Western Canada." Bull. Can. Min. Inst., No. 98, pp. 469-477, June, 1920.

Fullerton, Aubrey, "There Is Oil on the North." *Petroleum World*, Vol. 17, p. 498, London, December, 1920.

Hanes, Hon. G. S., M.P.P., Personal communication to U. S. Geologic Survey, July 23, 1920.

McConnell, R. G., "Exploration in the Yukon and Mackenzie Basins." Ann. Rpt., Geological Survey, Canada, new series, Vol. 4, pp. 14-16D; pp. 19-21D; pp. 98-100, Ottawa, 1890.

Malcolm, Wyatt, "Oil and Gas Prospects of the Northwest Provinces." Canadian Geological Survey, Memoir No. 29, pp. 60-61, Ottawa, 1913.

Ness, J., "The Search for Oil in the West." *Canadian Mining Journal*, Vol. 42, No. 16, pp. 313-323, Gardenvale, Province of Quebec, April 22, 1921.

"New Oil Field in Northern Canada." *Mining and Metallurgy*, No. 169, p. 37, New York, January, 1921.

"New Oil Field in Northern Canada." *Petroleum Times*, Vol. 4, No. 97, pp. 494-495, London, Nov. 13, 1920.

"Oil in Mackenzie Basin." *Oil and Gas Journal*, Vol. 19, No. 15, p. 44, Tulsa, Sept. 10, 1920.

"Opening of the Great Oil Field of Northern Canada." *Oil News*, No. 415, pp. 1077, 1084-1085, London, Nov. 13, 1920.

Park, William E., "Well Inside Arctic Circle Found Oil at 873 Feet." *Oil and Gas Journal*, Vol. 19, No. 22, p. 52, Tulsa, Oct. 29, 1920.

Pearce, N. C., "Oil in the Canadian Western Provinces." *Canadian Mining Journal*, Vol. 40, pp. 673-676, Montreal, Sept. 10, 1919. Also in *Petroleum Times*, Vol. 2, p. 353, London, Oct. 11, 1919.

Thompson, Phillips, "The Mackenzie River Basin." *Engineering and Mining Journal*, Vol. 108, pp. 866-868, New York, Dec. 9, 1919.

Willis, Bailey, "Index to the Stratigraphy of North America." U. S. Geological Survey, Professional Paper 71, pp. 225, 264, 269, 336-337, 639, 703-704, 796, 837-838, Washington, 1912.

Geologic maps of the Mackenzie River and Great Slave Lake basins accompany the papers by Camsell and Malcolm and Willis.

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[3] Cameron, A. E., "Explorations in the Vicinity of Great Slave Lake." Canada Dept. Mines, Geological Survey, Summary Rpt., 1917, pt. C, Ottawa, 1918.

Technical Papers

Dictionary of Labor Terms. — The Harvard Bureau of Business Research, Cambridge, Mass., has issued Bulletin No. 25 entitled "Labor Terminology." Definitions are given of two or three hundred words and phrases used in labor controversy, the aim being to prevent misunderstanding due to ignorance by the employer of the meaning commonly attached to various terms. The list seems to be fairly complete, though we feel sure that had the pamphlet been prepared in Butte, instead of Cambridge, the terms "wobbly" and "rustling card" would have been included.

Tungsten—"Tungsten in 1918," a separate of "Mineral Resources," containing fifty-three pages, has been issued and may be obtained on request from the U. S. Geological Survey, Washington, D. C. Domestic production in 1918 amounted to 5,061 tons of concentrates carrying 60 per cent WO_3, Colorado being the chief producer. Much information valuable to those in any part of the world who are interested in this metal is given.

British Guiana—A "Report on the Lands and Mines Department" for 1919 has been issued by the authority of the Governor and printed by the Argosy Co., Ltd., Government Printers, Georgetown, Demerara. During the year, gold production totaled $287,044.80, and was produced by placer washing and dredging; diamonds, 16,706½ carats; and bauxite, 1,967 tons. In addition, the report covers statements of revenues and expenditures, results of cultivation, grants, forests and forest products, quarries, and statements covering the surveys made by the department. The report is signed by John Mullin, acting commissioner of lands and mines.

Magnesite — "Magnesite in 1919," eight pages, may be obtained on request to the U. S. Geological Survey, Washington, D. C. The industry is briefly reviewed, all available statistics are given, and a list of producers is appended.

Bauxite.—The *Journal of Indian Industry and Labor* appeared for the first time with the February, 1921, number. It contained a sixteen-page article on bauxite, dealing with its industrial uses, the specifications and standards of quality demanded by buyers, marketing methods, and the sources of supply. (Price, 1 rupee 8 annas, from the Superintendent, Government Printing, India, 8 Hastings St., Calcutta.)

Powdered Coal—In *The Iron Age* for April 14 (239 West 39th St., New York, price 20c.) is a lengthy article by C. F. Herington, presenting the economics of pulverized coal compared with other fuels for iron furnaces, and giving a list of American installations in the field, with capacities and the kind of fuel which the pulverized coal replaced.

Lead Ores—The latest monograph published by the Mineral Resources Committee of the Imperial Institute is entitled "Lead Ores." It may be obtained from John Murray, Albemarle St., London, W.1, England, for 6s. The book is paper covered and contains 127 pages. The occurrence, character, and treatment of lead ores are given in the first chapter, followed by two chapters on the world sources of supply of lead ores. Much statistical matter is given, the figures generally including those for 1919. A well-edited little book for those interested in lead.

Flotation—"Flotation Tests of Idaho Ores" is the title of a seventy-page bulletin, No. 205, issued by the U. S. Bureau of Mines, Washington, D. C., and obtainable on request. The bulletin describes and gives the results of differential flotation tests on galena-sphalerite ores of various types; on chalcopyrite-pyrrhotite ore; on an antimonial-silver ore; and a copper-gold-silver ore. Lack of data prevented the reaching of any definite conclusions.

Mackenzie River Oil—The paper read by John Ness at the Montreal meeting of the Canadian Institute of Mining and Metallurgy is printed in the April *Bulletin* of that Institute. (Drummond Building, Montreal, Que.; price not stated.) It is entitled "The Search for Oil in the West," occupies twenty-eight pages, and is possibly the most complete description of the geology of the prospective oil regions of northwestern Canada yet published.

Mica—"Mica in 1919" is now available from the U. S. Geological Survey, Washington, D. C. Besides statistics, the nine-page bulletin discusses the nature and occurrence, physical properties, forms and classification, and uses of this mineral.

Cement—Large users of cement who may perchance have thought of making their own will be interested in a detailed article on the cost of making cement, by H. E. Hilts, in the January number of *Public Roads*, published by the Bureau of Public Roads of the U. S. Department of Agriculture. An abstract appears in *Engineering and Contracting* for April 6.

Wyoming Oil—Bulletin 702 of the U. S. Geological Survey, Washington, D. C., 107 pages, is entitled "Oil Possibilities in and Around the Baxter Basin, in the Rock Springs Uplift, Sweetwater County, Wyoming." The bulletin may be obtained upon application to the Survey.

Halides—"Salt, Bromine and Calcium Chloride in 1919," seventeen pages, can now be obtained on request from the U. S. Geological Survey, Washington, D. C.

Northern Manitoba — The Reed-Wekusko Lake area, in northern Manitoba, is described in Memoir 119 of the Canadian Geological Survey, Ottawa, Ont. (137 pages, with maps, free on request.) The geological features and the numerous recently discovered gold-quartz occurrences are discussed.

Book Reviews

Financial Engineering. By O. B. Goldman. Cloth; 6 x 9; pp. 271. John Wiley & Sons, New York. Price, $3.50.

The average technical graduate has to learn at least two things when he begins practical work: one is, that carrying figures out to the fourth or fifth decimal place is not *always* necessary, and the other is the importance of the *cost* of things. This latter point applies not only to the college graduate but to inexperienced technical men in general. Consequently a book on this subject should prove valuable.

The author makes some rather startling statements in the introductory chapter, such as "Competition is industrial disorganization" and "competition is always the short cut to higher costs." Such statements as these, however, are more than offset further on in the book, when the author clears up many what might be called "chronic" misconceptions.

The first five chapters deal with the underlying factors which go to make up the costs with which the engineer must deal. These include such items as depreciation, natural and operating life, fundamental financial calculations, basic costs, and vestances. The latter item furnishes a means whereby differently equipped plants may be compared quite readily on a dollars-and-cents basis.

The prices and operating costs of a large number of different types of machines and equipment are tabulated, due regard being paid to the fractional load characteristics.

The text is well explained by means of numerous concrete examples worked out in detail, and a set of illustrative practice problems is found at the end of some of the chapters for those inclined to make a further study of the subject.

In the later chapters of the book Mr. Goldman resorts to simple integral calculus which at first presents a rather formidable appearance, but which is necessary owing to the number of variables which must be considered. The author admits in his chapter on "The Size of System for Best Financial Efficiency" ". . . the work of solving such cost problems requires skill and considerable painstaking effort; it certainly permits of real and conclusive deductions."

By proper application of the principles developed in this book thousands of dollars might often be saved in the installation and maintenance of even moderately sized plants, and this, after all, is the true test of a book's worth.

Consulting and sales engineers, designers, and factory executives will derive the greatest benefit from this book, although men acting in lesser capacities might well afford to be conversant at least with the principles involved.

T. M. R.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Training for Foreign Exploration Outlined by Director Bain at Rolla, Mo.

The need for practical training in all those professions and avocations essential to the working efficiency of the engineer engaged in exploratory or prospecting work was discussed by Dr. H. Foster Bain, Director of the U. S. Bureau of Mines, before the graduating class of the Missouri School of Mines, at Rolla, Mo., on April 29. The title of the address was "Training for Foreign Exploration," and a summary of its chief points is given here:

"The mining engineer must be versatile," Dr. Bain said.

"To the lore of the geologist he adds the skill of the engineer and the science of the metallurgist. Always and everywhere an eclectic, he adapts means to the end. Clearly, where there are such varied duties and opportunities room for specialization exists, and this is, indeed, the fact. Mining engineers are called on to do geological, mining, and metallurgical work. No one man may be expected to be competent in all three, but one who achieves success in the profession must know something of all."

So long as man exists he will need to practice mining in some form, and as mines are wasting assets the life of the industry depends upon the continual finding of new mines. In fact, the peoples who make the most use of earth materials and forces are the peoples who work the shortest number of hours, produce the most goods, and have the most to divide among themselves. There are great differences between the peoples of various countries and between the countries themselves in this particular.

Thus we may regard the future of the mining profession as fairly assured, but the search for new mines to supply the increasing demands of a swelling population requires knowledge of the widest character. Even a reading knowledge of ancient classics may serve to reveal—as was the actual case with the American copper mine on Cyprus—deposits susceptible of development to meet modern needs. Of course a number of modern languages must be learned, but even these are but a means to the engineer's end, and interpreters should also be relied on. One of the chief values of such knowledge is that it helps to establish friendly relations with the everyday people among whom a modern explorer must work. The geologic facts, however, must be learned at first hand only. For the facts as to character and extent of the deposit one must depend on one's own powers and energy.

As the exploring engineer must "find ore," he must be a well-trained geologist. This is fundamental, but he must go farther and must know in general terms the cost limits which separate "ore" from mere "rock." He must also have an adequate idea of technical difficulties involved, and be able to recognize similar and dissimilar conditions surrounding two or more deposits; so that some apprenticeship under an operating or examining engineer is essential to a geologist who would go into mining or exploration. Costs, labor conditions, labor supply, market, and other questions in economics must be answered also, and training in economics thus become important. The exploring engineer who disregards such problems limits his usefulness and his rewards.

Today, the exploring engineer — and he is the one we are most concerned with—also needs, besides a knowledge of the rules of health, many accomplishments now rarer and classed as old fashioned, but common in the older days of country and village life. It is not always possible to ride up to a prospect in a Pullman or even in a Ford. At times the finding of new mines will take one into countries and circumstances that mean rolling back the centuries and living for a time in the Middle Ages. Skill in what we now call "sports" will always be of great advantage under such surroundings, and on occasion has been known to prove of first importance to an expedition.

"Lastly," said Dr. Bain, "I would urge that to be successful one should have something of the spirit of adventure. Unless new scenes and new faces appeal to you, unless you find joy in the long days in saddle or afoot, unless the cheer of the camp fire means more to you than the clank of the steam radiator, unless to you coffee does not lose its fine flavor when served from a tin cup, unless you can sleep between blankets and not think of their scratching, do not undertake exploration. If you must have a napkin and morning paper at breakfast, if you cannot write save at a well equipped desk, if you are not happy except with your family and intimate friends, if you must see the movies before you can go to bed at night, you will be wise to find a routine job at home."

Hadfield Offers Prize

Sir Robert Hadfield, of Hadfield's Steel Foundry Co., Ltd., and recipient of the John Fritz medal in 1921, has offered a prize of £154, through the Institution of Mechanical Engineers of Great Britain, for the best design for a device to determine accurately the hardness of metals. The device is to be suited for metallurgical work.

Idaho School of Mines Offers Fellowships

In co-operation with the U. S. Bureau of Mines and the Idaho Bureau of Mines and Geology the University of Idaho offers in the School of Mines a number of fellowships. These fellowships are open to college graduates who are qualified to undertake research work. The income of each fellowship is $750 a year for the twelve months beginning July 1, 1921.

Fellows will register as students in the University of Idaho and may become candidates for the degree of Master of Science in Mining or Metallurgy. The greater portion of their time will be spent in research work under the direction of the Bureau of Mines staff resident at the university. The purpose of this work is to undertake the solution of definite problems confronting the mining and metallurgical industries of the State of Idaho, such as flotation —with especial reference to differential separation of various minerals; treatment of the complex zinc-lead ores of Idaho; ore-dressing problems, and mining problems.

Applications, with certified copy of collegiate record, statement of professional experience, and names and address of three references, will be received up to June 1, 1921. The applications should be addressed to Francis A. Thomson, dean, School of Mines, Moscow, Idaho.

A. A. E. Elects Officers

At the annual meeting of the American Association of Engineers, which was held last week at the Hotel Lafayette, Buffalo, N. Y., considerable attention was given the question, How shall technical knowledge be applied in the service of the public? The adequate distribution of engineering ability throughout the country, leading to the better public utilization of engineering knowledge, was also discussed.

At the election of officers H. O. Garman, chief engineer and consultant for the Indiana Public Utilities and Railroad Commissions, was elected president, and A. N. Johnson, at one time with the Calumet & Hecla, later with the Maryland Geological Survey, and now dean of the Engineering College, University of Maryland, was elected vice-president. Among those on the new list of directors is Prof. G. M. Butler, dean of the Department of Mines and Engineering, University of Arizona, and director of the Arizona Bureau of Mines.

The association is steadily growing in membership, and is doing much to improve the working conditions of the younger engineers of this country.

MEN YOU SHOULD KNOW ABOUT

Frederick M. Feiker, vice-president and chairman of the Editorial Board of the McGraw-Hill Co., has been selected by Herbert Hoover, Secretary of Commerce, as his personal assistant in his plans to organize and develop the bureaus of Foreign and Domestic Commerce, of Standards, and of the Census, as aids to business. Mr. Feiker's wide experience and extensive acquaintance in technical journalism and in the general industrial field should be of great service in the solution of those industrial problems now presenting for attention.

By a series of conferences with the representative men of industry, the Government will learn what kinds of facts and figures industry needs. Having organized the department to meet these requirements, the next problem will be to devise an adequate system for [illegible] the collected data back to business. Mr. Feiker's training, grasp of the needs of industry, and sense of publicity qualify him in a marked degree to render personal service in furthering Secretary Hoover's plans to make the Department of Commerce an aid to industry and business.

Mr. Feiker is an electrical engineer by profession and has been specially interested in aiding Mr. Hoover in the development of his plan for the elimination of waste in industry which was undertaken by the Federated American Engineering Societies at Mr. Hoover's suggestion. He is a graduate of the Worcester, Mass., Polytechnic Institute, class of 1904. Following graduation, Mr. Feiker assisted in special research work in high-tension transmission and generation at Worcester. From 1906 to 1907 he served the General Electric Co., Schenectady, N. Y., as technical journalist, and in the latter year went with the *System* magazine at Chicago, Ill., soon after developing the idea of *Factory* magazine, of which he became managing editor. From 1912 to 1915 he was chairman of the editorial board of the A. W. Shaw publications, of Chicago. In the latter year he joined the McGraw organization as editor of *Electrical World*, which he soon supplemented by assuming like duties on *Electrical Merchandising*. In 1920 he was made a vice-president and chairman of the Board of Editors of the McGraw-Hill Co. He has been one of the prime movers in the movement to interest engineers in the broad problems of public service. While in Government service Mr. Feiker will retain his status with the McGraw-Hill Co.

FREDERICK M FEIKER

R. R. Rose, mining engineer of Montreal, and acting secretary of the Canadian Institute of Mining and Metallurgy from October, 1919, to January, 1921, has accepted a professional position with the Hollinger Consolidated Coal Mines, Ltd., at Timmins, Ont.

Theodore A. Link, geologist with the geological department of Imperial Oil, Ltd., has left Edmonton, Alta, for the Fort Norman field, in Mackenzie River district. He will make the trip by airplane.

Myron R. Walker, mine superintendent for the Corporación Minera Famatina, Chilecito, Argentina, stopped in New York City on May 11, while en route to his home in Pittsburgh, Pa.

Mining and metallurgical engineers recently visiting New York City included: **H. A. Kee**, of Kerr Lake Mining Co., Cobalt, Ont.; **Myron R. Walker**, Pittsburgh, Pa.; Chas. F. **Haselton**. West Hartford, Conn.; **Herbert H. Lauer**, Allentown, Pa.; **Gardner F. Williams**, San Francisco, Cal.; **Harvey A. Mudd**, Los Angeles, Cal.; **LeRoy B. Mitchell**, Bisbee, Ariz.; **B. L. Miller, Bethlehem**, Pa.; **Graham John Mitchell**, Bisbee, Ariz.

SOCIETY MEETINGS ANNOUNCED

American Institute of Mining and Metallurgical Engineers will hold its annual meeting at Wilkes-Barre, Pa., during the week beginning Sept. 12, next.

OBITUARY

Franklin K. Lane, Secretary of the Interior Department under Woodrow Wilson, died of heart disease on May 18.

M. E. Wadsworth, geologist, mining engineer, and educator, died at his home in Pittsburgh, Pa., on April 21, in his seventy-fourth year. Dr. Wadsworth was dean emeritus of the School of Mines of Pennsylvania State College, a school of which he was in charge from 1901 until his retirement on the Carnegie Foundation in July, 1912. His greatest service, perhaps, was the organization and development of the Michigan College of Mines, of which he was president from 1887 to 1899. Prior to the call to that work Dr. Wadsworth had done much valuable research, having served as geologist on the state surveys of New Hampshire and Minnesota, remodeled the geologic instruction at Colby, and introduced under J. D. Whitney at Harvard the microscopical petrography which he had studied under young Rosenbusch, Michel-Levy, and others in Europe. Professor Wadsworth was among other things one of the firm supporters of the theory of the igneous origin of iron ores. He was born at Livermore Falls, Me., on May 6, 1847, and held degrees, in course, from Bowdoin and Harvard colleges and the University of Heidelberg. Many honorary degrees were conferred on him and many societies claimed him as a member, notably the Geological Society and the Mining and Metallurgical Society of America.

THE MINING NEWS

LEADING EVENTS

Principals in Apex Suit Differ Over Accounting Details

Utah Apex To File Exceptions to Statement Submitted by Utah Consolidated

It is stated that the Utah Apex Mining Co. will file exceptions to the accounting for damages submitted by the Utah Consolidated Mining Co. in accordance with the court's decree, to make good the illegal extraction of ore from Utah Apex ground. Both properties are at Bingham Canyon, Utah. The Utah Consolidated has filed the following account in the circuit court of Utah:

	Principal	Interest	Total
1917	$ 47,573	$10,731	$58,304
1918	159,267	23,213	182,481
1919	208,111	13,646	221 758
1920	196,437	....	196,437
			$658,986

The Utah Apex has taken exception to the accounting, claiming that the sum of $655,986 is insufficient. The damages claimed by the Utah Apex amounted to $2,500,000. It is said that if the exceptions claimed by the Utah Apex be allowed, the total sum to be paid will more nearly approach the latter amount than the sum agreed to by the Consolidated. The Utah Apex is having the Utah Consolidated books audited by accountants. After the filing of the exceptions will come the adjudicating of the difference, and the settlement of the case, unless, of course, the Utah Consolidated should take an appeal. The Utah Apex is closed down at present, owing to the low price of lead, but it is probable that the recent rise in the price of that metal, if continued, will bring about the reopening of this large producer.

Jerome Verde Holdings Now Under U. V. Extension Control

At a meeting in Phoenix, Ariz., on May 5, with 72 per cent of the 5,230,000 shares represented, sale of the property of the Jerome Verde Copper Co. to the Jerome Verde Development Co. was agreed upon. New stock is to be accepted at the rate of one share for ten of the old. The new corporation will be controlled by the United Verde Extension Co., which, on approval of 75 per cent of the old stockholders, will proceed upon expenditure of $420,000 in development work and payment of debts. The acreage thus acquired is one of the largest mining plots in the district, lying west and northwest of the Extension, north of some separated Extension claims and east of the main property of the United Verde. Through the consolidation, Dundee, with its two claims will be wholly in Extension territory.

WEEKLY RÉSUMÉ

From Washington it is reported that Secretary Fall is against liberalizing existing legislation for war minerals relief. It is stated that a new commission may be appointed. The proposed revision of the mining code, which the Ingalls committee has been considering, is now ready for Congress. Numerous protests against further suspension of assessment work requirements have been received.

In northern Michigan, the Seneca Copper Corporation has purchased the interest held by the Hancock Consolidated Mining Co. in the Lake Milling, Smelting & Refining Co., thus acquiring sufficient milling capacity for its needs. In Arizona, the holdings of the Jerome-Verde Copper Co. have passed under the control of the United Verde Extension company. In New Mexico, the state tax commission has acquired the services of J. R. Finlay for the work of appraising the value of mines within the state. In Utah, the Utah Apex Mining Co. is expected to file exceptions to the accounting made by Utah Consolidated as the outcome of the apex suit won by the former. The Interstate Commerce Commission has set May 31 as the date for its hearing, at Chicago, on iron ore freight rates in the Lake Superior district.

J. R. Finlay To Appraise Mines of New Mexico

The State Tax Commission of New Mexico has entered into contract with J. R. Finlay, of New York, to appraise the mines of New Mexico for taxation purposes as he did the mines of Michigan in 1911, the work of appraisal to begin by Sept. 1 next, and to be completed by Feb. 1, 1922. This mine evaluation is in accordance with a law passed by the State Legislature in February this year.

Hearing on Iron Ore Freight Rates at Chicago, May 31

A hearing has been announced by the Interstate Commerce Commission, to be held in Chicago May 31, on the complaint of the Lake Superior Iron Ore Association relative to the freight rates on iron ore in Michigan, Minnesota, and Wisconsin. The eighty-seven members of the association who have signed the complaint have petitioned the commission to fix such rates for the defendant carriers, from June 25, 1918, to the present, so that the returns from their investment will yield 6 per cent. Owing to the scope of such a complaint, it is expected that it will take considerable time to hear all evidence.

Situation of Potash Industry in Germany Changed

Various Schemes for Socialization Contemplated—Position of Kali Syndicate Weakened

From Our Berlin Correspondent

Berlin, April 15—The end of the war found the German potash industry in a position quite different from that which it occupied in pre-war times. The fact that numerous countries are now producing potassium by chemical process, the finds in Spain and mainly the loss of Alsace-Lorraine have made a wide breach into the monopoly Germany had been enjoying throughout the whole world as potassium producer. The privileged position of the all-powerful German Potassium Syndicate is considerably weakened. This syndicate now finds it hard to market the industry's output, even at the present reduced scale. Export, which was fairly brisk last year, has greatly diminished. Exports of potassium salts in 1920 reached almost 60 per cent of the shipments of 1913, but have in the course of the current year dwindled down at an alarming rate. The domestic market also consumes not nearly the same quantity of potassium products as in pre-war times. Prices had to be lowered along the whole line, in order to stimulate the sluggish demand and to meet the foreign competition, especially that of the Alsace-Lorraine producers. The result is that only the richest and best-equipped mines are working on a paying basis, while the poor ones are operating at a loss.

The following are the present prices of potassium products at the mines:

	Per cent of Pure Potassium	Price per Metric Ton, Marks
Carnallite	9	45
Kainit	12	72
Kainit	15	90
Fertilizer salts	20	148
Fertilizer salts	30	249
Fertilizer salts	40	388
Fertilizer salts	42	407
Chloride of potassium...	50	575
Potassium sulphate	48	729
Potassium magnesium sulphate	26.	434

The recent increase of the railroad rates is further aggravating the already rather precarious situation. This increase, which is 50 to 60 per cent, will increase the cost to purchasers, according to distance, up to 160 per cent. This is bound to react strongly on the demand, especially in the agricultural districts in the Northeast, as previous increases of price indicate. The cost of transportation from Stassfurt to Königsberg in eastern Prussia of a 15-ton truckload of kainit, for instance, which used to be 110 marks in 1914, is 1,600 marks since April 1, considerably exceeding the price of the product itself, which is only 1,000 marks to 1,350 marks, according to grade.

In this situation the Kali Syndicate has decided upon a remarkable policy. It is evidently concluded that the demand will, if not at once, gradually decrease to a certain minimum of rock bottom necessity, which can be assumed to remain stationary regardless of prices. This seems to be the only explanation for the decision to follow the rise of transportation rates by a rise of prices, which, according to the proposal of the syndicate, will be no less than 65 per cent. It is obviously argued that the business which will be left shall at least be profitable. This proposed rise of potassium prices is, therefore, a radical measure which appears to be chiefly made in the interest of the weaker members of the syndicate.

This situation has the fullest attention of the government, or the administrative body, the National Kali Council, which as in the case of the coal production, has been constituted to exercise control over the potassium industry. The intention of the Kali Syndicate—to protect the poor mines—is not supported by this body. On the contrary, the prevailing tendency is to shut down the unprofitable mines in the interest of economy. Such strong measures are considered unavoidable. This tendency finds marked expression in the various proposals which have lately been forthcoming for the socialization of this industry.

It will be remembered that the coal and the potassium industry have been singled out to make a start with in the matter of socialization, and the government is being urged to proceed with it. Although the problem of socialization of the coal industry, which for a time toward the end of last year had assumed an acute aspect, has since then been pigeonholed, evidently for an indefinite time, the socialization of the potassium industry might possibly take concrete shape, the opposition of the mine owners being not nearly so strong as that of the coal producers.

THREE SCHEMES FOR SOCIALIZATION

The committee constituted for socialization problems has now three schemes under consideration. The first of these, submitted by industrial leaders like Rathenau and Siemens, has nothing to do with socialization proper, but attempts to put the industry on a sound basis by higher economy and co-operation. This scheme is identical to a large degree with the notions of the National Kali Council. Its main points are to effect the apportioning of production, which by the present legislation is adjusted at intervals of five years, by adjustments of longer duration, at least of thirty years. Mines going out of operation shall be permitted to sell their portion to other mines. Sinking of new shafts shall be prohibited by law. The National Kali Council shall further be empowered to enforce the shutting down of such works which during several years have been on an unprofitable basis. It is hoped that such measures will to a large degree tend to induce mine owners to shut down voluntarily. The authors of this proposal are, however, emphasizing that a contraction of the production cannot be delayed any longer, and that, if poor mines should not decide to shut down within a reasonable time, compulsory measures should be adopted. These proposals are supported by the non-socialistic trade unions.

The representatives of the socialistic unions, however, submitted a scheme, which in a much more pronounced way conforms with the socialization theories. They propose to form two organizations, one for the operation of the mines, the other for the selling of their products, both to be controlled by the National Kali Council. The latter shall be composed of representatives of the employed and the employers, geological and chemical scientists, and agricultural and chemical consumers. The executive is to be placed with a body of the directors of the five largest mining districts. The operating organization shall issue shares, nine-twentieths of which will be used for indemnifying the mine owners, while eleven-twentieths remain in the possession of the organization. The mine owners shall be entitled to a preferential dividend of 4 per cent, while the rest of the profits is divided equally between all shares. Premiums shall be paid for the reduction of working cost, in order to stimulate engineers and workmen to higher productivity and economy. The selling organization shall receive a monopoly, confirmed by legislation.

The author of the third scheme is Professor Lederer, who has also been responsible for one of the main proposals applying to the socialization of the coal mines. He proposes the formation of a holding company, organized as a joint stock company, the "Kali Trust." Part of the shares of this trust shall be issued to the mine owners, the private owners as well as the states, in proportion to their valuated assets. The rest shall remain state property. While, however, the socialistic proposal would give the state a controlling share Professor Lederer's scheme apportions the trust shares in such a way that the mine owners hold 51 per cent and the state 49 per cent. The National Kali Council shall be given a decisive voice in the management of the trust. The adjustment of prices shall as hitherto be subject to the approval of this council, and it shall be empowered to take any measures it may think fit for the reduction or the increase of production.

At present it is difficult to see on what lines the socialization committee will proceed, but from all indications it can be taken that the socialistic scheme has very little chance of realization. It is most likely that, as in the case of the coal socialization, a policy of procrastination will be followed.

Silver Mines in Arkansas To Be Developed

Hot Springs Business Men Organize $50,000 Company To Reopen Old Mines in Montgomery County

Interest is being taken in Hot Springs, Ark., in the reopening of the old silver mines near Silver, Montgomery County, about thirty miles west of Hot Springs. The Silver King Mining Co. was recently incorporated by J. W. Kelly and other Hot Springs business men, with a capital of $50,000. The company has purchased the old Waterloo mine in fee and has leased about 1,300 acres in the immediate vicinity of the Waterloo, including the Elnora, Silver City, Minnesota, and other mines, and containing all the known veins in the district.

Boilers, a compressor, drills, a hoist and other machinery have been purchased and installed. The Waterloo shaft has been unwatered and sinking is in progress. The old shaft now 185 ft. deep, will be sunk an additional 350 ft., and drifting will be done on the vein at the bottom level, with the idea of proving the vein.

The district around Silver is an old one, mining having been done there in the early 80's by crude methods and under poor operating conditions. Some of the properties gave large returns even at that time, and Silver was a properous and booming mining camp, with stores, banks, and more than 1,500 inhabitants. No work has been done for nearly forty years, since the properties were closed, due to poor mining, unfavorable operating conditions, and the forty-mile haul to the railroad.

The ore occurs in veins which cut across the steeply dipping shales and slates at an opposite angle. The filling is quartz and calcite. The silver-bearing minerals are galena, sphalerite, and tetrahedrite. The assays as given by Dr. Branner in the Arkansas state geological report are high, ranging from 21 to 446 oz. of silver per ton. The present operators plan an initial expenditure of about $25,000 for sinking and drifting with the idea of proving up the property at depth.

Clement K. Quinn Takes Option on Atikokan Iron Mine

Contrary to recent press statements Clement K. Quinn has not purchased the Atikokan iron mine, in Ontario, but has simply taken an option on it with the idea of carrying on further investigations. The Atikokan mine is located about 125 miles west of Port Arthur in Ontario and on the main line of the Canadian Northern Ry. between Port Arthur and Winnipeg. The McKenzie-Mann interests and the Stamford White interests, of Chicago, have controlled this property for a number of years through the Atikokan Iron Co., and at one time operated a blast furnace in Port Arthur which was run exclusively on these ores. The tonnage developed is quite large. Mr. Quinn has been identified with the property in one way or another for several years.

To Encourage Shipment of Iron Ore Stockpiles

The Great Northern and the Duluth, Missabe & Northern railroads have notified the mining companies on the Mesabi Range that the charge of $7.50 per hour for the use of switch engines and crews in spotting cars for loading stockpiles has been eliminated. This means a saving of 2½ to 3c. a ton in handling ore in stockpiles. It is anticipated that it will encourage the shipping of some of the stockpiles to the steel furnaces.

Volatilization Process Giving Satisfaction in Test Runs at Salt Lake City

Test runs of twenty-four hours' duration or longer, which are being made in the volatilization plant of the U. S. Bureau of Mines at the University of Utah, are bringing satisfactory results. The plant at the university is semi-commercial and is said to prove that the volatilization process can be applied on a commercial scale to low-grade oxidized and semi-oxidized ores, which do not respond to flotation or other processes. A good recovery is being made, at moderate cost. There are large deposits of ores of the nature described in the West, carrying 5 to 6 per cent lead and about 5 oz. in silver, which do not respond to flotation or other processes. The process will be especially useful where the deposits are far from the railroad, as the bullion only need be shipped.

Volatilization plants can be erected at comparatively low cost, as the construction is simple. The installation of electrical appliances used in connection with such plants would probably be the heaviest item of expense, but this would not be prohibitive. Power costs would be reasonable, for although the voltage would be high, the amperage would be proportionately low.

In preparation for treatment by volatilization, the ore is crushed to different sizes, varying from four to thirty mesh. The crushed rock is then mixed with sodium chloride, or common table salt, and this mixture fed into a revolving kiln, where it is roasted. By this roasting is formed chlorine gas, which picks up the metal values in the form of chlorides. These chlorides are collected and run off to a Cottrell precipitator, which consists of a number of air-tight pipes, through the center of which runs a nichrome wire. A high voltage of practically static electricity is discharged from this wire, which causes the solid particles to be dropped. These particles or fumes, resembling ashes in appearance, are smelted into bullion. Experiments made in the reduction of fumes in several types of furnaces—including electric, blast, reverberatory, or muffle—have proved that a high extraction can be made. Thomas A. Varley is in charge of the work at the Utah station.

Ontario Mining Act Changed

Legislation passed by the Ontario Legislature makes some changes in the Mining Act. The most important of these relieves patented mining claims from sudden forfeiture for the non-payment of acreage taxes. Last fall a large number of claims were declared forfeited and thrown open for re-staking, the owners of which having, for the most part, inadvertently, failed to pay the small amount of the tax. A years' grace is now allowed, during which patentees can redeem their claims. Another amendment reduces the amount of assessment work required from 240 to 200 days, spread over five years, forty days to be worked each year.

NEWS FROM WASHINGTON

By **PAUL WOOTON**
Special Correspondent

Fall Against Liberalizing Act For War Minerals Relief

Possible That Present Law May Be Construed More Freely—Appointment of New Commission Expected

The Secretary of the Interior is opposed to legislation at this time which will liberalize the War Minerals Relief Act. Before any legislation is attempted he wants to assure himself that more liberal treatment cannot be accorded claimants under the existing statute. A new war minerals relief commission is to be named in the near future, it is understood. Secretary Fall will not be surprised if a new commission will find it possible to construe the law more liberally than the present commission.

The objection to the bill, which would widen the scope of the existing law by admitting stimulation based on a published notice, is that it would open the door for manufacturing and all types of war activities which were stimulated by published notices of the Government's needs. The passage of the War Minerals Relief Act was made possible because it was declared that the Government had practically entered into a contract with certain producers of war minerals. After certain producers had been urged personally by officials of the Government to produce certain war minerals Congress accepted a policy of moral responsibility in certain cases where negotiations had not reached the stage of an actual contract. There will be determined opposition to any expansion of the law which will bring into such a classification those who had nothing more formal than a published article on which to base their assertion of stimulation.

Proposed Mining Code Revision Ready for Congress

Changes Prepared by Ingalls Committee To Be Submitted Soon to Committees on Mines

The text of the proposed revision of the mining code will be submitted to Congress within a few days, the Bureau of Mines has advised the committees on Mines and Mining of the Senate and of the House of Representatives. This is the fourth revision of the law, and represents extended and painstaking work on the part of the committee, consisting of W. R. Ingalls, J. Parke Channing, Horace V. Winchell, L. D. Ricketts, and Walter Douglas.

Both Senator Poindexter and Representative Rhodes, chairmen respectively of the committees of Mines and Mining of the Senate and the House, are particularly anxious to take up the consideration of this revision. It is generally admitted that the present mining code, adopted in 1872, is in urgent need of revision.

Many Demand Assessment Work Be Resumed

Alaskan Delegate Against Fiscal Year Basis for Far North

Senator Poindexter, the chairman of the Senate Committee on Mines and Mining, is receiving a large number of letters protesting against any further exemptions from assessment work on mining claims. These letters come from all the states affected, and indicate, Senator Poindexter said, a widespread demand for the resumption of assessment work.

The delegate from Alaska has filed a formal protest with the Senate and House committees against any change in the assessment work year in Alaska. He says most of the assessment work there is done in the winter when the snow facilitates traveling. In view of his protest a proviso will be added to the bill changing assessment work to a fiscal year basis, which will exempt Alaska from that change and specify that the assessment work there is to be completed on or before Dec. 31.

Shipping Strike Holds Up Alaska Sailings

The marine strike has tied up boats in the Alaskan service, and as a result the geological and topographical parties assigned to do work for the U. S. Geological Survey in Alaska have been delayed in leaving Seattle.

NEWS BY MINING DISTRICTS

Special London Letter

Ivanhoe Company in Australia Affected by High Labor Cost; Financial Position Sound—Rand Working Costs About £5 Per Oz.—Nigerian Tin Royalties Modified

By W. A. Doman

London, May 3—In the same manner as the South African mines the West Australian gold companies are becoming more and more dependent upon the excess realized for the metal above the standard price. The Ivanhoe, one of the greatest of the Kalgoorlie mines, is feeling severely the high level of working expenditure due to advances in wages and reductions in hours of labor—to say nothing of the additional outlays caused by the frequent strikes. At the time of writing a woodcutters' strike is in progress, and is affecting not the Ivanhoe alone but various other properties.

In 1919 working costs averaged 31/6 per ton, which meant that the averages of the reserves could be made to yield a profit only by the incidence of the gold premium. Last year the cost was 32/6 per ton, and during the current period it is likely to be higher still. At the beginning of 1920 the ore reserves were estimated at 972,387 tons, worth 33/9 per ton; at the end of the year they were 861,786 tons, averaging 34/4 per ton. Taking residues at about 4/2 per ton the recovery would be approximately 30/—, showing a loss of 2/6 a ton, to be made good by the gold premium. About one-third of the total tonnage could be extracted at a profit at the standard price of the metal. As 154,920 tons was milled last year only about 44,000 tons of new ore was opened up.

The company writes off all development charges against working costs. To the end of last year the sum laid out on development and equipment was £1,134,900, and this stands in the balance sheet at only £54,295, the original working capital of the company. As a result, the financial position is quite sound. The Ivanhoe seems to be an investment as well as a mining company, for it has £126,797 in thirty-one different securities, this being equal to 12.6 per cent of the capital. On account of last year 6/6 per £5 share was paid in dividends, making a total since the inception of the company of £3,88[illegible],000, or 38.8 per cent of the value of the gold recovered from the treatment of [illegible]345 tons of ore.

The Nourse Mines works two reefs, the Main Reef Leader and the South Reef, the former being the principal gold carrier. Values show a tendency to improve.

The decrease in the reef width last quarter is more than compensated for by the gold content, for, as worked out on the Rand, the number of inch-dwt. is 480, as compared with 425. The Nourse Mines has been doing none too well, so that the improvement shown in the six months is welcome.

Generally speaking it would appear that the average working costs of the mines of the Rand are now approximately £5 per oz. As the realizable value is only slightly over this figure it is clear that several of the properties will soon be under the necessity of closing down unless the price of gold recovers or the level of working expenses can be reduced. Naturally the bulk of the community does not wish to see the price of gold rise, because it means a further depreciation in the paper money in circulation. A decline in costs is probable, but whether it will go so far as to compensate for the fall in the price of gold remains to be seen.

Last week I mentioned that the Nigerian government was taking steps to alleviate the burdens of the tin-mining industry. So far, railway rates have not been reduced; only the scale of royalties has undergone modification. On the old scale, when tin was quoted below £130, 2 per cent was paid on value, the figure rising until on £180 and upward it was 7½ per cent. Now the rate is 2 per cent when the price is less than £180, and rises by easy stages until it reaches 10 per cent on £300 and upward.

CANADA

British Columbia

Premier Aërial Tramway To Be 11½ Miles Long

Stewart—The Red Cliff group of mineral claims on Bear River is reported to have been taken over by Messrs. R. W. Wood and A. B. Trites, who propose developing them this year. The outcrop on the Montrose claim is said to contain good gold values, with a small percentage of copper and a greater one of iron pyrites.

P. H. Graham, who has charge of the installation of an 11½-mile aërial tramway for the Premier mining company, from that company's property at Salmon River to tidewater near Stewart, has taken personal direction of the work. The tramway, the route of which parallels the wagon road, will require enough lumber to keep the Hyder and Stewart mills busy for some month. There are to be 150 ordinary towers and twelve tension towers, as well as three angle stations and two terminals. The stationary or carrying cable will be of one-inch steel and the traveling cable five-eighths of an inch in diameter. Mr. Graham also is to supervise the construction of ore bunkers at the wharf, at Stewart, the same having a capacity of 4,000 tons

Hudson's Hope—The provincial government has let a contract to Lynch Brothers, of Vancouver, B. C., to sink three test holes by diamond drill in the Boulder Creek district, about 24 miles northeast of Hudson's Hope. A minimum of about 3,000 ft. of drilling is to be done. The party already has set out for the locality and expects to begin work soon. This action is in line with the policy of the government of definitely ascertaining the oil possibilities of the Peace River country.

R. D. Featherstonehaugh plans to prospect the placer gravels of the Ingenika River, in the Peace River district, this year on a considerable scale for gold and platinum. He will be assisted by William Halderman. The company's claims are not far from Hudson's Hope. They will be worked by drag-line scraper, scraper capacity being 1,000 cu.yd. of gravel daily. Operations will continue until about the middle of October.

Trail—Ore shipments received at the Consolidated smelter the week ended May 7 totaled 9,583 tons, coming entirely from the company's mines.

New Denver—The Slocan Lake Union No. 98, Internation Union of Mine, Mill and Smelter Workers, has accepted a proposition providing for a reduction of 75c. per shift in all classes of labor, as previously more briefly announced. Rates for board have been reduced by the operators from $1.50 to $1.25 per day. The recognized wage scale throughout the Slocan will stand for the present for the various classes of labor: Miners, $4.50; muckers, $4; timbermen, $5; timbermen's helpers, $4.50; millmen, $5; flotation men, $4.50; carpenters, $5.50; blacksmiths, $5; blacksmith's helpers, $4.50; steam compressormen, $5; compressormen other than steam, $4.50; head end tramway operators, $4.50; underground mule drivers, $4.50; mule train brakemen, $4; teamsters, $5; cable men, $4.50; unskilled, $4. These scales became effective on May 6 but are subject to revision at quarterly conferences.

Sandon — Officials of Silversmith Mines, Ltd., which company closed arrangements for the purchase of the Ivanhoe mill of the Minnesota Silver Co. early in May, have announced plans for amalgamation of the present Silversmith milling equipment with the Ivanhoe plant. The building housing the latter will be enlarged. The change will give Silversmith a daily milling capacity of from 150 to 300 tons. A few men are at work on the preliminary operations, and by the end of the summer it is expected that the Silversmith mill equipment will be moved down to the Ivanhoe mill site, construction completed and the combined plant in operation. Use of the present half-mile Silversmith aërial tram to Sandon will be discontinued and an entirely new tramway, about a mile long, built from the Silversmith main adit tunnel to the Ivanhoe mill site, which is about a mile below Sandon. Underground development at the Silversmith has been entirely discontinued for the present, as ample ore reserves are available.

The Cariboo District

Rich Shallow Ground Exhausted, but Other Areas Offer Promise—Government's Attitude Changed Toward Speculators

By Donald D. Fraser

Official figures give the placer gold production of the Cariboo district of British Columbia as $45,000,000, although the actual production is variously estimated at between $60,000,000 and $75,000,000. For twenty years after its discovery it was a prolific gold producer. Since that time its output has gradually diminished until in 1919 the district is officially credited with less than $80,000.

The gold fields of the Cariboo cover an extensive area, about 7,000 sq.mi. The eastern boundary is the Cariboo Range and the western the Fraser River. From the Horsefly River on the south it reaches well northward toward the Grand Trunk Pacific R.R. The eastern section is mountainous, with peaks rising to 8,000 ft. Proceeding westward the topography becomes more subdued and merges into a plateau which slopes to the Fraser and Quesnel rivers. There are three main rivers which drain this territory, the Willow, the Cottonwood, and the Quesnel. It is mainly along the headwaters of these rivers that the gold has been recovered, although the headwaters of Bear River were also important producers. The direction of the glacial action has apparently been from northeast to southwest. The glacial debris gradually increases in this direction. The country rock is composed of various slates and schists, which are cut by numerous quartz veins. These veins were undoubtedly the source of most of the placer gold discovered.

There were three main sections of the district which produced the major portion of the gold; namely, Barkerville, Stanley, and Keithley, in order of their importance. The character of the ground worked comes under two main headings: the shallow ground of the creeks and benches and the deep ground of the main drainage basins. Both glacial and pre-glacial deposits occur. These areas were extremely rich and soon worked out. Drifting, ground sluicing, rocking all played a part. It will be noted that these three centers are near the head of the district, the country sloping in all directions from them. As the rich shallow ground became exhausted attempts were made further down the drainage systems. Most of these failed when it was not possible to combat the underground water and heavy ground. Hydraulicking has found wide application but mainly around the three centers named. In both drifting and hydraulicking there have probably been as many cases of "mining the public" as of mining the ground. Hydraulicking has, however, been successful where used with good judgment and good management. Except for a few half-hearted attempts on the Quesnel River dredging has not been attempted. This is owing mainly to the high transportation rates which have prevailed in the past.

The main cause for the lessened production is the exhaustion of the rich shallow ground. The cream has evidently been skimmed. A further cause, which is by no means a small one, is the attitude of capital due to the extensive wildcatting and bad management of the past. Added to these have been the high freight rates and the consequent excessive costs. Last but by no means least is the fact that so much of the country has been tied up by speculators.

Regarding this last point the attitude of the provincial government has not aided the development of the placer ground of the province. By far the larger part of the ground taken up is under leases, of which there are two kinds; namely, a creek lease and a bench lease. A creek lease is one-half mile long and the width of the valley. A bench lease has a 1,500-ft. creek frontage with an area of 80 acres. Each lease represents a fairly large tract of land. It has been customary to grant these leases for a term of twenty years. The lessee obligated himself to perform $1,000 worth of work annually and pay a yearly rental of $75 and $50 for a creek and bench lease, respectively. These terms were found to be impracticable, and so, instead of correcting them, the government did not attempt to hold the lessee to them. The consequence was that by paying the first year's rental anyone could obtain a twenty-year lease on crown land and hold it for speculation without doing any work or paying further rentals. That is what happened. Practically all the ground within easy reach has been held in this manner. In many cases the ground was held for high figures and capital went elsewhere. Last year, however, this matter was remedied. The rentals have been lowered to $37.50 for a creek lease and $25 for a bench lease. The work required has been cut to $250 per year. In case the lessee does not meet these requirements his lease is cancelled.

The new government railroad, the Pacific Great Eastern, is now being extended through the district, so that the communication will be direct to Vancouver. Freight delays and rates should be greatly lessened.

The district is by no means exhausted. About the above-named centers there are numerous creeks and benches well worth investigating. The areas remaining are buried deep under glacial debris and need intelligent prospecting before large expenditures are made. The ground may be drilled to good advantage. Toward the head of the district the water supply is small, but the richness of the ground makes up for this deficiency. There are large areas on Williams, Antler, Beaver Pass, Swift, Swamp and other creeks which are worth investigating for dredging purposes. Slough, Peters, Fountaine, Lower Lightning and other creeks hold good possibilities for deep drifting if the water can be handled successfully. There are innumerable creeks and benches which offer a variety for the investor looking for hydraulicking ground.

As soon as capital looks favorably again upon gold mining there will probably be renewed activity in all three of these fields. The district is not unique in that new companies seem to think that all that is necessary in a placer camp is to find a spot where there is some evidence of gold and then decide upon a method of operation and pay dividends. Placer work requires less preliminary work than does rock work, but it is a poor idea to try to get along without preliminary testing. A few thousand dollars spent testing the ground by drills or otherwise is the best insurance obtainable for the company's capital. This fact is no less true in Cariboo than elsewhere. The glacial debris has so covered the old channels that preliminary prospecting should be done wherever possible.

Ontario

Mining Corporation Resumes—McIntyre To Increase Mill Capacity—Dome Lake and West Dome To Amalgamate

Cobalt—The Mining Corporation, which has been closed for the last few months, has resumed operations. The mill capacity has now been brought up to over 300 tons per day, and it is expected that considerable economies in operations can be effected.

The Coniagas mill will soon start handling about 600 tons a day. Of this 300 to 350 tons will be mine rock and 200 to 300 tons old tailings.

The Benson-Gilmour Syndicate has started operations on the old Silver Leaf dump, which the syndicate owns, and will start shipments to the Bailey mill soon.

The Nipissing report for April shows that during the month the company mined ore of an estimated net value of $142,610, and shipped bullion from Nipissing and custom ores of an estimated net value of $177,762. The value of the silver was estimated at 61⅜c. per oz. Underground work was suspended part of the month, on account of the destruction of No. 73 shaft house by fire. The low-grade mill treated 6,633 tons and the refinery shipped 301,075 fine ounces of bullion.

The mill of the Keeley mine in South Lorraine will be operated this summer. A discovery of high-grade was made underground recently.

The Hylands property, which has been closed down for the last twelve years, is to be reopened.

Porcupine—It is expected that the McIntyre will soon start to increase the capacity of its mill, and that it will have reached 800 tons a day by next October, and 1,000 tons a day by the end of the year. Orders have already been let for some of the additional machinery, and arrangements are being made to enlarge the mill buildings.

The Dome Lake and West Dome properties, in Porcupine, are to be amalgamated. The main vein on the Dome Lake dips into the West Dome ground at a depth of about 500 ft., and the work done by the Dome Lake showed a considerable improvement in both continuity and values in the vein at this depth. The Dome Lake has a mill of seventy tons' capacity, but a certain amount of both mine and mill equipment has been sold.

The Hollinger has made application for the right to develop 30,000 hp. at Kettle Falls on the Abitibi River. For some time the Hollinger has not been satisfied that the power developed in the Porcupine district would be sufficient to supply the operating mines. The Northern Canada Power Co. develops 15,000 hp. in Porcupine, but it is understood that when the changes contemplated by the Hollinger are completed, that company could use practically the whole of this supply. The Kettle Falls development would require a sixty-mile transmission line to the Hollinger mine. The capacity of the falls, under control, is estimated at 40,000 hp., but the Ontario government would reserve the right to 10,000 hp. for provincial purposes.

The Allied Porcupine is the name of a new company which has taken over the Three Nations and La Palm properties, and arrangements are now being completed for financing mining operations.

Port Arthur — The Atikokan blast furnace has been purchased by the Palatine Mining & Development Co., of Chicago, which holds iron ore lands in Cook County, Minn. to reach which it is planned to construct a twenty-one mile connecting link of the Port Arthur, Duluth & Western Ry. to the American boundary. The blast furnace will be rebuilt and its capacity increased from 150 tons of pig iron per day to 225 tons, and ore docks will be constructed at Port Arthur.

AUSTRALIA

Queensland

Mount Morgan Announces Necessity of Cutting Wages or Shutting Down

Brisbane, April 5—The manager of Mount Morgan, the only copper-producing mine remaining operative in Queensland and with one exception in Australia, has told the employees that there must either be a reduction in salaries and wages (suggested at 20 per cent) or a closing down. He says that even with that reduction there will be no dividends for the shareholders. The men have decided to leave the matter with the Industrial Arbitration Judge.

AUSTRIA

About 132 Mining Enterprises in Country—Lack of Coal Results From Loss of Mines in Czecho-Slovakia

From Our Berlin Correspondent

Austria bears a close resemblance to Switzerland in many respects. As to mineral resources, she is even more fortunate than the latter country. She has several gold deposits in the Alps, which have never been properly exploited, on account of their difficult situation. The prospective output did not warrant installation of extensive plant, and the mining of former years was performed in a primitive manner. Under the changed conditions, the gold deposits are now receiving considerable attention. At one of the gold mines in Salzburg, operations were resumed some time ago. An adit is being driven at an altitude of 5,000 ft. and has reached a length of about 600 ft. After the new equipment is installed it is expected that the mine will produce 100 tons of ore per day.

Another gold mine has been in operation since last year in Carinthia. No gold was then produced, but it is believed that a small quantity will be obtained this year.

Other mineral products of the country are graphite and talc in considerable quantities, and some lead, silver, and zinc. Several long-abandoned copper mines in Tyrol have resumed work. The chalcopyrite and pyrite mines of Fragant, in Carinthia, have been taken over by the state and will be enlarged. A new bauxite mine has recently been opened near Salzburg.

The most important of Austria's mineral resources are the iron ore deposits in Styria, which are extensive. The ore is of good quality. They represent a large portion of Austria's national wealth. It is characteristic of the situation into which the country became involved after the war, that in 1919 it suffered the output of this important product to drop to 11 per cent of the full capacity. An increase of 70 per cent took place in 1920, but only 18 per cent of the production of 1916 had thus been reached. The main difficulty is lack of workmen. The old force had dispersed at the end of the war, leaving only a comparatively few native miners. The low purchasing power of the Austrian currency is the main obstacle in the way of filling up the ranks of workmen from outside.

Conveniently near the iron ore there are extensive magnesite deposits. New finds of magnesite of good grade have recently been made, in which great interest is being exhibited by inland and foreign iron works.

The Styrian Alps have also been found to store another wealth of a peculiar quality. Large caves occur which contain thick layers of fossiliferous earth, from which a phosphoric-acid fertilizer can be produced. Operations have been started at several of these caves. Wild rumors of fabulous riches of these deposits are in circulation, but authentic figures are not available. The discovery is, nevertheless, considered of importance, and it helps raise the spirits of the population.

The sorest point of Austria is her lack of coal. The main coal deposits of the former empire are now situated in Czecho-Slovakia. What is left to the country is insufficient for her needs. The total production in 1920 was 134,000 tons of coal and 2,400,000 tons of lignite. A steady increase in production is, however, disclosed by the monthly figures. The coal properties of Austria are in a rather undeveloped state, as they were neglected before the war, owing to the better production of the old empire's northern collieries.

The undeveloped state of the coal-mining industry is characteristic of the whole Austrian mining industry. The equipment of nearly all the mines and the method of mining are antiquated. Not nearly all the resources of the country are being exploited, and in fact it is probable that many valuable deposits have not been discovered yet, as is proved by the recent finds.

The country has now 134 mining enterprises, which may be classified as follows: Graphite and talc, 32; coal and brown coal, 44; lead, silver, and zinc, 14; magnesite, 8; copper, 9; gold, 3; iron, 13, and miscellaneous, 11.

MEXICO

Sonora

Nacozari Consolidated To Resume Development

Nacozari—After four months' delay, the Nacozari Consolidated Copper Co. will resume active development work through its main crosscut tunnel, which is being driven northeasterly under the prominent iron-stained capping which extends southeasterly from the Pilares mine of the Moctezuma Copper Co. An extensive development campaign has been planned on the strength of recent results in the tunnel, which have been very encouraging in that the advance has disclosed stringers of copper sulphide ore, increasing in both number and size as the tunnel proceeds. Development is under way on the company's San Pablo property, which continues to disclose high-grade gold-silver-copper-lead ore. A carload of high-grade ore was shipped to the El Paso smelter recently. Both the San Pablo and San Pedro mines are producing milling ore preparatory to resumption of operations at the company's concentrator, which has been remodeled by adding two large oil flotation units. Arrangements are being made for an oil supply for the new power plant which will replace the wood-burning equipment formerly in use. The company has secured a 99-year lease on a tract of 250 acres located less than two miles south of the main workings, which will be developed as a townsite. The main crosscut tunnel has tapped a flow of water ample for milling. Sinking of the San Pablo shaft will continue, and drifts No. 1 and No. 2 will be advanced.

PLANT OF NACOZARI CONSOLIDATED COPPER CO., NACOZARI, SONORA, MEX., IN CENTER. PILARES MINE LOCATION INDICATED IN LEFT BACKGROUND

From the main crosscut, the company plans to advance headings to connect with the Tharsis-York and Copper King shafts, and more extensive prospecting of the large iron-capped formation north of the main workings may be undertaken by means of churn drilling. The officers and directors of the company are: John G. Alexander, president; Thos. D. East, vice-president; B. R. Russell, secretary; Roy Hiatt, treasurer; and R. C. Heath, L. M. Williams, and George Motz. The company's properties are located southeast of Nacozari de Garcia, Sonora, Mexico, and the main office is in Douglas, Ariz.

Coahuila

Torreon — W. H. Williams, manager at Velardeña for the American-Mexico Mining Co., has left for San Antonio, Texas, on account of ill health. Work at Los Libres mines, the principal properties of the company, has been suspended.

Saltillo—A group of eleven mining claims has been taken up in the San Marcos mountains district of Monclova by Casmiro Trejo.

The zinc miners of the state of Coahuila are clamoring for a protective tariff on zinc. They claim that the zinc industry is suffering from the lack of interest and assistance by the federal government.

The board of directors of La Perlita Mining Co., with offices in this city and mining properties in different parts of the state, has called for the payment of the third assessment due on the second issue of stock. The amount is one peso per share, payable at the offices of the company in Saltillo. These funds will be employed in general development work and to defray overhead expenses.

Baja California

Compagnie du Boleo, operating copper mines at Santa Rosalia, Baja California, and purchasing its important supplies and equipment to the extent of approximately $2,000,000 per annum through a purchasing office in San Francisco, is issuing $1,000,000 in 8 per cent serial gold debentures, redeemable at the option of the company in whole or in part at $102 and accrued interest.

CALIFORNIA

Wage Scale Reduced at Mother Lode Mines

San Francisco — The revised wage scale, representing an average reduction of 50c. per shift, effective May 1, 1921, which, as previously announced, has been generally adopted by mine operators in Amador, Calaveras and Tuolumne counties, California, follows:

	Per Day
Miners	$4.00
Machine men	$4.00
Muckers and trammers	$3.50
Timbermen and pipemen	$4.00
Timbermen helpers	$3.75
Top laborers	$3.25—$3.50
Hoistmen	$4.25—$5.00
Underground hoistmen	$4.00—$4.25
Blacksmith	$4.25—$5.25
Blacksmith helper	$3.50—$3.75
Carpenters	$4.50—$5.25
Timber framers	$3.50—$4.00
Skip tenders and pumpmen	$4.00—$4.50
Tool nippers	$3.50—$4.00
Battery men	$4.00—$4.25
Concentration men	$3.50—$3.75

At present approximately 1,500 miners are employed in the mines on the Mother Lode and from 900 to 1,000 in the Grass Valley district. Existing wage agreements in the Grass Valley district are such that no wage changes have been made in this district. Labor is abundant in both districts, and labor efficiency is reported to be steadily increasing.

NEVADA

Silverhorn Booming — Amalgamated Pioche To Widen Shaft

Pioche — With conditions favoring progress, the big shaft of the Prince Consolidated, now 727 ft. deep, is nearing the bed of silver ore, which lies about 90 ft. below. The data obtained in diamond drilling over a wide area indicates that possibly 200,000 tons of ore, assaying $29.25 in gold and silver, will be available. Favorable smelting rates have been arranged, based on the analysis of drill cores.

A 600-gal. Prescott sinker pump is now lifting the water from the pocket at the 700-level station to the 468 level, eliminating the 593-level pump station.

Arrangements have been completed between the Amalgamated Pioche and the Combined Metals, by which the latter company will start overhauling the power plant at No. 1 shaft. This is preparatory to widening the shaft from the 420 level to the surface. It is planned to put in three boilers, with a capacity of 250 hp., and all the machinery will be overhauled.

Ore shipment from the Pioche district for the two weeks ended May 12 was confined to 408 tons from the property of the Bristol Silver Mines. Other properties are developing or awaiting the expected reduction in freight rates effective May 20 next. A seven-month trial of the increased rates has closed down 75 per cent of the shipping mines at Pioche.

Silverhorn—This camp is now a prosperous growing community, and Pioche is benefiting largely through the increased business derived from being the nearest supply point. Only three months old, Silverhorn now has an estimated population of over 200 people, and the surrounding district is being closely searched for profitable ore. It will take many months to prove up the ore reserves on the main properties and determine their true worth, and in the meantime outside properties will be developed that otherwise doubtless would have remained idle.

Ely—The Ely district is quiet and daily train service has been reduced to three trains per week. Attention is being given to the outlying portions of the district which in the early days furnished ore discoveries that were responsible for the White Pine boom. Operations are being started on the Hamilton mines, and with an increasing lead price production should be profitable. Gold production in and around Osceola still continues on a small scale. Several big nuggets have been discovered, and in seasons when water is plentiful, sluicing is still carried on in the town gulch. The gold, when it has been found, has been coarse and attractive.

A number of Ely business people have located in the new Silverhorn district.

UTAH

Utah Metal & Tunnel Leasing Large Part of Holdings — Utah Con. Installing New Hoist

Bingham Canyon—The Utah Metal & Tunnel company is throwing open a considerable portion of its underground holdings to lessees, who will pay royalties of from 25 to 50 per cent, according to the value of the ore developed.

The Utah Consolidated is installing a new 500-hp. Nordberg hoist. No shipments are being made at present, owing to the low price of copper; and no effort will be made to open the new mill until better prices prevail. Seventy men are employed in various ways at the property.

Eureka — Shipments for the week ended May 6 amounted to 134 cars, as compared with 126 the week preceding. Tintic Standard shipped 50 cars; Chief Consolidated, 32; Iron King, 16; Iron Blossom, 8; Dragon, 7; Eagle & Blue Bell, 6; Victoria, 4; Gemini, 3; Colorado, 3; Swansea, 2; Eureka Hill, 1; Eureka Mines, 1; Mammoth, 1.

IDAHO

Clark's Fork — On instructions from New York, Compton White, manager of the Clarinda Copper Mining Co., has let a contract to Reed Bros. & Clagg, headed by Joe Reed, a local mining man, for the completion of tunnel No. 5 at the Clarinda property, it is announced by the company. A new drill has been installed and work resumed at the face 930 ft. from the portal. The tunnel will be completed to the Lone-Pine vein a distance of 475 ft.

MONTANA

Black Rock Copper Vein 20 Ft. Wide

Butte—The vein of copper ore on the 20th level of Butte & Superior's Black Rock (zinc) mine shows a width of 20 ft.

The Anaconda company will continue development work on its phosphate properties.

Crosscutting has been started by the Tuolumne Copper Mining Co. on the 16th level for the Spread Delight vein.

OREGON

Rich Gold Discovery at Boswell Mine Attracts Attention

Grant's Pass—Much local interest is aroused by the rich gold ore now being mined from the Boswell gold mine near Grant's Pass. This property was recently purchased from R. Boswell by Seattle people, the purchase price being reported at $50,000 cash. Recently the property has been examined by various engineers. It is understood that Mr. Boswell has blocked rich gold ore valued at $[illegible],000, with a few hundred feet of development work. The limits of the pay shoot are as yet indefinite. Careful sampling has shown that there is a limited tonnage of assured ore, some of which will assay as high as $1,000 in gold per ton. There is a dump of lower grade ore that has accumulated from previous operations and a small cyanide mill will be built to treat this and the lower grade mine ore.

MINNESOTA

Mesabi Range

Crosby Mine Closed — Hill - Trumbull Resumes

Nashwauk—The Crosby mine has been closed indefinitely. This is the second Cleveland-Cliffs property to close recently. Over 100 men are affected. It is possible that the washing plant will be operated to handle the underground stockpile.

Marble—The Hill-Trumbull mine of the Mesaba-Cliffs company has resumed operations at its pit and washing plant. The plant will work to full capacity the whole season and some direct shipping ore will also be forwarded. Work of changing certain portions of the mill is under way.

Cuyuna Range

Hillcrest Resumes Open-Pit Mining—Croft Ships 30,000 Tons of Stock Ore and Again Shuts Down

Ironton—The Hillcrest mine, Coates & Tweed, operators, resumed open-pit mining on May 16, and will ship at least 100,000 tons this year The normal output at the Hillcrest is 200,000 tons.

The Inland Steel Co. has shipped 40,000 tons of iron ore from its Armour No. 2 stockpile, leaving 50,000 tons in stock which will not be shipped till later in the season. Underground operation is being continued on a one-shift basis with somewhat reduced labor force, maintaining a daily hoist of 300 tons and better.

The Mahnomen mine of the Quinn interests; the Pennington mine, operated by Todd-Stambaugh Co.; and the Feigh mine, M. A. Hanna & Co. (all large shippers in normal years) are still inactive and have no immediate plans for resumption of mining.

Charles W. Potts, of Deerwood, operator of the Northland mine, and the Denison-Schell high-grade manganese mine at Cushman, Ark., called a mass meeting of mine operators and business men recently to urge support of a tariff bill on manganese and manganiferous ores. Mr. Potts has just returned from Washington, where he has devoted several months to backing the fight for a manganese tariff.

Crosby — John A. Savage shipped about 30,000 tons of high-grade Bessemer ore from the Croft mine stockpile before May 1, on which date the mine was again closed down and the labor force reduced to a minimum.

Riverton—Hydraulic stripping is being continued with marked success at the Sagamore mine, of John A. Savage & Co. Mining has not been resumed but a large amount of construction work is planned. Machinery is being received for a modern screening and drying plant, which will be erected this summer. A concrete and steel machine and carpenter shop will also be completed.

Trommald—A steam shovel has been purchased and shipped for open pit operation at the Maroco mine of the Marquette Ore Co., where hydraulic stripping of overburden is nearing completion.

MICHIGAN

Gogebic Range

Despite Apparent Activity, Many Mines Are Down or Running on Reduced Scale

Ironwood — The Ashland mine received an order for 10,000 tons of ore for immediate shipment and sent its first ore to the docks on May 2. The several mines of the Oliver Iron Mining Co. started shipping on May 5, and a few days later the steam shovels were started on the stockpiles. Two or three shovels have been kept working every day since, but they may have to be stopped soon, as there is some difficulty on the Lakes about getting boats.

Although there seems to be greater activity on this range than on some of the others, many of the mines are closed down or operating on much reduced scales. The Yale mine of the Charcoal Iron Co. closed down May 3, and only the pumps will be kept working. The Oglebay-Norton Co. has even considered pulling the pumps on some of its properties. The Newport and Anvil-Palms mines, which last year shipped about 2,215,000 tons, will employ only enough men to operate the pumps and do the necessary repairing to keep the shafts and levels from caving in. The old timber-lined portion of "K" shaft may be relined with steel and concrete. The Newport, especially, is troubled with heavy ground, and will probably lose a number of its sub-levels and raises during this forced shut-down. For a number of years it has been the largest underground iron mine in the state.

The Michigan State Tax Commission held a hearing at the Gogebic County Court House on May 12, at which the assessments of the various mining properties in the county were reviewed. Evidence was submitted by some of the mining interests to show that mining properties in the state were assessed at more than their cash value. Michigan mines have fared better than those in Minnesota in the matter of taxes, but still seem to be overvalued.

The valuation of mining property in the city of Ironwood, as established tentatively by the state tax commission, has decreased from $19,878,226 in 1920 to $19,013,677 in 1921, the largest part of this decrease being in the personal property of the Norrie-Aurora-Pabst group of mines, where a cut of $575,135 was made. On account of the showing of ore at the Ashland mine, which a few years ago had worked out all ore in sight, its valuation was raised from $100,000 to $153,036.

The Copper Country

Calumet—The Seneca has acquired the interest in the Lake Milling, Smelting & Refining Co. formerly owned by the Hancock. This gives Seneca company immediate facilities for stamping from 1,000 to 1,200 tons of rock daily and increasing the stamping capacity as desired. The arrangement saves Seneca the time necessary to build a new mill and it also gives it the benefit of the best technical mill talent at the command of the Calumet & Hecla.

THE MARKET REPORT

Daily Prices of Metals

May	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
12	12.50@12.75	31.75	32.75	5.00@5.15	4.95	4.90
13	12.50@12.75	31.675	32.75	5.00@5.10	4.90@4.95	4.90
14	12.75	31.50	32.50	5.00	4.85@4.90	4.85
16	12.75	31.25	32.375	5.00	4.85	4.85
17	12.75	32.00	33.00	5.00	4.85	4.85
18	12.75	32.00	33.00	5.00	4.85	4.85

*These prices correspond to the following quotations for copper, "delivered": 12.75@13c. for May 12 and 13; 13c. for May 14, 16, 17 and 18.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

May	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
12	72⅝	71¾	73½	179	181	24⅜	23⅞	26⅝	27⅜
13	73⅛	72⅛	74	178¾	180	23¼	23¼	26½	27½
14	...	...	...	....	....	...	...	...	...
16	...	...	...	....	....	...	...	...	...
17	74⅛	73⅜	74½	181	182¾	23⅝	23½	27	27⅞
18	74½	73¾	75	180⅞	182	23⅞	23⅞	27⅞	28⅞

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

May	Sterling Exchange	Silver			May	Sterling Exchange	Silver		
		New York, Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York, Foreign Origin	London
12	398½	99¼	60⅞	34½	16	399½	99¼	59¾	...
13	399½	99¼	60¼	34¼	17	399	99¼	59⅝	33¾
14	399¾	99¼	59¾	33⅞	18	399⅜	99¼	59⅛	33½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, May 18, 1921

The week has been a quiet one, with little demand for any of the metals, especially from domestic consumers, who have yet to feel any increased general business activity.

Copper

As a result of curtailed production and a satisfactory export demand, the copper market has maintained the stronger tendency of recent weeks, and the price has gradually crept upward. Today we know of no one willing to sell even prompt copper for less than 13c., delivered, and producers are in some cases quoting as high as 13.25c. for May shipments, and are not anxious to sell at that price. The feeling is general among producers that conditions will slowly improve and that they will lose more by selling at present prices than the loss of interest by holding the metal. The export demand is generally sufficient to take care of current output, so that domestic demand must be supplied from higher-cost stocks. However, practically no copper is being sold to domestic consumers. A large cable company was inquiring for prices on six or seven hundred tons yesterday, but orders for lots of this size are infrequent. Conditions are reported particularly unsatisfactory just now among copper consumers in the Middle West. Copper for shipment later than May is obtainable at a premium of about ⅛c. per month. Copper for export sold at 13c., c.i.f. European ports until Friday, when the Export Association raised the price to 13.25c.

Lead

The official price of the A. S. & R. Co. remained all week at 5c., New York and St. Louis.

The demand for lead was fair on Thursday, but since then practically all producers report no sales and few inquiries. This let-up in demand has had the effect of putting a brake on the constantly increasing price of recent weeks, in fact, as soon as it was seen that consumers' interest was failing producers were disposed to do business at somewhat lower levels. Today it is possible that a preferred consumer could buy lead in St. Louis at 4.75c., although we have heard of no sales being made at that figure. These conditions have brought some speculative holdings into the market which were offered somewhat above the figures which we quote but which generally went unsold. It is considered that present consumption is greater than production, and as the stocks are not so large as to be a menace, the present setback is likely to be only temporary.

Zinc

Practically all of the zinc sold during the week was marketed at a concession of 5 points from last week's closing quotation of 4.90c., St. Louis. The market is dull, and inquiries are light, the demand that helped to improve prices a short time ago having disappeared almost entirely. Producers in general are not pressing sales, and are making but few offerings. The London market has improved £1 12½s. over the last seven days and is now £27 17½s. A further rise of approximately £1 10s. would put the American zinc industry on an export basis, a result that should have highly beneficial consequences. Although little interest is shown in futures, quotations of 4.90c. for June and 4.95c. for July are being made. High-grade zinc is selling for 6.75c., with customary freight allowance of not more than 30 points.

Tin

The tin market is almost entirely in the hands of speculators, who are making a little money dabbling in small lots and taking advantage of London fluctuations. The market was strong on Thursday but very easy over the week-end in the absence of London buying orders. Local dealers expected a depressed London tin market on Tuesday in view of the Silesian difficulties, but were mistaken. A small tonnage of electrolytic tin was sold to consumers at prices which averaged about ⅛c. under those of Straits. Tin for forward delivery was quiet at the same prices as for spot Straits to ⅛c. higher.

Arrivals of tin, in long tons: May 12, London, 75; May 16, London, 20; May 17, London, 50.

Gold

Gold in London: May 12, 103s.; May 13, 102s. 11d.; May 17, 102s. 11d.; May 18, 102s. 9d.

General stock of money in the United States, May 1: Gold coin (including bullion in Treasury), $3,089,679,782; standard silver dollars, $276,482,326; subsidiary silver, $271,058,297; United States notes, $346,681,016; Federal Reserve notes, $3,059,943,360; Federal Reserve Bank notes, $175,014,400; National Bank notes, $723,816,352; total, $7,942,675,533. The outstanding notes decreased about $232,000,000 during April, and the gold and silver increased about $92,000,000.

Foreign Exchange

Practically all European exchanges exhibited stronger tendencies during the week and trading was in many instances of larger volume than usual. On Tuesday, May 17, francs were 8.48c.; lire, 5.525c.; and marks, 1.735c. New York funds in Montreal, 11$\frac{7}{16}$ per cent premium.

Silver

The silver market has been dull and narrow the last week, with weaker tendency due to selling by the Indian bazaars, the only support to the market being bear covering by China buyers. The London price has fallen from 34½ to 33⅜d. and closes dull. Domestic demand continues light and on a small scale. The future tendency for silver seems uncertain, with no important rise probable until there is a revival in trade in the Far East.

Mexican Dollars—May 12, 46⅝c.; 13th, 46c.; 14th, 45⅝c.; 16th, 45⅝c.; 17th, 45⅝c.; 18th, 45¼c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 22@23c. per lb.; 22½c. for imports, duty paid.

Antimony—Chinese and Japanese brands, 5¼c.; market dull. W.C.C. brand, 5¼@6¼c. per lb. Cookson's "C" grade, spot, 9½c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb., 500 lb. lots.

Cadmium—Range $1@$1.10 per lb., in 1,000 lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $4 per lb.; black oxide, $3@$3.10 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $250@$300 per oz.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 38@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—$72@$75 per oz.

Quicksilver—Nominally, $46@$48 per 75-lb. flask. San Francisco wires $47. Steady.

[1]**Rhodium**—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 45@55c. per long ton unit, f.o.b. Atlantic ports.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $7.45; Mesabi bessemer, 55 per cent iron, $7.20; Old Range non-bessemer, 51½ per cent iron, $6.70; Mesabi non-bessemer, 51½ per cent iron, $6.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5.80; old bed concentrates, 63 per cent, $6.70; Harmony, cobbed, 63 per cent, $6.70; new bed low phosphorus, 65 per cent, $9.50.

Manganese Ore—25@30c. per unit, seaport; chemical ore (MnO_2) $55@$60 per gross ton, lump; $70@$75 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3 $3@$3.75, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Zinc and Lead Ore Markets

Joplin, Mo., May 14—Zinc blende, per ton, high, $28.35; basis 60 per cent zinc, premium and Prime Western, $25; fines and slimes, $22.50@$20; calamine, basis 40 per cent zinc, $12. Average settling prices: Blende, $24.35; calamine, $15; all zinc ores, $24.29.

Lead, high, $58.90; basis 80 per cent lead, $60; average settling price, all grades of lead, $56 per ton.

Shipments for the week: Blende, 4,627; calamine, 30; lead, 1,439 tons. Value, all ores the week, $193,740.

No buyer offered over $25 basis this week, sellers holding back. Lead ore demand sent the basis up $2.50 per ton again, advancing the price to $60 basis, a steady increase from $35 the end of February. Low production is responsible for an unwarranted price basis.

Platteville, Wis., May 16—Blende, basis 60 per cent zinc, $28 per ton base offered, but operators carrying stocks are holding for advance. Lead ore, basis 80 per cent lead, $55 per ton. For the first time in two decades no finished blende was shipped out of the Wisconsin district. Shipments for the week: Lead ore, 91 tons. Shipments for the year: Blende, 11,461; lead ore, 659 tons. Shipped during the week to separating plants, 818 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $2,000@$3,000; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7 per long ton, f.o.b. Cartersville, Ga. Small lots as low as $5.

Bauxite—High-grade French bauxite, $8@$10 per ton, Atlantic ports. American quotations the same. Consumers generally well supplied. Prices vary according to grade. Crude, unground, $16.50 per ton; ground, $22; calcined, ground $35; unground, $45, f.o.b. plant.

Chalk—English, extra light, 5@5½c. Domestic light, 4½@5c.; heavy, 4@4½c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$10; washed, $10@$12; powdered, $15@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $15@$20, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $15@$25, f.o.b. American ports; powdered, $35@$45, f.o.b. New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c. f.o.b. New England points.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$25 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $15, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $32, New Mexico, Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines. Market is improving in western ground acid grades for glass and enamel manufacture.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 7½@8c. per lb.; chip, 6@6½c.; dust, 4@4½c. No. 1 flake, 7c.; amorphous crude, ¾c.@2¼c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$2 per net ton; 1½ in., $1.50@$2. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned — $38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

[1]Monazite — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $6.75; 68 per cent, $6.25; 68@66 per cent, $6.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 14c., c.i.f. Atlantic seaport; furnace size, 14c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 12 @ 14c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$40, talcum powder grade. Southern talc, powdered, carload lots, $10@$14 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 7¾@8c. per lb. in carload lots.

Sodium Nitrate—$2.75@$3 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; $33@$35 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.75@$1.80 per unit, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 15c. per lb. of chromium contained; 4 to 6 per cent carbon, 16@17c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $80@$85, f.o.b. furnace; resale, $90, delivered; English, $80@$85, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $32, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $50@$55; 50 per cent, $80@$85; 75 per cent, $145@$150.

Ferrotungsten—Domestic, 70 to 80 per cent W, 50@55c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$5@$6 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 20½@20¾c. per lb.; wire, 15c.

Lead Sheets—Full lead sheets, 7¾c.; cut lead sheets, 8c. in quantity, mill lots.

Nickel Silver — 33½c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets 18¼c.; sheathing, 17¼c.; rods, ⅝ to 3 in., 15¼c.

Zinc Sheets—$11 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $35@$50 per ton, f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $75 per net ton, shipping point; arches, keys, wedges, $80; splits, soaps, $90.

Fire Brick—First quality, 9-in. shapes, $40@$50 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $90 @$95 per net ton; 9-in. arches, wedges and keys, $100; soaps and splits, $110.

Silica Brick—9-in., per 1,000: $45@$55 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, May 17, 1921

It is now the common view that the demand for steel during the next three months will be less than the rate of production has been in the last few weeks. Buying is particularly light.

Production of steel ingots is running a shade lighter than the average of April, being about 15,000,000 tons a year, or a trifle under a 30 per cent rate. The Steel Corporation is operating at between 35 and 40 per cent and the independents at between 20 and 25 per cent.

The steel prices that became the general market a month ago are being well maintained, but the real test is regarded as to come in the next few weeks.

Pig Iron—A merchant furnace interest has sold a steel works 2,000 tons of basic iron, both buyer and seller being in the Shenango Valley. The price was $22, furnace, or 50c. under the price at which a steel works had been selling surplus iron, and which merchant furnaces for a time refused to meet. Bessemer is quoted at $24, Valley, against the former nominal quotation of $25. Foundry is offered at $23.50, Valley, against $24 formerly quoted. Demand is light for all grades.

Steel—Prices remain at $37 for billets, $38 for slabs, $39 for sheet bars and small billets, and $48 for rods.

Coke

Connellsville—Furnace, $3.25@$3.75; foundry, $4.50@$5.

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[1]Foote Mineral Co., Philadelphia, Pa.

The Recovery in Lead

The Market Has Risen Steadily Since February, and Large Transactions Have Been Recorded—The Penarroya Co., With Spanish Lead, Actively Competing in American Markets—Continued Rise May Hinder Attempt To Obtain a High Tariff

EDITORIAL MARKET STUDY

THE LEAD MARKET has lately shown a surprising amount of strength, and the New York price is now around 5c. On Feb. 26 last, New York lead was sold for 3.75c., but since that date the market has steadily improved, and at present shows a stronger undertone than for months. Curtailment of production has had something to do with the improvement, but this influence is probably exaggerated, because of the pardonable reluctance of certain Western lead producers to decrease lead production, the "dollar silver" recovered being the chief stimulus to present day non-ferrous metal mining.

The principal contributory cause to the betterment in lead has been the regular and insistent demand for the metal, a demand that is fortunately confined to no one source, but is well distributed among the many classes of lead consumers. All the leading lead-producing companies have booked heavy orders for their product and have recorded a heavier amount of business than for many months. They have been able not only to improve their financial position, but, by making an inroad on surplus stocks, which had threatened to increase, have improved their statistical position. Another lull in buying will find the lead producer in a good position to weather the readjustment period.

Effect of Foreign Lead on Domestic Price Is Negligible

At the same time that lead buying has increased, the usual irritating damper, in the form of a steady or declining London market, coupled with imports into the United States, was not a strong element. It is true, as current reports indicated, that negotiations looking to the shipment of more than 5,000 tons of Spanish lead were concluded by the agents of the Penarroya Co. in this country and that about 2,000 tons additional Spanish lead will be available in the domestic market, but, nevertheless, there has been little disposition to sell the uncontracted metal at prices lower than the American product.

London quotations have risen contemporaneously with those of New York and St. Louis, despite the reports of large stocks in London (24,000 tons) and quiet trading. It may well be that these stocks are in strong hands, and hence are not likely to disturb the rise, and that speculation in the metal is a prominent trade factor. Real support to the London market is reported to come from German purchases of Spanish lead, and to absence of new supplies from Australia and other countries. At £24, and current rates of exchange, lead cannot be profitably exported and laid down in Atlantic ports under 5c. per lb., so that the American market is not on a parity with London.

Activities of the Penarroya Company

Spain has important lead resources and produces from one-third to one-half as much lead as the United States. Prior to the war, production ranged from 1[illegible],000 to 203,000 metric tons. In 1919, the last year for which statistics are available, production was 125,722 metric tons. The following table from the *Metallgesellschaft's* compilations furnishes details of individual years:

SPANISH LEAD PRODUCTION IN METRIC TONS

[illegible]	[illegible]	1915	161,300
[illegible]	[illegible]	1916	[illegible]
[illegible]	[illegible]	1917	[illegible]
[illegible]	[illegible]	1918	146,300
[illegible]	[illegible]	1919	(a) 125,72[illegible]
[illegible]	[illegible]		

(a) [illegible] report published in *Commerce Reports*, March 31, 1921.

The Societé Minière et Metallurgique de Penarroya, which has frequently figured in market reports, is a Franch organization, of $14,625,000 capitalization (the U. S. currency equivalent of 292,500 shares of 250 fr. par value), and operates lead-silver mines at Penarroya, Province of Teruel, Spain, coal mines in the same vicinity, lead mines in the Pyrenees, and also mines in Algiers and Tunis, northern Africa. The company owns or controls every lead smelter in Spain, and, besides its private smelter at Penarroya, operates another at Marseilles, France. A new reduction plant, roasting and smelting equipment (American built), insures modern and efficient operation. The Penarroya company is a member of a French trade association or "consortium," the Societé Minerais et Metaux, a highly centralized organization formed for mutual protection and organization in trade competition with other nationals, and occupies a strong position in the French and Spanish lead industries.

The lead from Spain can be readily shipped directly to London, Germany, or the United States and does not have to be handled through London, enabling it actively to compete in the three markets mentioned. Usually the direct calculation based upon the London quotation, and upon shipment of lead from English ports, furnishes a higher estimate of the cost of selling Spanish lead in American markets, because the metal can be shipped directly from Spain at a saving in freight rates.

Demand for Lead From All Classes of Consumers

The consumption of new lead in American industries has been exceptionally well diversified and bespeaks a recovery in many manufacturing enterprises. Although it may be stretching the point too far, the omen may be one of the indications that conditions are improving and that the country is slowly but gradually emerging from the present period of depression.

Lead has a wide variety of uses and enters into the manufacture of cables, pipe, sheets, foil, batteries, babbitts, solder, bearing metals, ammunition, type metals, brasses, white lead, battery oxides and red lead and other pigments. This wide diversity of application emphasizes the inference that a demand for lead is an excellent trade barometer for general business conditions, were it not for the fact that lead has during the last year or more behaved differently from other metals and only recently touched relatively low points. Although no detailed figures are available covering the normal percentages of lead consumed by the various industries, the following order of importance is a deduction made from a table prepared by the War Industries Board during war time: Lead cable, white lead, ammunition, lead pipe, sheet lead, batteries, babbitts and solders.

It is, of course, idle to predict whether the advance in lead will grow or wither. For every reason to forecast a further rise in price, another reason can be advanced pointing to a decline. Lead producers were more fortunate than other metal producers in 1920, and the record made so far this year would appear to presage a duplication of this record. If the market should continue to strengthen, the lead producers' cry for a higher protective tariff would no doubt be inconsistent with conditions. However, they would be quick to argue that the present rise in price is merely temporary and that the danger of heavy importations is still formidable—to which the best answer will be the price of lead during the next few months, and a clarification of the still troublesome European situation or a return to actual peaceful conditions.

COMPANY REPORTS

Kennecott 1920 Surplus More Than Double

A report of operations of Kennecott Copper Corporation for 1920 states that 51,365,261 lb. of copper and 507,727 oz. of silver were received at the smelter. Cost of production, including all credits and charges except depletion, was 10.84c. per lb. Income account follows:

Operating revenue		
Copper sold. 45,487,855 lb @ 17.415c		$7,921,928.55
Silver sold 507,726.88 oz. @ $1.0148		515,262.07
		$8,437,190.62
Operating cost		
Mining and milling	$2,373,424.71	
Treatment, refining, and freight	2,320,535.39	
Selling and delivery charges	320,163.04	
General expense	171,576.87	5,185,700.01
		$3,251,490.61
Miscellaneous income at mines		7,897.61
Profit on metals sold		$3,259,388.22
Other income		
Dividends and interest		3,217,632.60
Total income for year		$6,477,020.82
Deduct interest and taxes		1,279,686.38
Balance to undivided profits		$5,197,334.44
Undivided profits		
Balance as stated, Dec. 31, 1919		7,511,404.59
Add—sundry adjustments in compliance with U. S. Treasury Department tax rulings		9,900,971.65
Balance as adjusted Dec. 31, 1919		$17,412,376.24
Income for year, as above		5,197,334.44
		$22,609,710.68
Depreciation of construction and equipment	$222,104.06	
Depletion for year	3,505,832.67	
Dividends Nos. 17, 18, 19 and 20 (but not including capital distributions amounting to $2,787,081)	2,787,081.00	6,515,017.73
Balance of undivided profits Dec. 31, 1920		$16,094,692.95

Capitalization 2,787,081 $\frac{2}{13}$ shares of no par value.

Copper Range Paid Smallest Dividends In 1920

A report of operations of the Copper Range Co. for 1920 states that $591,625.50 was paid in dividends on the 394,309 shares outstanding of $25 par, the smallest dividends ever paid by this company. Consolidated operating statement follows:

23,756,267 lb. of copper produced and sold at average of 17.148c per lb		$4,073,883.82
Interest		150,521.74
Atlantic Mining Co. income from rents, interest, etc		8,358.45
		$4,232,764.01
Mining expense, exploration, smelting, freight, sales department and all other expenses		3,692,779.01
		$539,985.00
Taxes paid by mining companies		436,477.67
		$103,507.33
Operating income of Copper Range R.R. Co. (which includes Government compensation and guaranty)	$205,540.31	
Less interest on bonds	114,000.00	91,540.31
		$195,047.64
Deduct one-half of net mining profit of Champion Copper Co., which belongs to the St. Mary's Mineral Land Co		199,886.32
Operating deficit		$4,838.68

Cost of production was 17.77c. per lb.

Arizona Commercial Mining Co.

A report of operations of the Arizona Commercial Mining Co. for 1920 states that 7,913,836 lb. of refined copper, 31,028 oz. of silver, and 1,722 oz. of gold was produced. Income account showed $1,020,223.47 received for copper, silver, and gold. Mining, treatment, and refining plus inventory losses amounted to $717,615.14; general expenses, $93,922.47; depreciation, $46,891.10; depletion, $194,930; loss for the year, $33,135.24. Surplus balance on Dec. 31, 1919, was $2,372,978.96; on Dec. 31, 1920, $2,339,843.72.

Alaska Juneau Deficit Decreases

A report of operations of the Alaska Juneau Gold Mining Co. for 1920 says that $732,870 of gold, 23,348 oz. of silver, and 487,574 lb. of lead were produced, compared with $499,002 of gold, 16,431 oz. of silver and 19,367 lb. of lead in 1919. Operating statement follows:

	1920	1919	Total to Date
Production—(Gross recovered gold, silver, and lead values)	942,870 Tons	692,895 Tons	3,327,834 Tons
Bullion	$583,134.82	$400,644.29	$1,820,242.54
Concentrates	208,255.17	142,069.70	816,677.18
Expenditures	$791,389.99	$542,713.99	$2,639,919.72
Mining:			
Prepaid mining	9,428.70	43,693.95	131,131.98
Stoping	22,701.81	13,947.12	424,738.75
Bulldozing	88,444.67	74,175.56	298,400.62
Tramming	75,142.20	74,309.89	312,922.03
Total	$195,717.38	$206,126.52	$1,167,193.38
Milling:			
Coarse crushing	$53,767.86	$50,843.58	$221,897.19
Intermediate crushing	228,092.35	192,667.65	619,818.87
Fine crushing	17,594.41	86,671.07	566,670.46
Concentration	23,165.19	18,904.35	145,471.68
Re-treatment	22,940.27	22,113.21	97,309.01
Sorting	75,270.87	17,379.44	98,937.33
Total	$420,830.95	$388,579.30	$1,750,104.54
Other Juneau operating and marketing costs	84,320.10	63,382.88	404,643.45
Total Juneau operating and marketing costs	$700,868.43	$658,088.70	$3,321,941.37
All other costs and interest	157,972.63	138,606.03	492,007.01
Total operating costs	$858,841.06	$796,694.73	$3,813,948.38
Juneau operating profit-deficit	$90,521.56	$115,374.71	$685,021.65
Net profit-deficit — (1914-1920 inclusive)	$67,451.07	$253,980.74	$1,177,028.66
Capital and other assets: (August, 1911, to December, 1920, inclusive.)			
Property and plant	$203,415.14	$142,375.61	$3,449,227.78
Deferred charges:			
Preparatory mining	69,336.17	41,288.53	486,236.20
Mine development	21,384.47	66,308.66	786,818.97
Total	$294,135.78	$249,972.80	$4,722,282.95
Total of all expenditures	$1,152,976.84	$1,046,667.53	$8,536,231.33
Surplus-deficit	$361,586.85	$503,953.54	$5,899,311.61

Nipissing Mines Co. Net Profit $1,279,091

A report of operations of the Nipissing Mining Co. for 1920 states that 3,332,303 oz. of silver was produced, at a cost of 37.4c. per oz. Operating statement follows:

Gross settlements		$2,628,333.01
Gross value of ore and bullion at mine shipped and outstanding Dec. 31, 1920		1,629,710.79
		$4,258,043.80
Less: Gross value of custom ore purchased	$661,709.13	
Gross value of inventory Dec. 31, 1919	1,093,110.95	1,754,820.08
Gross value of 1920 ore—Nipissing production		$2,503,223.72
Cost of mining and all other expenses (including smelter deductions, treatment, etc., on settlements 1920 ore and accrued charged on ore, and bullion at mine shipped and outstanding)	$1,382,974.10	
Less: Other income at Cobalt:	136,569.28	
Net cost of production		1,246,404.82
Net income for 1920 production		$1,256,818.90
Add interest at New York, Boston, Toronto, etc		138,429.43
		$1,395,248.33
Less: Cost and work on outside properties	$105,358.58	
Loss on sale of Government bonds	10,788.40	116,156.98
Net profit		$1,279,091.35
Surplus, Jan. 1, 1920		4,372, 52.33
Less: Dividends declared and paid during 1920	$1,235,000.00	
		$5,652,043.68
Dividend payable Jan. 1921	600,000.00	1,835,000.00
Net surplus		$3,817,043 [illegible]

The Nipissing Mines Co., a company controlling the entire stock of Nipissing Mining Co., declared dividends totaling $1,800,000 in 1920.

MINING STOCKS

Week Ended May 14, 1921

COPPER

Stock	Exch.	High	Low	Last	Last Div.	
Adventure	Boston	*70	*50	*50		
Ahmeek	Boston	52½	51	51	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	½	⅜	7/16		
Allouez	Boston	23	21	23	Mar. '19	1.00
Anaconda	New York	43½	41⅞	42	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2¾	2½	2.		
Ariz. Com'l	Boston	9	8½	8½	Oct. '18,	.50
Big Ledge	N. Y. Curb	5/16	¼	5/16		
Bingham Mines	Boston	10¼	10	10¼	Sept. '19, Q	.25
Calumet & Arizona	Boston	52¼	51	51	Mar. '21, Q	.50
Calumet & Hecla	Boston	255	251½	253¾	June '20, Q	5.00
Canada Copper	N. Y. Curb	....	....	*13		
Centennial	Boston	....	....	10	Dec. '18, SA	1.00
Cerro de Pasco	New York	32	29	29¼	Mar '21, Q	.50
Chile Copper	New York	12½	11¾	12¼		
Chino	New York	27¼	25¼	26	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*29	*28½	*28½		
Con. Arizona	N. Y. Curb	....	....	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	..	..	1⅛		
Copper Range	Boston	36½	35	35	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*29	*24	*26		
Davis-Daly	Boston	7	6⅜	6¾	Mar. '20, Q	.25
East Butte	Boston	9⅜	9⅛	9¼	Dec. '19, A	.50
First National	Boston Curb	*80	*75	*80	Feb. '19, SA	.15
Franklin	Boston	2¼	2⅛	2⅛		
Gadsden Copper	N. Y. Curb	....	..	*25		
Granby Consol.	New York	24¾	23½	24⅜	May '19, Q	1.25
Greene-Cananea	New York	25⅝	23¼	24	Nov. '20, Q	.50
Hancock	Boston	3	3	3		
Howe Sound	N. Y. Curb	....	....	2¼	Jan. '21, Q	.05
Inspiration Consol.	New York	37⅜	36	36⅞	Oct. '20, Q	1.00
Iron Cap	Boston Curb	6¾	6¼	6¾	Sept. '20, K	.25
Isle Royale	Boston	22	20½	21	Sept. '19, SA	.50
Kennecott	New York	22⅝	21¼	22	Dec. '20, Q	.50
Keweenaw	Boston	1⅝	1⅜	1⅝		
Lake Copper	Boston	2⅜	2⅜	2⅝		
La Salle	Boston	2	2	2		
Magma Chief	N. Y. Curb	..	....	*21		
Magma Copper	N. Y. Curb	21½	21½	21	Jan. '19, Q	.50
Majestic	Boston Curb	*10	*9	*10		
Mason Valley	Boston	1¾	1¼	1¼		
Mass Consolidated	Boston	2¾	2¼	2¼	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	4⅝	4½	4¼		
Miami Copper	New York	23½	23¼	23¼	May '21, Q	.50
Michigan	Boston	2¼	2¼	2¼		
Mohawk	Boston	53¾	52¾	53¾	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5⅜	5¼	5⅜		
Nevada Consol.	New York	13⅛	12½	12½	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	16	15¼	15½	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....	....	*5		
North Butte	Boston	11	10¾	10¾	Oct. '18, Q	.25
North Lake	Boston	....	....	⅜		
Ohio Copper	N. Y. Curb	....	....	9/16		
Old Dominion	Boston	23½	21	23½	Dec. '18, Q	1.00
Osceola	Boston	33	32	33	June '20, Q	.50
Phelps Dodge	Open Mar.	†160	†140	....	Apr. '21, Q	1.00
Quincy	Boston	42½	41	42	Mar. '20, Q	1.00
Ray Consolidated	New York	15	14½	14½	Dec. '20, Q	.25
Ray Hercules	Boston Curb	....	....	*35		
St. Mary's Min. Ld.	Boston	38½	38	38½	June '20, K	2.00
Seneca Copper	Boston	....	....	17⅞		
Shannon	Boston	1	1	1	Nov. '17, Q	.25
Shattuck Arizona	New York	7	6½	6¾	Jan. '20, Q	.25
South Lake	Boston	....	....	1½		
Superior Copper	Boston			4	Apr. '17,	1.00
Superior & Boston	Boston	2	1⅞	2		
Tenn. C. & C. ctfs.	New York	10	9¼	9¼	May '18, I	1.00
Toulumne	Boston	*55	*51	*51	May '13,	.10
United Verde Ex.	Boston Curb	29	26	26	May '21, Q	.25
Utah Consol.	Boston	4¼	3½	3½	Sept. '18,	.25
Utah Copper	New York	57¼	54¼	55	Mar. '21, Q	1.00
Utah M. & T.	Boston	1 13/16	1¼	1 13/16	Dec. '17,	.30
Victoria	Boston	*60	*54	*55		
Winona	Boston			*50		
Wolverine	Boston	12	12	12		

NICKEL-COPPER

Stock	Exch.	High	Low	Last	Last Div.	
Internat. Nickel	New York	16¼	15½	16	Mar. '19,	.50
Internat. Nickel, pf.	New York			85	May '21, Q	1.50

LEAD

Stock	Exch.	High	Low	Last	Last Div.	
National Lead	New York	80½	79	79	Mar. '21, Q	1.50
National Lead, pfd.	New York	102	102	102	Mar '21, Q	1.75
St. Joseph Lead	New York	12¼	12⅛	12⅛	Mar. '21, Q	.25
Stewart Mining	Boston Curb	..		*6	Dec. '15,	.05

ZINC

Stock	Exch.	High	Low	Last	Last Div.	
Am. Z. L. & S.	New York	9⅞	9⅛	9⅜	May '20,	1.00
Am. Z. L. & S., pfd.	New York	29½	28½	29	Nov. '20, Q	1.50
Butte C. & Z.	New York	5¼	5	5	June '18,	.50
Butte & Superior	New York	15	14	14	Sept. '20,	1.25
Callahan Zn-Ld	New York	5¼	5¼	5¼	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb	127	125	126	May '21, Q	2.00
Success	N. Y. Curb	*3	*2	*3	July '16,	.03
Yellow Pine	Los Angeles	*60	*60	*60	Sept. '20, Q	.03

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

GOLD

Stock	Exch.	High	Low	Last	Last Div.	
Alaska Gold	New York	⅞	⅝	⅝		
Alaska Juneau	New York	1¼	1⅛	1⅛		
Carson Hill	N. Y. Curb.	...	.	14¾		
Cresson Consol. G.	N. Y. Curb	2⅝	1 7/16	2⅝	June '20, Q	$0.10
Dome Extension	Toronto	*75	*70	*75		
Dome Mines	New York	21	18	19½	Apr. '21, Q	.25
Golden Cycle	Colo. Sprgs.	*74	*73	*73	Dec. '20, Q	.02
Goldfield Consol.	N. Y. Curb	*8	*7	*8	Dec. '19,	.05
Hollinger Consol.	Toronto	7.23	7.20	7.21	Feb. '21, M	.05
Homestake Mining	New York	61	57½	61	Sept. '19,	.50
Kirkland Lake	Toronto	*50	*48	*50		
Lake Shore	Toronto	1.33	1.30	1.31	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	2.02	1.98	1.98	Jan. '21, K	.05
Porcupine Crown	Toronto	*28	*28	*28	July '17,	.03
Portland	Colo. Sprgs.	*62	*62	*62	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*4	*2½	*3½	May '19,	.05
Silver Pick	N. Y. Curb	*6	*3	*5		
Teck Hughes	Toronto	*18	*16½	*16½		
Tom Reed	Los Angeles	*84½	*65	*65	Dec. '19,	.02
United Eastern	N. Y. Curb	2¾	2 9/16	2⅝	Apr. '21, Q	.15
Vindicator Consol.	Colo. Sprgs	*32	*30	*31	Jan. '20 Q	.01
West Dome Consol.	Toronto	*10	*8	*8⅛		
White Caps Mining	N. Y. Curb	*6	*3½	*4		
Yukon Gold	Boston Curb	....	....	*70	June '18,	.02½

SILVER

Stock	Exch.	High	Low	Last	Last Div.	
Arizona Silver	Boston Curb	*33	*20	*24	Apr. '20, M	.03
Batopilas Mining	New York	⅞	¾	¾	Dec. '07, I	.12½
Beaver Consol.	Toronto	*34	*34	*34	May '20, K	.03
Coniagas	Toronto	1.76	1.76	1.76	May '21, Q	.12½
Crown Reserve	Toronto	*13	*13	*13	Jan. '17,	.05
Kerr Lake	Boston	3 9/16	3⅜	3⅜	Apr. '21, Q	.12½
La Rose	Toronto	....	....	*23	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*19	*19	*19	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.12	0.85	1.09	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4⅝	4½	4½	Apr. '21, Q	.15
Ontario Silver	New York	6	5⅛	5⅛	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	2	1⅞	2	Jan. '12,	.10
Peterson Lake	Toronto	....	....	*6¼	Jan. '17,	.01½
Temiskaming	Toronto	....	....	*20	Jan. '20, K	.04
Trethewey	Toronto	*20	*16¼	*16¾	Jan. '19,	.05

GOLD AND SILVER

Stock	Exch.	High	Low	Last	Last Div.	
Atlanta	N. Y. Curb	*1	*½	*1		
Barnes-King	Butte	‡....	....	1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*65	*61	*61		
Cashboy	N. Y. Curb	*7	*5	*7		
El Salvador	N. Y. Curb	⅜	5/16	5/16		
Jim Butler	N. Y. Curb	*10	*8	*10	Aug. '18, SA	.01
Jumbo Extension	N. Y. Curb	*10	*6½	*10	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	⅛		
MacNamara M. & M.	N. Y. Curb	*28	*16	*24	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1 7/16	1 5/16	1⅜	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1 5/16	1 3/16	1¼		
Tonopah-Extension	N. Y. Curb	1 9/16	1½	1 9/16	Apr. '21, Q	.05
Tonopah Mining	N. Y. Curb	1⅝	1½	1 9/16	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	1 3/16	1	1 1/16	Dec. '19, SA	.05

SILVER-LEAD

Stock	Exch.	High	Low	Last	Last Div.	
Caledonia	N. Y. Curb	*12	*10	*12	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	...	...	*15	Dec. '20,	.15
Chief Consolidated	Boston Curb	...	.	2½	May '21, Q	.05
Consol. M. & S.	Montreal	17	16½	16¾	Oct. '20, Q	.62½
Daly Mining	Salt Lake	..	..	2.50	July '20, Q	.10
Daly-West	Boston	3½	2¾	3	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb			2¼	Apr. '21, K	.05
Electric Point	Spokane	*7	*7	*7	May '20, SA	.03
Federal M. & S.	New York	7¾	7¼	7¼	Jan. '09,	1.50
Federal M. & S., pfd.	New York	27½	27	27½	Mar. '21, Q	1.00
Florence Silver	Spokane	*15	*15	*15	Apr. '19,	.01½
Grand Central	Salt Lake	...		*07½	June '20, K	.03
Hecla Mining	N. Y. Curb	4¼	4	4¼	Mar. '21, Q	.15
Iron Blossom	N. Y. Curb	*20	*20	*20	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	.		3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*9	*6	*7½		
Prince Consol.	N. Y. Curb	3/16	3/16	3/16	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*5	*5	*5	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*12	*10½	*12		
South Hecla	Salt Lake	...		*65	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	3/16	⅛	3/16	Oct. '17,	.05
Tamarack-Custer	Spokane	1.80	1.70	1.70	Jan. '21, K	.04
Tintic Standard	Salt Lake	2.55	2.42½	2.50	June '20, Q	.10
Utah Apex	Boston	2⅛	2	2⅛	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*4	*2½	*3	Nov. '17,	.01

QUICKSILVER

Stock	Exch.	High	Low	Last	Last Div.	
New Idria	Boston	.		*50	Jan. '19,	.25

VANADIUM

Stock	Exch.	High	Low	Last	Last Div.	
Vanadium Corp.	New York	38	33¼	34	Jan. '21, Q	1.00

ASBESTOS

Stock	Exch.	High	Low	Last	Last Div.	
Asbestos Corp.	Montreal	64	61	61	Apr. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	83	82	83	Apr. '21, Q	1.75

MINING, SMELTING AND REFINING

Stock	Exch.	High	Low	Last	Last Div.	
Amer. Sm. & Ref.	New York	44½	41¼	42	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf.	New York	80	77¼	77½	Mar. '21, Q	1.75
Am. Sm. pf. A.	New York	71½	71¼	71½	Apr. '21, Q	1.50
U. S. Sm. R. & M.	New York	34½	33½	34	Jan. '21, Q	.50
U. S. Sm. R. & M. pf.	Boston	42	40½	41	Apr. '21, Q	.87½

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Franklin K. Lane

He left no will and no estate.—*New York Tribune* news item.

WE PROBABLY should not have been so quickened to notice editorially the death of the former Secretary of the Interior had it not been for the laconic sentence quoted above, which is the end of probably the last news item Franklin K. Lane will ever get. Publicity rushes back for news of the living. Yet we cannot let this last word of his newspaper epitaph go by without comment. As Secretary of the Interior, Lane was ipso facto Secretary of Mines, and many of us have come in personal contact with him. We know that he left an estate—a legacy to the American people beyond the ability of accountants to evaluate. He left the memory and the inspiration of a high soul, a clean life, of a great ideal of public service, of a career devoted to humanity, which great things so occupied him that he never found time for the accumulation of cash. We know that he left a will—a will to live intrepidly and without currying favor, and to die serenely, awaiting the orders of a Destiny which he frankly recognized was beyond his comprehension. "I accept" was the creed he dictated on his deathbed.

To those who place, as the great objective, business, commerce, the accumulation of lands and bonds—to the greatest commercial country in the world—such an estate, such a legacy as he bequeathed to the world, is priceless. It is not an isolated case, and reveals the deep-set foundation of the nation, on which the busy superstructure of bartering, toil and hubbub, and the great constructive work of industry, is reared.

During the war, a member of the War Cabinet whose entire record was that of a money-getter once remarked to Secretary Lane in scorn, "Queer that these doctors, experts, and scientists who are so busy around here don't seem to be able to make any money." "Did it ever occur to you," rejoined Secretary Lane, with finer scorn, "that there were people with other aims and ambitions than to make money?"

It is said of estates that a man cannot take them with him when he passes into the Shadows which Franklin K. Lane entered at Rochester. But the great estate he left was not of that kind; he takes it with him wherever he goes—and he leaves it all to the country.

New War Minerals Relief Legislation

A BILL (the Shortridge Bill) is now before Congress to amend the existing War Minerals Relief Act. It provides, in effect, that the existing provision as to war production (that the metals in the production of which losses were incurred must have been produced "on the request or demand of the Government") shall be so liberalized as to permit recoveries for metals produced "in response to any personal, written, or published request, demand, solicitation, or appeal from any of the Government agencies in said act." The reason for this attempt to amend the original measure is the interpretation of the cited clause in the original act, by the executive branch of the Government, to cover only direct request or demand or "stimulation," which must be proved in each individual case, and to exclude newspaper or magazine appeals, or those requests or appeals that were made through circulars. On this decision the administration of the act has gone steadily on, and the work of the War Minerals Relief Commission of the Department of the Interior, and of the organization of engineers and auditors of the Bureau of Mines, under the Chief Engineer, is now practically completed. We understand that Chairman Shafroth is leaving for a well-earned vacation in Europe, that Mr. Moore has tendered his resignation, and that only Mr. Pomeroy will be left temporarily to clean up the odds and ends.

The new legislation, if it passes, will admit *all claims hitherto excluded* on the basis of such claimants having been unable to show any specific and reasonably direct "request or demand" by the Government. Various circulars and newspaper and magazine articles, during the period of war need, reported the desire on the part of the Government for an increased activity in the production of the necessary war minerals. Most inclusive, perhaps, was a general appeal printed as an advertisement in the *Saturday Evening Post* and other publications, entitled "Wanted—Men To Discover America," and signed by the late Secretary Lane.

In a way, the proposed legislation remedies artificial and unjust distinctions. No specific "request or demand" which amounted to a verbal order or contract, for the production of any war mineral, was ever made on anybody; the obligation of the Government, if it existed, was not legal but moral. And the moral obligation rested on the fact that the Government did urge, in general, increased domestic production of high-grade manganese, chromite, and pyrite east of the Mississippi. If the Government is to pay at all for losses in mining operations resulting from this urge, the only fair way is to pay in all cases, and not to make quibbling distinctions, as was done by Congress in the original act, as to who was advised direct by an officer of the Government as to its needs (and so came within the interpretation of the act) and who got the message only indirectly or read it or heard about it (and so fell into the group whose claims were disallowed under the act).

The reader will note the restriction above to high-grade manganese, chromite, and pyrite east of the Mississippi. Another evidence of the light-hearted and careless handling of legislation by Congress and its interpretation by the Executive Branch is that under the act producers also of tungsten have recovered substantial damages, as also have producers of low-grade (spiegel-grade) manganese ores. No real Government urge, request, demand, or stimulation was ever made for these minerals; and it would have been quite as fair to the miner and the taxpayer to have included the whole list of minerals, from antimony to zircon, as was indeed attempted by the promoters and prospective beneficiaries of this legislation.

Now, if all losses incurred in the war-time production of chromite, manganese, pyrite, and tungsten are to be paid (as they will be under the Shortridge Act), we shall indeed have lived to see the halcyon days of mining—a blessed war period where every mining enterprise which has not turned out profitably has its losses made good by the Government. Would that we could induce the Government to continue indefinitely the same wise and liberal policy; it would induce many, who are now reluctant, from having been once singed, to return to the game.

But we must criticise the blundering and discriminatory legislation of Congress: if it holds its first act incomplete and hasty (as it has), why has it waited till it had been diligently and faithfully carried out before throwing the gates wide open? This late change of heart will admit three and a half million dollars' worth of claims disallowed for failure to show "request or demand" under the act. Moreover, under the administration of the act, damages for each claim on which award has been made have been figured by the auditors and engineers, for a certain "stimulation date," at which claimant was able to show "request or demand," which differed in each particular case. If the new Shortridge Bill becomes a law, the awards on these claims should in equity also be reconsidered, as the published request or appeal will probably be found to really date back to the entrance of the United States into the war. Can such awards be reconsidered? Under existing Treasury rulings that an award once made closes the claim, it is altogether probable that they cannot be reopened. Here, then, we have new inequities likely to require separate Congressional bills of relief in each case.

Again, 100 claims were ruled out because they were received after midnight, June 2, in accordance with the original act. Is it not inequitable, if all losses are to be paid, to exclude those who heard this news a little late, or who were so unfortunate as to be far from the post office?

Our readers will rightly conclude that the whole war minerals business has been a muddle. In the war activities of the executive branch of the Government, it is not hard for the student to put his finger on the beginning of these claims—the activity of the War Industries Board and of the Ship Control Committee of the Shipping Board in succeeding in bringing in under the "ballast and backhaul" argument large and entirely unnecessary shipments of chromite from New Caledonia, and so breaking the announced importation limit set by the Committee on Mineral Imports of the War Trade and Shipping Board, over the protests of the latter. Thus there was created a valid argument (and the only valid argument) on the part of the producer for a claim against the Government for his losses. The consideration of the various executive and legislative blunders made by the Government in the matter of war minerals speaks eloquently for a stronger Government organization to administer this most important branch of our industry. It is plainly evident that we need a Department of Mines.

Needed—A Congressional Editor

WHEN, at the last Presidential election, we were called upon to choose as Chief Executive between two small-town editors from Ohio, our ideas as to the dignity of the editorial profession were immeasurably advanced. We recalled that Theodore Roosevelt became contributing editor on the *Outlook* on retiring from the Presidency, as the only position of dignity compatible with his earlier occupation; and that ex-President Taft is before the public at present largely as a newspaper writer. Also, when George Harvey was sent as Ambassador to England to sit in with Lloyd George and Briand, and settle the world affairs, we realized that public sentiment demanded editors as those best trained to tell the people what to do about everything, including much in which said editors may not be at all versed.

We note the steady call, for such national positions where an assumption of wisdom and a firm manner of laying down principles is needed, on professions trained accordingly. First, and still, it was the lawyers, that class to whom, in their own judgment, and by their own confession, all human knowledge and wisdom has been vouchsafed. Next it was the college professor, to whom the same remarks apply. Finally, thank Heaven, it is the editor, to whom also the same remarks apply. And we (speaking editorially) begin to think that after all a deeply concerned Destiny has led us (speaking editorially) into the path leading to the high places we have always thought (speaking editorially to ourselves) we should grace.

And this moves us, seriously, to a practical suggestion. We could point out a lot of ways to improve the Government; but one of the things it needs badly is an official Congressional editor. The acts of Congress are frequently—if not typically—passed without anyone (including in this any Representative or Senator) really knowing what they mean. They are the result in most cases of compromise, suggestion, concession, and striking out; everybody has a crack at them, and finally they are rushed through by those who have them in charge, to escape further manhandling.

Let us be specific, and take the War Minerals Relief Bill, which was so patched up and cut into that it was as if Joseph's coat had been through a machine-gun attack. No one could say what it really provided, or why. So it had to be interpreted; and this by the solicitor of the Interior Department and by the Attorney General. They were skillful and competent enough, and put more clear intelligence into it than any of the Congressmen who had worked on it had any idea of; when it was thus elucidated to them they had the first clear idea of what they had said. To some of them it was what they had intended to say: to others it was not at all what they had had in mind. The majority never knew exactly what the whole thing was about and didn't particularly care whether the language said this or that. Was it not the best they could do under the circumstances?

But not only the Government attorneys become needlessly vexed and overworked by this carelessness of phrasing, but a host of private attorneys as well. These are bound to question the Government attorneys as to their interpretation of what the act failed to state, to argue and have hearings thereon, to try to throw it into the courts, so that the meaning may be argued on some more. What Congress intended—the deep meaning of the phrases—becomes a Rosetta stone or a Delphic oracle, embodying all wisdom, but hard to get at.

In an editorial last week, we quoted from a bill recently introduced to exempt from taxation the net income of corporations engaged "in the mining of gold, or in the mining, milling or reduction of silver." Should this become a law, we can foresee the thousands of arguments as to what under the circumstances was included in the "mining of gold." In corporations mining both gold and silver, as at Tonopah and many other camps, the accountants as well as the attorneys would find steady occupation in figuring out the income derived from the mining of gold, but not the milling or reduction, in the right proportion to the mining, milling and reduction of the associated silver.

Therefore we suggest that an official editor be appointed to Congress, to scan the verbiage of all bills before they are released from Congress, and to have the authority to hold up bills until he can make clear and unequivocal sense out of them. If the Congressmen who pass the bills cannot explain clearly what they meant, he should be empowered to return such bills to them with instructions to find out, and to assist him in incorporating such new or amended language in the bills that the intent may be quite clear.

Judging from the War Minerals Relief Act alone, such an editor would be cheap in Congress at a million dollars a year. We do not say that we would not serve for less; and we hope if the idea should appeal to the public as sound (and it is very sound) that the proponent should naturally have first call on the office. The cost of living in New York is very high.

Company Reports and Company Reports

SPRING is commonly associated with the budding of the leaves, the peeping of crops through the soil, an intense desire to get out in the open, and many other physiological indications of seasonal changes; but in our editorial offices—to bring our thoughts back to more prosaic matters—spring is heralded by a flood of company reports. Most of them come from the New York headquarters of mining companies and tell of operations, successful and unsuccessful, in all parts of the earth. Naturally, an excellent opportunity is given to compare the merits of the financial information furnished stockholders—usually the public—and to observe with what care the directors and company officials choose to conceal or reveal certain operating details.

Interesting contrasts are afforded by such an inspection. Some company activities are reported *in extenso;* others confine themselves to such meagerness of data that they are practically valueless. Many reports are so clearly presented that a person unfamiliar with the complex terms frequently used in accounting can readily grasp the significance of all the financial statements; others are so beclouded by the grouping of an immense amount of related financial matter that the accounting terms employed are meaningless without other interpretation. It seems as if a fraction of the mining companies frankly exposed all their wash on the line, whether fine linen or tattered rags; others prefer not to expose their laundry to the inquisitive public gaze.

From among the many annual reports which we have recently examined, a few strike us as being models of excellence in the presentation of mine accounts; whereas many are a waste of time to read.

The report of the Bunker Hill & Sullivan Mining & Concentrating Co. deserves especial commendation as belonging to the best class. Practically every question arising in the mind of a stockholder covering the financial and physical condition of the Bunker Hill properties is answered in this report, and operating details are given with such minuteness of detail that they are a valuable guide not only to the cost of silver-lead mining in Idaho but to the economics of mining in general. Excellent maps of the surface and mine workings are included, graphically illustrating the advances made during the year. Costs, be they exploratory, stoping, pumping, or milling, or other elements of expenditure, are itemized to an unusual degree. Balance sheets and income statements are examples of financial simplicity, without sacrifice of clearness. A report of this sort must result in imposing utmost confidence in the direction of the enterprise.

The porphyry copper reports, and those of Miami Copper, Tonopah Belmont, Calumet & Hecla, and Chile, to mention a few, are excellently presented and well worth studying, giving a fund of information about the varied operations of these organizations. Frequently the generosity with which a company dispenses details of its technical processes is not the attitude carried to its finances; at least the stockholders and public are not taken into confidence to any marked extent. The Anaconda Copper Mining Co., to mention an example, furnishes but the barest financial outline of its manifold operations, though it is an exponent of a ready exchange of technical information. The New Jersey Zinc Co., in its reports, goes many steps further in conservatism.

What policy guides certain companies in withholding financial information to stockholders? Is it an underestimation of the comprehension of the stockholders, a fear of furnishing competitors with valuable data, an innate secrecy, or some other reason? We don't know. No doubt the policy adopted is often the outcome of continued conservative control. It is our impression that the tendency is distinctly toward greater freedom in financial details, and that mining companies are realizing more and more that taking the stockholders into their confidence can only breed a wholesome solidarity between them and directing officials, a desirable asset in times of depression. Perhaps the reports of the future will show considerable general improvement. At any rate, it is a pleasure to find here and there, among the many reports that come to our desk, some that are as different from their fellows as the English language from Egyptian hieroglyphics. Not only are they appreciated by us, but by the stockholders, for whose enlightenment they are intended.

Electrical Prospecting in Queensland

"ELECTRICAL ORE-FINDERS" have been used in prospecting by some operators in the recently opened silver-lead district at Indooroopilly, near Brisbane, according to our correspondent in Queensland. Ordinary methods of prospecting failed there, it seems, owing to the absence of outcrops. Much interest has been shown in the experiments, if so they may be termed. They have, however, disappointingly proved unsuccessful. Shafts sunk below the depth where the "diviners" had predicted ore would be found have failed to reveal it. Our correspondent does not describe the electrical instruments used nor the mode of employing them. The news, however, is of interest in connection with the article, by Mr. Schlumberger, on underground electrical prospecting that we have recently published.

WHAT OTHERS THINK

Self-Education

"Only a Correspondence School Engineer," applied as you applied it, in one of your recent editorials, has the effect of doing the one thing which you probably have no desire to do—providing *Engineering and Mining Journal* is read, as you intend that it shall be, by men engaged in mining and metallurgy, especially young men. It discourages many who have not had the advantage of attending a technical school, but who have hopes of overcoming the disadvantage by applying themselves to a correspondence school course. Many a man who has started out on such a course with enthusiasm and high hopes of accomplishing something for himself will decide that if the attitude assumed by the mining world is that which you have expressed there is no use; and then and there he will lose his enthusiasm and do nothing more, and the man he might have been shall never be.

There can be no question that in choosing a doctor or a lawyer, and having no references, one would look for the man who had been trained in the best schools and not one from a correspondence school. However, if a certain man had a wide reputation, the choice would be based upon it, and no inquiry made as to the source of his knowledge. In fact, except in the case of a man new to these professions, no inquiry is made as to his schooling. Judgment is based upon his reputation for accomplishment and upon his character. Many poor men escape from first class-schools and many good men come from poor ones.

A man who is graduated from a mining school realizes two things: The vast amount he does not know, and that all he has acquired is a foundation upon which to build. His most important accomplishment is to read understandingly matter without which his education would be beyond his reach. His ability, reputation, and success must be built upon that part of his foundation, and to this he must add experience.

Perhaps some, but few indeed, can be expert in all branches of mining and metallurgy, no matter what their schooling may have been. When we come to a subject in which we are not expert, and in which we have to solve problems, there are but two things to do—employ an expert in that particular subject or read. Most of us have to do the latter. If one happens to have been engaged during most of the years since graduation as an executive, he will, most certainly, be rusty on many subjects. You find yourself examining a mine and working out the geology. It has to be done, you have to do it, and you have had little to do with geology for many years. What must you do? You must use your foundation and read the best books on the subject. Probably those of Weed, Emmons, Lindgren, Spurr, and others—and you apply the results of this reading to your problem.

The following month you find yourself confronted with a metallurgical problem. You are not an expert metallurgist, but you have a foundation, and you repeat the process noted above; get the best books on the subject, read them, and apply what you get to your problem.

When it comes to stratigraphy, most of us realize that no matter how much we may read, it is probable that we will make serious errors; so we call upon a paleontologist to identify our fossils. We are confronted by the necessity of making a mineralogical determination. If it is simple, we feel certain of ourselves, but for anything out of the ordinary we have to call on an individual who devotes his time to crystallography and petrography.

You must recognize that the courses given by the best of the correspondence schools are complete and thorough, so far as they can be without laboratories, and are especially well written. It would be well for many of us to carry correspondence courses in subjects which we are not applying, especially in mathematics and allied subjects.

A mine manager should encourage the young, uneducated man in his employ to acquire an education and to read and to observe. The correspondence school offers the means for education; but if in reading the technical press young engineers find discouragement, where, above all other places, they should find encouragement, the manager will find himself facing a hopeless task. His enthusiasm, interest, and efforts will cease.

There is nothing better than just criticism, and a good man appreciates it. It would seem that the able and brilliant editors of the technical press, with the opportunities afforded them for encouraging, educating, and putting enthusiasm into the young men of the mining industry, could be less critical and more helpful; as it were, surround themselves, as do many great teachers, with a following of loyal, earnest young men, who would feel free to go to them with any subject concerning their profession. E. M. GLEIM.

Terlingua, Tex.

The Birth of a Nugget

Your editorial on the "Birth of a Nugget," on p. 506 of the issue of March 19, is interesting, as indeed is the matter of the origin of nuggets in general. Apparently there is no escape from the conclusion that they are battered down and more or less water-worn particles from veins, freed largely from the matrix by weathering and stream action. But why has no one found in a vein masses that with any amount of such treatment would yield nuggets like Australia's Welcome Stranger? Is it because these exceptional pieces occur only in the upper portions of veins which have grown lean as they increase in depth? It would sometimes seem so.

It will be recalled that about twenty-five years ago Liversige, of Australia, undertook a series of experiments with a view of testing out a popular notion that the nuggets grew in the gravel by a process of chemical accretion. The evidence attained was to the contrary. Some years ago, in connection with my museum work, I started to collect a series showing the various stages by which a mass of dendritic gold might through natural agencies be reduced to nuggets. The necessary materials proved too expensive for a national institution, and I was obliged to give it up. Nevertheless, if any of your readers have any really instructive specimens in this line that they wish to donate the national collections, I shall be glad to give them a place.

Washington, D. C. GEORGE P. MERRILL,
Head Curator of Geology,
Smithsonian Institution.

The Development of the Rod Mill

Cylindrical Grinders Using Rods Instead of Balls Now Receiving Much Attention in This Country—Wide Application for Stage Grinding in Connection With Roughing Table Treatment and Flotation Indicated

By Edward H. Robie
Metallurgical Editor, *Engineering and Mining Journal*

ALTHOUGH not a new type of machine, the rod or roller mill for grinding ores has come to be seriously considered by most American mining engineers only within the last year or so. At present it is invading the field which the ball mill has so exclusively occupied in this country for the last ten years; or possibly it would be more correct to say a part of the field, for the rod mill is neither adapted to, nor do its proponents advocate, grinding in one machine through the wide range of sizes which the ball mill accomplishes more or less efficiently.

If the rod mill has been on the market for several years and has merit, why has it not been more widely adopted? There are several reasons: Until recently it was generally believed that a slimed pulp was necessary or desirable for the flotation process; in fact, no doubt it was, with the more limited knowledge of manipulation and reagents possessed by flotation operators from five to ten years ago. The ball mill (a cylindrical or conical mill using large steel balls) had grown up with the flotation process and was found well adapted to the preparation of a pulp whose coarsest particles passed a 48- or 65-mesh Taylor screen (0.295 or 0.208 mm.) and which had the desired proportion of fine slimes. Then, too, the ball mill has another feature which made it popular. Early in the last decade American engineers became converts to the idea of simplification of ore-dressing plants. The fewest possible machines and processes was the great desideratum. A concentrator the flow sheet of which could not be comprehended at a glance was not à la mode. The Jackling concentrating plants, Utah Copper, Nevada Con., Ray Con., Butte & Superior, Chino—particularly Chino—were ridiculed as being examples of how not to do things. In this wave of simplification—or shall I say simplicity?—the ball mill fitted perfectly. Feed as large as three inches for 8-ft. mills was not only suggested as a possibility but recommended for regular practice, with the classifier overflow going to flotation. Into this scheme, the rod mill did not fit at all. It was tried in a few instances, but, as a competitor of the ball mill, was considered to have been introduced too late. It would have been a fine machine, said millmen, to grind a Chile-mill product for tables and vanners. Another reason for lack of early excitement about rod mills was the generally accepted opinion that the type of machine first introduced was mechanically weak. Also, the fact that the company manufacturing them was not financially as strong as its ball-mill competitors, and thus was not able to push them properly, must be taken into account.

With the further development of flotation and an appreciation that the ball mill might not be an efficient crusher on 3-in. feed, conditions became more agreeable for such a machine as the rod mill. In giving more attention to this mill, metallurgists have had in mind a machine to fit into a flow sheet somewhat as follows: Crushing to approximately one inch with gyratories, rolls or disk crushers; grinding to 8 or 10 mesh, followed by tabling; and regrinding table sand tailings to the necessary size for flotation. To such a flow sheet, particularly for ores giving a low ratio of concentration, the rod mill has its application, and the design of a suitable machine has been receiving no little attention.

For the benefit of those who have no clear idea as to what a rod mill may be, it may be described as similar to a tube mill but with rods of approximately the same length as the mill, instead of balls or pebbles for the crushing medium. Line contact rather than point contact, therefore, results, thereby increasing the effective grinding area per unit of steel and also reducing the tendency to crush a part of the ore to a very fine state of division. This may readily be visualized. Suppose two steel balls are considered; if brought in contact they meet at a point, and any ore particle which happens to be at this point is crushed or ground exceedingly fine, the actual fineness depending upon the force of impact and movement of the balls, and the resistance of the ore particle. As we go away from this point the spherical surfaces become farther apart and the crushing or grinding action will result in proportionately coarser particles, until we get so far away that such action will not take place, but the particles will merely be shoved aside.

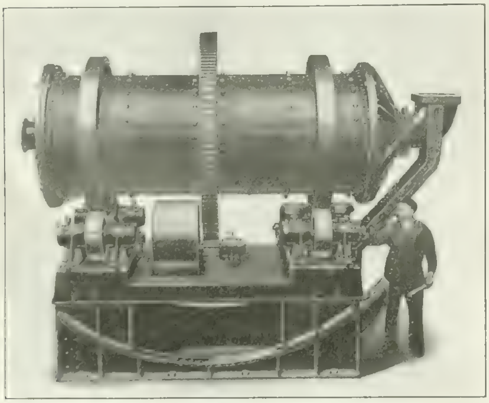
With rods instead of balls, the action will be similar, except that maximum crushing and grinding will take place along a line instead of at a point. Other conditions being the same, the maximum impact will never be as great as in the case of balls, for the impact and weight, though greater, are distributed over many points instead of centering at one point. Furthermore, there will not be the tendency to crush exceedingly fine, for, if we consider the rod to be rigid, the entire crushing action along any longitudinal line is concentrated on the two coarsest particles which support the rod, thus allowing the finer particles between a free clearance. In practice, of course, the rods are elastic and not strictly parallel, but the maximum grinding action is always exerted on the coarsest particles. We would expect, therefore, a narrower range of sizes in the product, and this is actually what is produced. The rod mill, then, is adapted to stage grinding, and if it is desired to grind a coarse feed to flotation fineness, multiple units must be installed or ball mills employed. On ores which will yield a good recovery by jig or roughing table treatment, the rod mill promises to be an excellent machine to use, particularly if any tailings sufficiently low in value to discard can be obtained, for unnecessarily fine grinding of barren rock is thereby obviated.

Because of the limited application which rod mills up to this time have received, not a great deal of operating data is obtainable. Some types have yet to wear out their first set of liners and others have hardly passed the experimental stage. This article will, therefore, be confined largely to a brief description of the various rod mills now on the market, their principal features, where they have been installed, and the kind of work which they are doing. The information given has in part necessarily been furnished by those interested in the type of mill under discussion, but I believe none is misleading. In fact, without the assistance of E. C. Johnson, F. E. Marcy, O. H. Johnson, C. G. Willard, David Cole, J. E. Knapp, and R. C. Greenfield an article of this scope would not have been possible.

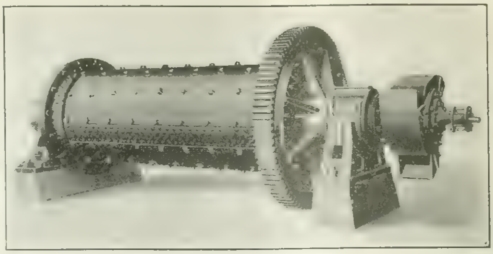
E. C. JOHNSON'S "MARATHON MILL" THE PIONEER

The idea of using a rod or a few bars extending from end to end on a drum-type mill is old—something over fifty years. The original patentee of a practical machine of this type I believe was a German by the name of Zarinko. Ernest C. Johnson, who developed the Marathon mill, patented certain details on Feb. 6, 1912, and the credit for securing practical results with the rod mill is due to him.

The Marathon mill has been on the market about eight years. The Phelps Dodge Corporation ran extensive tests on these machines in 1914 and 1915, which proved their worth as granulators with a low power consumption. They were installed in several of the Phelps Dodge concentrators, notably at Morenci, Tyrone, and Globe, and also in the southeastern Missouri lead district, and elsewhere. An excellent description of the mill and the early experiments with it at Morenci is given in the paper by F. C. Blickensderfer in Vol. LV of the *Trans.* A. I. M. E., p. 678 *et seq.* In 1917, A. E. Watt prepared a paper (*Trans.* A. I. M. E., Vol. LVII, p. 357 *et seq.*) describing the use of the Marathon mill on Missouri lead ores. These papers describe the general features and work of the mill completely, and repetition is not desirable here.


THE MARATHON MILL—ORIGINAL DESIGN

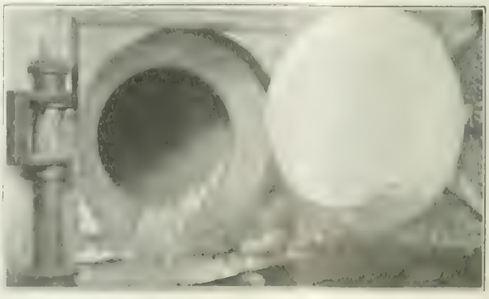
The two illustrations show the original design of mill, as well as a later type in which the weight of the mill is carried on trunnion bearings instead of on rollers. The mechanically unsatisfactory features of the original have been gradually eliminated in the later types, and the mills which have been installed at Morenci and Globe in the last two or three years have operated as smoothly as one could wish. Three distinctive types are now made, the full roller wheel, with the grinding cylinder rotating on four roller wheels; the full trunnion type, as shown in the illustration; and the half-trunnion half-roller-wheel type, in which the feed end is supported by a trunnion bearing, and the discharge end on rollers.


THE NEW TRUNNION-SUPPORTED TYPE OF MARATHON MILL

MARCY ROLLER MILL DESIGNED TO USE LARGER RODS AND TO ALLOW EASY ACCESS TO INTERIOR

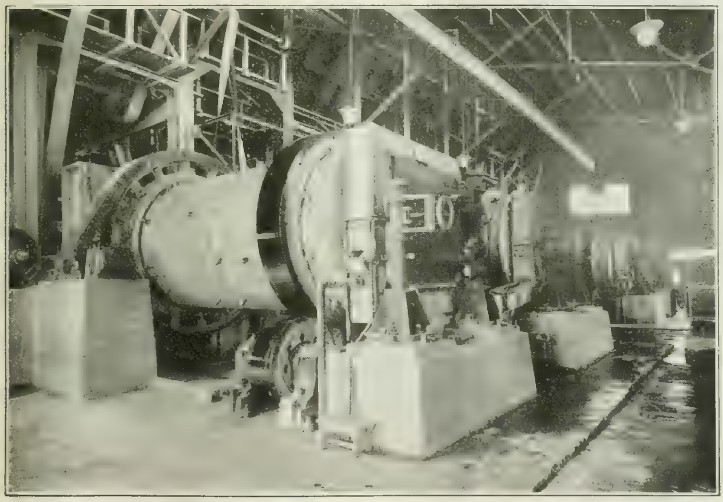
In March, 1916, F. E. Marcy began experiments on a rod mill of somewhat different design. He called this a roller mill, because he planned to use 3½-in. rods instead of 1- to 1½-in. By so doing he expected to secure greatly increased capacity. Other features were an easily opened head for the removal of worn rods with the minimum of inconvenience, and a large discharge opening which would give a low-line discharge and result in a minimum quantity of pulp in the mill. The lining of the mill was also to be slightly tapered toward the discharge end to retain the rods. In January, 1917, arrangements were made with the Anaconda Copper Mining Co. to install such a mill, approximately 5½ ft. in diameter and 10½ ft. long, and it was placed in Section 1 of the Anaconda concentrator, in closed circuit with a Dorr classifier, where it began grinding table middlings some time in June, 1917.

It soon developed that the tapered lining was a mistake, for the rods would not stay parallel and showed a tendency to kink. The lining was then made perfectly cylindrical and the entire shell tilted back about ¼ in. to the foot, the discharge end being the higher. This change was satisfactory, and in the ensuing tests it was proved that the roller mill ground a greater tonnage with less power than the ball mills regularly installed, and that, moreover, the product was so much freer from —200 mesh material that the flotation recov-


THE DISCHARGE END OF THE ANACONDA EXPERIMENTAL MARCY ROLLER MILL WHILE IN OPERATION

ery was higher. (The chief flotation loss was in the finest slimes.) It was also proved that a mild steel was unsatisfactory for rods and that a high-carbon steel, as used for railroad rails, was preferable. A carbon content as high as 1 per cent was suggested by Mr. Marcy.

In 1918, the Phelps Dodge Corporation decided to remodel all of its concentrating plants, Old Dominion, Morenci, Tyrone, and Nacozari, and build a new plant on the sidehill south of Warren, Ariz, in the Bisbee district. As a result of the Anaconda tests and the excellent results which had been obtained with the Marathon mill, it was decided to experiment with a 6 x 12 Marcy roller mill at Nacozari. This mill was somewhat larger than the one used at Anaconda, and a tapered flange or diaphragm was bolted on to the discharge end, which tended to force the rods forward and keep them in the mill without the necessity of tapering the lining or tilting the entire shell. In addition to this, a circular door, mounted on columns and entirely separate from the mill, was designed to fit loosely into the large discharge opening, leaving an annular space through which the ground pulp could discharge. This door prevented all possibility of the rods coming out, eliminated splashing, and yet left it possible to observe the action of the mill at any time while running, and to remove worn rods or add new ones at a minute's notice. The large discharge opening also greatly facilitated relining and allowed large liner sections to be used. The low pulp level also thereby secured is a feature which millmen thoroughly understand from experience with ball mills having grate or center discharge, the principles involved being identical.



MARCY ROLLER MILLS AT THE BURRO MOUNTAIN BRANCH OF THE PHELPS DODGE CORPORATION, TYRONE, NEW MEXICO

The three steps in the development of this type of mill, covering the various methods of retaining the rods, are covered by U. S. patents 1,239,286, 1,309,210, 1,309,211, and 1,309,212.

The Nacozari ore is considered an exceptionally hard one, consisting of chalcopyrite in a quartzite gangue. The following data will indicate the character of work done in single-pass wet crushing of crude ore preparatory to roughing table treatment:

SCREEN TESTS (TYLER STANDARD)

	Feed		Discharge	
Mesh	Per Cent	Cumulative Per Cent	Per Cent	Cumulative Per Cent
+1½ in.	3.32	3.32	...	
1 in.	13.50	16.82	...	
½ in.	31.02	47.84	...	.
3	2.28	50.12	.	...
4	5.90	56 02		...
6	8.40	64.42	0.76	0 76
8	4.90	69.32	1.36	2.12
10	4 64	73 96	4 46	6.58
14	3.64	77.60	5.92	12 50
20	3 44	81 04	8.44	20.94
28	2 50	83 54	9.24	30.18
35	2 30	85.84	9.68	39.86
48	2.36	88 20	9.38	49 24
65	1.76	89 96	7.60	56 84
100	1 40	91.36	6 80	63.64
150	1 16	92.52	4.72	68 36
200	1 12	93.64	4 24	72 60
-200	6.36	100.00	27.40	100.00

OPERATING DATA 6 x 12-FT. MARCY ROLLER MILL

Dry tons feed per 24 hours	668.24
Total kw.-hr. per 24 hours	2,745.6
Kw.-hr. per ton feed	4.11
Kw.-hr. per ton—48-mesh material produced	10.65
Horsepower	153 3

When operating on a finer feed and grinding to the same fineness, the tonnage was increased considerably, a month's average showing a daily tonnage of 1,027. At this time, 0.25 per cent was on a 2-in. diameter screen; 1.10 on 1½; 4.28 on 1; 3.92 on ½; and 24 per cent on 4 mesh. The cumulative percentage on 4 mesh was therefore 33.55 when 1,027 tons was ground, compared with 56.02 when 668 tons was ground per 24 hours.

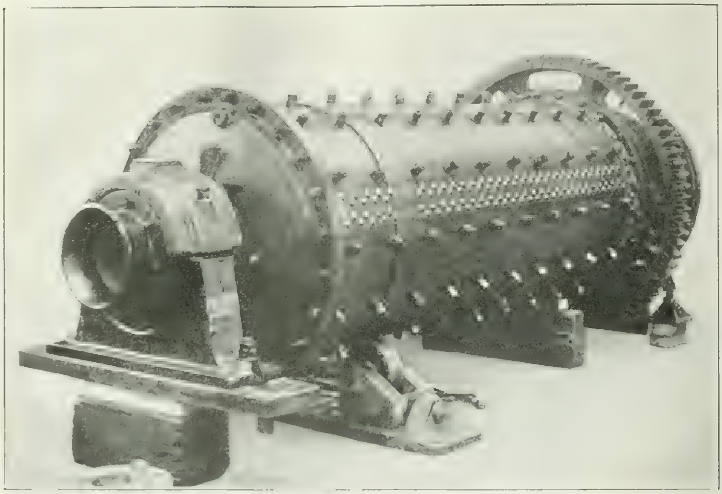
The results obtained with the Nacozari test mill, which began operating in June, 1919, led the Phelps Dodge Corporation to install these mills at that plant for all grinding operations. They were also chosen for the new Warren concentrator, and have been installed at Tyrone, forty-two mills altogether having been purchased.

The work at Nacozari is done in two stages. The primary Marcy roller mills, as already indicated, grind crude ore in one pass approximately from 1½ in. to 8 mesh for roughing tables, the sand tailings and middlings from which are dewatered and reground in secondary roller mills in closed circuit with Dorr classifiers, the finished product being 2 to 3 per cent +48 mesh for flotation feed. I believe that no grinding finer than all through 60 mesh has yet been done with this type of mill on a commercial scale, but, operating in closed circuit with a Dorr classifier, there would seem to be no reason why a pulp could not be slimed if necessary; possibly, however, not so economically as with a tube mill.

The 6 x 12-ft. Marcy roller mills are heavy, weighing over fifty tons each without the eighteen-ton rod load. Each mill is driven by a 150-hp. slip-ring or phase-wound rotor type of motor. Indications are that with a medium hard ore, or ore mixture, such as the porphyry and granite fed at Tyrone, which may be slightly more difficult to grind than the Inspiration or

Miami ores, about 2 or 2½ kw.-hr. will be required per ton of —1½-in. ring crusher product, ground to —10 mesh. For the total grinding to 2 or 3 per cent +48 mesh from the same crusher product, 6 or 7 kw.-hr. per ton would be a fair approximation. This would indicate that slightly less power is required for rod mills of this type than for ball mills, although without complete comparative data any statement on this subject is worth little.

The installation of Marcy roller mills recently made by the Mexican Corporation, Ltd., under the direction of Hugh Rose, is also of interest. Six 6 x 12-ft. mills are expected to take crusher feed of —1-in. ring and grind in closed circuit with Dorr bowl classifiers to 75 per cent —200 mesh.



A 4 x 10-FT. ALLIS-CHALMERS ROD MILL BUILT FOR DESLOGE CONSOLIDATED MINING CO.

In the Missouri lead district experiments are being made with the use of tubes along with rods for grinding. The St. Joseph Lead Co. recently went back to ball mills after using combined rods and tubes. I understand that the broken tubes are not removed, which would seemingly result in a considerable decrease in capacity. Small or bent rods or tubes probably are not efficient grinders, and if broken are a positive detriment. High-carbon rods which will break rather than wind up are no doubt advisable, but they should be removed before they become so small that they will do either, unless the mill is so operated that they are discharged as soon as they break, which is often the case.

Allis-Chalmers Uses Large Rods With Center Discharge in a Trunnion-Supported Mill

When the early experiments had indicated an attractive future for the rod mill, several manufacturers entered the field. Experiments by the Allis-Chalmers company proved the advisability of using large (3 to 4 in.) rather than small (1 to 2 in.) rods, for two principal reasons: First, the capacity was greatly increased, and, second, the large rods would break the small rods before they would bend and kink, and the broken pieces would discharge automatically through the trunnion with the pulp. This eliminated all necessity of removing the head to take out worn and deformed rods, and allowed the use of trunnion-supported mills.

Following are some of the features of the Allis-Chalmers rod mill now on the market: The shell is of ⅜-in. steel plate with riveted butt straps and cast-steel flanges. No manhole is provided, as the discharge spout is sufficiently large on all sizes of mills to admit a man if it is necessary to replace a liner bolt or make other interior repairs. Heavy sole plates are placed under the main bearings on both the feed and discharge end. The sole plate on the gear end is bolted to the sole plate under the pinion-shaft bearings, thus tying together the entire drive to the mill. The liners are of the ship-lap type, either chrome or manganese steel, held in place with ¾-in. bolts. If it is desired to remove the head of the mill for relining, supporting rollers are provided on which the mill may be turned when not supported at the trunnion. These may be backed away when not required.

The 4 x 10-ft. Allis-Chalmers rod mill shown in the illustration is one of two which have been in use by the Desloge Consolidated Lead Co. for over a year. These mills are each grinding in one pass about 450 dry tons per 24 hours, 45 per cent moisture, using a 13,000-lb. rod charge and consuming approximately 40 hp. Without a complete knowledge of the characteristics of the ore, data regarding operation mean little, however. The following screen tests will aid in obtaining some idea of the work these mills are doing:

SCREEN TESTS OF FEED AND PRODUCT

Mesh (Taylor)	Feed Per Cent	Feed Cumulative Per Cent	Product Per Cent	Product Cumulative Per Cent
+3	4 85	4 85		....
4	16 30	21 15		
6	11 33	32 48	0 26	0 26
8	12 41	44 89	2 61	2 87
14	36 30	81 19	27 60	30 47
20	11 20	92 39	18 31	48 78
28	3 88	96 27	12 16	60 94
35	1 62	97 89	8 85	69 79
48	0 64	98 53	5 33	75 12
65	0 34	98 87	4 26	79 38
100	0 24	99 11	3 84	83 22
150	0 06	99 17	1 87	85 09
200	0 17	99 34	4 11	89.20
200	0 66	100 00	10 80	100 00

These tests supplement those previously given in showing the granular character of a rod-mill product.

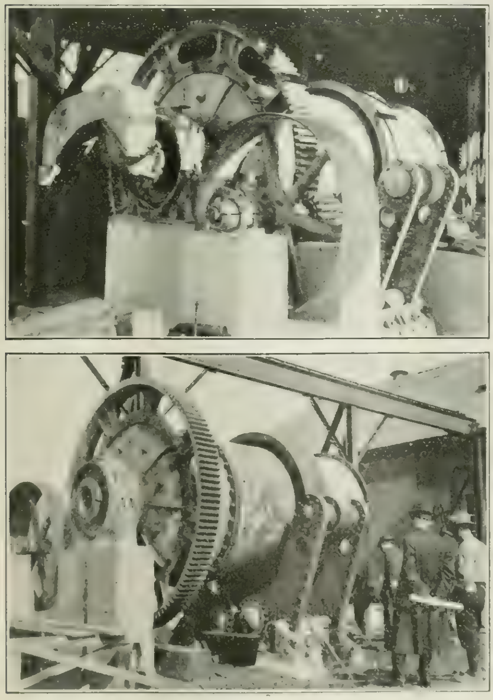
Six 5 x 10-ft. Allis-Chalmers rod mills are now being built for the Homestake Mining Co. These are designed to work in closed circuit with Dorr classifiers and are estimated to have a capacity of approximately 200 tons per mill, grinding from [illegible] in. to 60 mesh.

For feed crushed to 1 in., on which the rod mill will do its best work, an initial charge of 50 per cent 4-in. rods, 25 per cent 3-in., and 25 per cent 2½-in. rods is recommended by the Allis-Chalmers company. For regrinding, however, 3-in. rods are the largest size recommended. Steel consumption has been found to be approximately the same as the liner and ball consumption in a ball mill grinding the same ore.

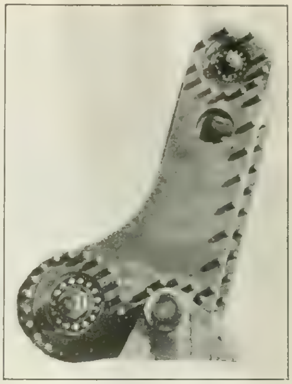
A 4 x 10-ft. mill working on *dry* ore is in operation at the plant of the D. W. Jones Co. in Denver, Col., crushing a fairly hard porphyry from all —¾ in. to 22 per cent +40 mesh. The capacity of the mill is about 125 tons per 24 hours; the rod charge, 8,000 lb.; and 40 hp. is used. Greater capacity could be secured by increasing the weight of rods in the mill. In this mill, the discharge end is carried on roller bearings and a grate discharge is used. The mill operates at 26 r.p.m.

COLE-BERGMAN MILL FEATURES BALL BEARINGS

Another type of rod mill which has sprung into prominence in the last year is the Cole-Bergman mill. This was first tried out in the New Cornelia test plant at Ajo, Ariz., during 1919, and proved about 28 per cent more economical in power than a ball mill and also indicated about the same saving in costs. Unfortunately, the tests were concluded before a set of linings had been worn out. The mill was 5 x 10 ft. inside dimensions and operated at 19 r.p.m. About 90 hp. was required, the rod charge being 16 tons of 2-in. and smaller rods, and the mill ground about 250 tons per 24 hours of "very hard" ore from —1 in. to —48 mesh. Mr. Cole tells me that a great deal of experimental work was done in varying the point of discharge from the periphery to the center, and that several discharge heads were constructed for demonstration purposes. Central discharge was found to be the best for wet work, inasmuch as this assured a proper amount of mortar-like pulp throughout the mill to coat the rods. With a full charge of rods of various sizes in a mill, and a proper dilution, there is probably little likelihood of rods cascading and uselessly splashing in a deep bath of pulp. The Cole-Bergman mill is a trunnion-discharge mill, although the discharge end is carried on roller bearings. These bearings carry 85 per cent of the revolving load of the mill and are equipped with "SKF" ball bearings, which the makers of the mill claim should save 16 per cent of the power required with other mountings. A part of one of these supports is shown in the illustration. The outer race of the main bearing is more than 12 in. in diameter, and the 1¾-in. balls are in double rows. The balls in the smaller bearing are 1 in. in diameter. The spherical trunnion bearing is 10 in. long. The revolving part of the mill weighs 41,000 lb. and the normal rod load for the mill is 32,000 lb. Each of the four ball bearings carries about eight tons. These figures all apply to the standard 5 x 10-ft. mill.



THE 5 x 10-FT. COLE-BERGMAN ROLLER ROD MILL



ONE OF THE FOUR BEARINGS WHICH CARRY 81 PER CENT OF THE WEIGHT OF THE COLE-BERGMAN MILL

Eleven Cole-Bergman mills have so far been built, the installations including the concentrator of the Iron Cap Copper Co., at Copper Hill, Ariz., and the Santiago concentrator of the American Smelters Securities Co. at Santa Barbara, Chihuahua, Mexico.

The Iron Cap concentrator went into operation last June with rod mills as part of the original equipment. While building the plant, the Iron Cap ore was treated in one section of the Inspiration concentrator, which was rented and segregated for that purpose. A good opportunity was, therefore, given for comparing the work of the 8 x 6½-ft. Marcy ball mill, which is the standard grinding unit at Inspiration, with the 5 x 10-ft. Cole-Bergman rod mill, which afterward operated on the same ore in the new plant. The Inspiration company handled the Iron Cap ore for about six months. In that time it was shown that the power required to crush and grind the ore from run-of-mine size to —48 mesh was 14.96 kw.-hr. per ton, allowing the same power for preparatory crushing that is used for Inspiration ore; namely, 0.46 kw.-hr. per ton for crushing to 2 in. The power input to the Marcy mill motors in the Iron Cap section was 14.5 kw.-hr. per ton. It also developed that only 600 tons of Iron Cap ore could be handled in a section which formerly handled 1,000 tons of Inspiration ore, thus establishing a comparative friability factor for the two ores.

Grinding this same Iron Cap ore in the rod mills of the new concentrator, the coarse crushing and conveying from run-of-mine size to 1½ in. requires 0.638 kw.-hr. per ton, and the fine grinding from 1½-in. size to all —48 mesh requires 9.0 kw.-hr. per ton, making a total of 9.638. This compares with 14.96 kw.-hr. per ton required by the Inspiration equipment, showing

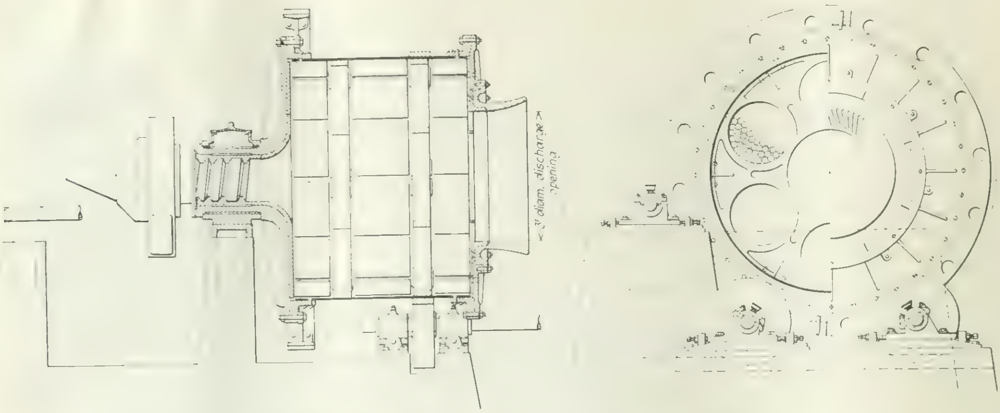


DIAGRAM OF A 5 x 4-FT. FORRESTER-HENDY ROD MILL

an apparent saving of 35 per cent, due to the use of rods and ball bearings, and also possibly to the fact that less of the ore was slimed, although I have not the comparative screen tests to show this. The fact that stage grinding is done at Copper Hill, whereas one mill takes 2-in. ore and produces a finished product at Inspiration, also must be considered.

The Iron Cap flow sheet is simple. The feed, about 325 tons per day, is supposed to pass 1½ in., and 40 per cent is +¾ in. This is mixed with 25 per cent water, in a 5 x 10-ft. rod mill, No. 1, to 1 per cent +8 mesh, and divided among four roughing tables. Sufficient water is added to make the tables work properly. The concentrates amount to about 8 per cent of the feed and contain slightly over 50 per cent of the total copper. The tailings pass to a Dorr duplex, Style "D," classifier in closed circuit with the No. 2 5 x 10-ft. rod mill. A little more water has to be added to give the correct ratio for the classifier overflow, which goes direct to Inspiration type flotation machines. The flotation tailings are deslimed with drag belts, the sands are retabled for precautionary reasons, and the slimes and sand table tailings go to waste. The copper recovery is over 95 per cent. No thickening is done between the various stages. This brief summary of operations is given to indicate how well the rod mill fits into a flow sheet of this type.

The rods used in the primary mill are what are known as "3-in. rounds," manufactured by the Colorado Fuel & Iron Co., and cost, at least until recently, about 4¼c., f.o.b. Globe, Ariz. These are removed after being reduced to approximately 2-in. size. Thus, the primary mill contains nothing but relatively large rods, well suited to breaking the hard quartzite in the ore. The rods taken from the primary mill are used in the secondary mill, where they are retained until worn to about ¾ in. They are taken out when of this size because it is economical to do so. There has never been difficulty with crooked rods, winding up of rods, or broken rods. No regular interval for taking out worn rods is followed. On change day, or at intervals of about one week, the condition of the rod load is observed through the discharge opening and the small rods are removed. Each mill averages about 1.30 lb. of rods per ton of ore. It is still too early to give definite data as to wear of linings. These liner plates are of cast steel, made in El Paso. So far, a smooth liner has been used, but it is likely that a waved type would give better results.

THE FORRESTER-HENDY MILL CARRIES RODS IN INDIVIDUAL COMPARTMENTS

Another totally different type of rod mill has not yet been put on the market, but is now undergoing large-scale tests. This, called the Forrester-Hendy rod mill, after the patentee and maker, is to be made by the Joshua Hendy Iron Works, and some idea of its design may be had from the illustration. The mill is divided into six cylindrical compartments, each containing a separate charge of rods. The axis of rotation is not within the space inclosing the rods, and the grinding action will, therefore, not be the same as in the mills already discussed. The mill is also much shorter than other rod mills, 5 ft. diameter x 4 ft. long. The mill of this size has a 3-ft. discharge opening and is designed to operate at 28 r.p.m. Great claims for power economy are made, it being asserted that the power required is only about one-quarter of that consumed by any other type of ball or rod mill of the same capacity. This is, of course, because the mill is balanced, there being three compartments filled with rods, aiding rotation on the descending side while work is being done on the others. The power curve characteristic is also doubtless more smooth than in the case of rod mills of other types, for which it is a jagged line, caused by the rods being elevated near the top of the mill and falling to the bottom. The starting torque in a balanced mill of this kind would certainly be much less than for the ordinary ball or rod mill, in which the entire charge must be lifted as so much dead weight, a fact which requires attention in designing the motor drive. More data should be obtainable later in the year regarding the performance of this mill.

THE FIELD OF THE ROD MILL

Summing up, then, it is seen that rod or roller mills are being actively developed by several companies and have every possibility of being successful competitors of ball and tube mills in certain fields of work. They are adapted only to grinding through a comparatively narrow size range in individual mills, and work done up to this time indicates that they cannot take feed as large as is often given to a ball mill, nor is it yet proved that they are superior or equal to tube mills where material finer than 100 mesh is desired. Theoretically, however, there is no reason why they should not be efficient grinders for the finest sizes. They do not seem as adaptable to small as to large units, for a small mill could not carry sufficient weight of rods to break up large or tough ore particles, for the rods act along a line contact. They have been successfully used for dry crushing, although this is not generally desired. There would seem to be no reason why rods could not be substituted for balls in mills of the Krupp type which discharge through perforated plates forming the cylindrical surface of the mills. I have never heard of their use in this way, however; removal of the worn rods would be an inconvenience.

In rod mills, a waved type of liner is probably superior to a smooth surface. The indications are that liner consumption will be possibly one-half pound per ton less than for ball mills. Also, the forms are simpler and can be made more cheaply. There are no grates or manholes to provide for. The consumption of steel rods appears to be slightly less in the rod mill than of balls in the ball mill. In this connection, it is important to remember that steel in the form of rods or rounds is a standard article, cheaply made, and obtainable from many rolling-mill plants. Competition is active, and there are no trade name handicaps. Statistics covering several years indicate that balls sell for about double as much as rods. Freight, however, will be perhaps half of the delivered cost and is about the same for rods as for balls. Power consumption would seem to be somewhat less as a general rule for rod than for ball mills of equal capacity, the exact figures depending upon the grinding problem and the type of mill selected.

Indications are that flotation concentrates are more easily filtered when the ore has been ground in rod mills than when balls have been used as the grinding medium. If this be true, it would seem to be a logical result of the lessened amount of slime produced in rod-mill grinding, inasmuch as it is this which clogs the canvas and results in a thin and wet filter cake.

Most of the rod mills described have not been in use long enough to prove the extent of their applicability or to afford fair comparisons with ball or tube mills. The information given indicates possibly more of their advantages than disadvantages, but it may conservatively be said that they are machines of considerable promise for certain classes of work.

Mineral Production Curves

BY G. M. SCHWARTZ

Written for *Engineering and Mining Journal*

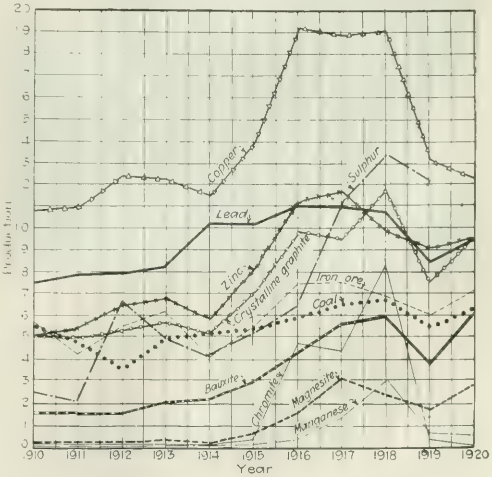
THE CURVES illustrated indicate the trend of the production of eleven important mineral products during the years 1910 to 1920 inclusive and have been plotted from U. S. Geological Survey and *Engineering and Mining Journal* statistics. They suggest that already there is a return to normal, and that for some metals the production is now below normal. The greatest rise in production occurred in minerals entering into munitions of war, namely copper, zinc, sulphur, chromite, manganese, and graphite.

The following table gives the production units used in plotting the curves:

Mineral	Unit
Iron ore, long tons	1,000,000
Bauxite, long tons	100,000
Sulphur, long tons	10,000
Coal, short tons	10,000,000
Magnesite, short tons	100,000
Manganese, short tons	100,000
Chromite, metric tons	10,000
Copper, lb	100,000,000
Lead, lb	100,000,000
Zinc, lb	100,000,000
Graphite, lb	1,000,000

A few details of individual minerals are interesting. Iron ore and coal, which rose less rapidly, have slumped less than the other products. This is due in part to the large normal production and to the fact that labor enters into the production to such an extent that a large increase was difficult during the war, and the demand was not excessively increased. The increase in steel was partly compensated by the lack of demand for ordinary construction work. Thus it seems that steel, ordinarily taken as a barometer of business, is not as sensitive as copper, for instance. It is noticeable that 1914, a year of dull business, shows a tendency to decreased production of all important minerals except lead.

Minerals not normally produced in large quantities, *i.e.*, chromite, magnesite, manganese, dropped back with the increase in imports and the lessened demand at the end of the war. Of all the metals, copper shows the greatest increase and is probably now experiencing the greatest depression.



Copper, lead, iron ore, chromite, manganese, and coal approached normal production in 1919 and 1920. Zinc is the only metal of any importance that has failed to return to pre-war levels; recent reports indicate that it has about reached normal in the last few months. If the normal annual increase in production is considered, many minerals are now below the production that might be expected. This is accounted for by the slackened demand due to the ending of the war and depressed business conditions, and also by the large stocks accumulated during the peak production. Even the large uses in war materials did not utilize the largely increased production of 1916 to 1918.

The Engels Copper Mine and Mill, California

Low-Grade Copper Ores Made Profitable by Flotation—Ore Deposit Of Unusual Type—Large Orebodies Mined by Shrinkage Stoping—Improvements in Equipment and in Organization and Management

By George J. Young
Western Editor, *Engineering and Mining Journal*

THE ENGELS COPPER CO. is one of the most important and well-directed copper producers of California. With careful management, a comparatively low-grade bornite and chalcopyrite deposit has been made of economic importance, thanks in large measure to the flotation process of concentration.

The mines are in Plumas County, and have the advantages of railroad connection with the Western Pacific at Paxton by the Indian Valley R.R., which terminates at Engels. This branch railroad is twenty-two miles long. The mining property is in a less accentuated portion of the Sierras, on the western slope, at an elevation of approximately 5,000 ft. The region is heavily timbered and is on the whole a delightful mountain country.

GENERAL VIEW OF UPPER CAMP AT ENGELS MINE

The early operations at the Engels mine were of a desultory character. The property has been known since the 80's. I noted in the issue of the *Engineering and Mining Journal* of [illegible] 30, 1902, an advertisement soliciting the sale of stock by the company, which at that time was organized on a capitalization of $1,000,000. It was then proposed to erect a smelter to treat the oxidized and richer sulphide ores, which were of comparatively high grade. In [illegible], a smelter was constructed, but it was never operated, and until late in 1914 ores were shipped to Garfield, Utah. Late in 1914, a flotation mill was constructed. Since that time, owing to the success of the flotation process, the tonnage mined steadily increased, and in 1919 a 750-ton flotation mill was installed. In the same year capitalization was increased from $[illegible] to $[illegible]. In September, 1919, Robert A. Kinzie, well known through his successful management of the Alaska Treadwell group of mines, was engaged as operating engineer. Mr. Kinzie initiated a diamond-drilling campaign which had for its objective the delineation of the orebodies in depth, width and length. The results of this work were of importance, for they proved up sizable reserves of the low-grade ore characteristic of the deeper development. The next important work was the rehabilitation of the operating plant. Of the two mills, the upper and older mill was abandoned and the milling operations were restricted to the new mill, which was completely overhauled and its capacity increased. Living quarters, shops, and mechanical plant were greatly improved, and operations were systematized into a closely knit unit in charge of excellent operating men.

Two Orebodies Mined

Two orebodies are being mined—one, the Engels mine, known as the upper mine, and the other, the lower or Superior mine, which is at Engels, close to the concentrating mill, two miles southwest of the upper mine and 1,200 ft. lower in altitude.

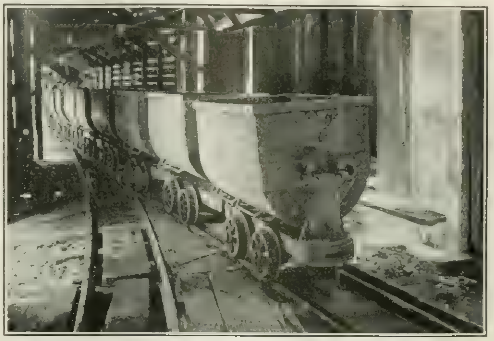
The ore deposits have excited considerable discussion among mining geologists. According to H. W. Turner and A. F. Rogers (*Economic Geology*, Vol. 9, p. 359), the ores are of direct magmatic origin, and the development of chalcocite and some covellite by replacement of bornite was due to the work of ascending heated alkaline waters, an example of upward secondary enrichment. L. C. Graton and D. H. McLaughlin (*Economic Geology*, Vol. 12, p. [illegible]) subsequently made an extended study both of the ores and the deposits. Their conclusion was that the ores are of pneumatolytic and hydrothermal origin, and this interpretation appears to be the accepted one. The Engels ore deposit occurs in a "basic differentiate of the great Sierra Nevada batholith of granodiorite." The rock can be termed for practical purposes diorite.

SUPERIOR MILL, MACHINE SHOP IN FOREGROUND

According to Graton and McLaughlin, "commercial ore at Engels is distributed in somewhat indefinitely bounded shoots, of which several have been opened and which collectively constitute a deposit of roughly elliptical plan within the modified norite (diorite). As a rule the ore merges into the country rock, and all gradations exist, from scattered minute sulphide grains to heavy masses of ore with subordinate gangue. Bornite and chalcopyrite, the most abundant ore minerals of the Engels deposit, were found mainly under hydrothermal conditions, together with a small amount of enargite, tetrahedrite and sphalerite. Magnetite, ilmenite, and hematite, which apparently had continued to develop during the early period of bornite formation, ceased to form as conditions became milder, and became surrounded or rarely veined by the bornite and chalcopyrite which continued to increase. The bornite is four times as abundant as the chalcopyrite. Calcite is abundant in most of the specimens. The orebody is capped by a moderate but irregular thickness of oxidized and leached rocks."

ORE CHUTE AT UPPER MINE

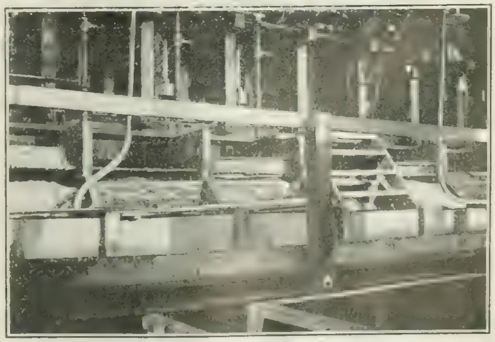
At the Superior mine there is practically no oxidized surface zone, but in other respects the deposits are similar. "Bornite and magnetite are the most abundant ore minerals. The magnetite appears as large grains surrounded by a cement of bornite. The latter also occurs as fine flecks or irregular veinlets on the magnetite; it is clearly of later age and in part a replacement of the iron oxide. Association between the two minerals is more intimate than in the Engels ore, and the magnetite seems to have been more generally attacked by the bornite than is the case in the larger deposit. The absence of specularite and ilmenite is noteworthy. Chalcopyrite is more plentiful than at Engels. A few small blebs of galena were observed. Chalcocite is present in subordinate amount intimately associated in all cases with the bornite." There is a further discussion of the Engels deposits by the same authors in *Economic Geology*, Vol. 13, p. 81.



ORE TRANSPORTATION AT ADIT OF UPPER MINE

From a miner's standpoint the deposits belong to that class where the ore shoots follow a consistent trend, southwest and northeast in this instance, and are associated with a definite type of rock, diorite. The shoots of pay rock do not differ in broad characteristics from the scantily mineralized rock, nor are they generally defined by walls or other characteristics usually serving as a guide to the miner. There is a gradual impoverishment of copper minerals as the limits of a shoot are approached. In appearance, the ore ranges from fresh-looking diorite to a more or less altered diorite. The ore minerals do not to a conspicuous degree occupy rock-fracture planes, but are in masses, lenses, and veins in the body of the rock. Silicification is conspicuously absent, and the presence of calcite in relatively small amount is of no special service in following the zone of mineralization. Visual inspection of the rock and analysis are the only methods of distinguishing the ore. Diamond drilling has been effective in determining the position and probable limits of ore shoots.

The Engels deposits are well worth study by mining engineers, as they typify an unusual kind of ore deposit



FLOTATION UNIT IN SUPERIOR MILL

and one that might be duplicated under similar conditions. The incidental associations of bornite with diorite, having some of the characteristics of magmatic segregation, should be rather carefully examined, in my opinion, as the Engels deposits prove that valuable copper ore shoots might be thus indicated.

MINING PLANT AND METHODS

At the upper mine a three-compartment shaft connects with an adit level, through which the ores are hauled by electric locomotive, trolley and storage-battery types, to a bin. From the bin the ore is fed by steel apron feeders to a belt conveyor, which discharges into an 18 x 36 jaw breaker. The ore is then loaded from a receiving bin into a Riblet bucket tramway, by which it is transported to the mill at the Superior mine. The shaft is arranged for skip hoisting and serves the levels below No. 6, the adit level. A two-drum Nordberg hoist, driven by a 150-hp., 2,200-volt motor, serves the shaft. The compressor equipment consists of a Sullivan angle-type, 18-11-14 size, a belted Imperial Type 10, 18-11-16 (originally steam driven), and a belted Imperial Type 10, 28-17-24 size, all motor driven. Tool sharpening and timber shops complete the surface plant. A commodious dormitory serves for the working crew. A club room is also provided. An old bucket tram is used for transporting supplies to the upper mine.

Practically all of the richer ores near the surface have been stoped, and a caved area at the surface of the Engels mine indicated the extent of the underground workings. The stopes are operated on the shrinkage system, and chute loading is the prevailing practice. As a rule the stopes stand well, except in the oxidized zone, and on the transportation and haulage levels timber is required only at the chutes. The section of the drifts and crosscuts used for transportation is usually arched. The orebody at the upper mine is 120 x 800 ft., and pillars are left in for support transversely.

At the Superior mine a three-compartment shaft, served by a motor-driven, two-drum hoist, delivers the ore by skip to the mill bin, which is near the shaft collar. The compressor equipment consists of a Sullivan angle-type compressor, 16-9¾-12, belt driven by a 75-hp. induction motor, 2,200 volts, and an Ingersoll-Rand Type 10, 28-17-24, belt driven by induction motor. Both compressors are in a separate building, in which is housed an alternating-current generator direct connected to an Allis-Chalmers hydro-turbine of 485 brake hp. This unit operates under a 440-ft. head and supplies 2,300-volt current, 3 phase, 60 cycles. It is used only for emergencies, as the power current is supplied from a hydro-electric plant and is bought by the company.

The Superior orebody is mined in part as a glory hole and in part by shrinkage stoping. An adit gives access to the workings from a point on the general level of the machine shop and compressor building. The shrinkage stopes are laid off with rock pillars 100 ft. apart and ore pockets at 25 ft. centers. A raise 8 ft. square outside dimensions, protected on either side by pillars 10 ft. thick and constructed as shown in Fig. 1, is carried up as a preliminary to stoping. Short horizontal drives cut through the side pillars at 30-ft. vertical intervals give access to the stope. These are plugged up as the stope is extended upward. A ladderway, drill chute, and rock chute occupy the manway, which also serves as a pipeway. The drill chute is a box made of four boards. It is open at the bottom and top (Fig. 1). The drills are hoisted and lowered through this chute by a "Tugger" hoist, which also serves for hoisting the timbers used in the construction of the manway. Necessarily, the disposition of rock and manway pillars varies, as sometimes the ore shoots are inclined. Some difficulty is experienced with the inclined ore shoots, which may flatten to such an extent as to interfere with the downward movement of the ore. This has been overcome by the use of a scraper and "Little Tugger" hoist. In some cases the access manway is built up into the stope without pillar protection. Under these circumstances it is built up three or four feet above the broken rock and rock is filled in around it.

Stoping is done with the Leyner Ingersoll No. 148. Stopers are used in raising and jackhammers for plug work. In drifting, an advance of 3.5 ft. is made per round. Never less than twelve and up to thirteen to sixteen 5-ft. holes are required per round. The "toe-cut" required two center, two side, three lifters, three breast, and three back holes. This cut has been displaced by the "pyramid cut," which requires four holes to the center, three top, three lifters, and three breast holes. In addition, two holes are required in between and three bottom holes. Starters are 2¼ in. and finishing drills 1¼ in., decreasing in size ⅛ in. per drill. Drills are changed every twelve inches. A 50-lb. box of 40 per cent 1¼-in. power is required per round.

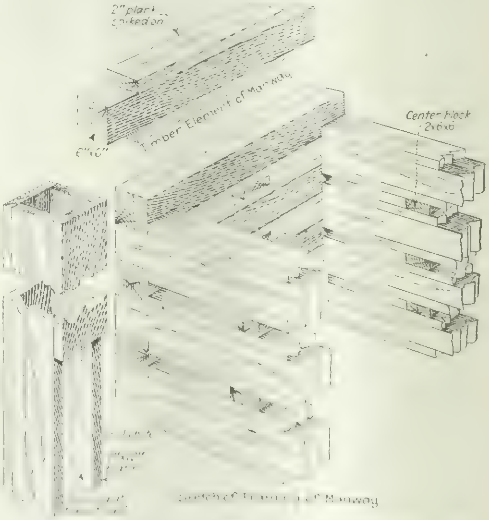


FIG. 1. DETAILS OF MANWAY TIMBER FRAMING AND DRILL CHUTE

In the Superior mine short crosscuts were put into the stope, and an elevated shoveling platform, car high, was put in, practically the same as is used in the Homestake mine. This method of loading cars has been discarded in favor of chute loading.

The mining is relatively simple, and as the ground holds well in drifts, crosscuts, and stopes, timber support is confirmed to manway raises and to chute construction.

Omitting the ores characteristic of near-surface conditions in the Engels, the ore mined from the lower levels is low grade, ranging from 2 to 3 per cent copper. About one ounce of silver is recovered for 72 lb. of copper, and gold is present in the ratio of one ounce to 98 oz. of silver. Recoverable gold and silver approximate 60c. per ton of ore. The principal copper mineral is bornite. Accompanying it are chalcopyrite, incidental amounts of chalcocite, and small amounts of cuprite. Magnetite and accessory heavy minerals are in important amounts from a metallurgical standpoint. A recovery in excess of 80 per cent is made, and concentrates produced are approximately 30 per cent copper. This is exceptionally good work, as the percentage recovery includes part of the oxidized copper minerals.

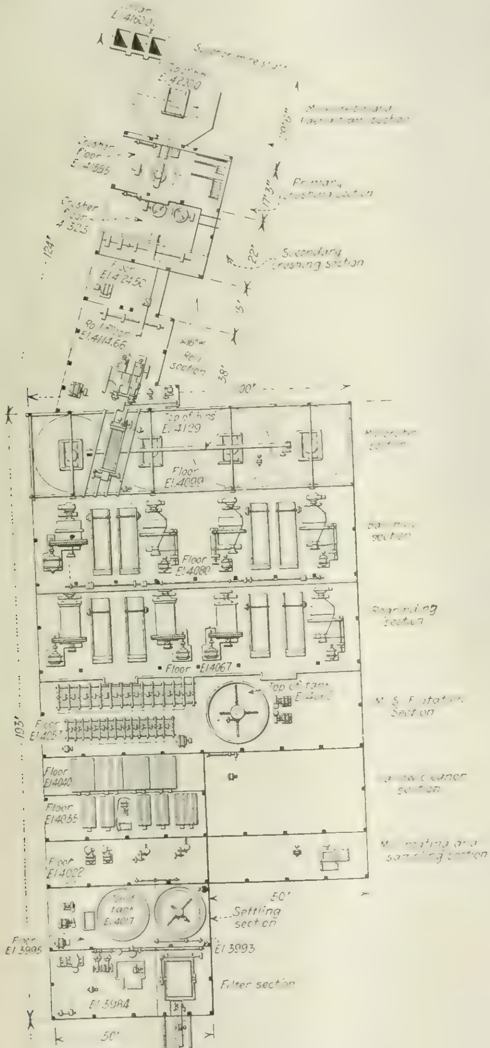


FIG. 2. GENERAL ARRANGEMENT PLAN OF SUPERIOR MILL

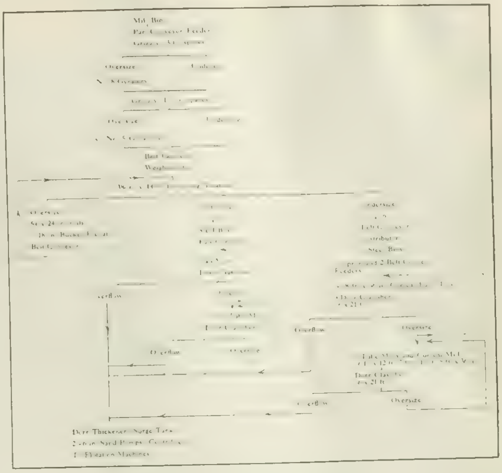


FIG. 3. FLOW SHEET OF CRUSHING AND GRINDING SECTION OF THE SUPERIOR MILL

Before the railroad was built to Engels, the nearest rail point was Keddie, on the Western Pacific, about twenty-eight miles away. The low-grade ores could not be concentrated by the ordinary methods available, on account of the accompanying heavy minerals, which diluted the copper concentrates and gave a concentrate too low in grade to be shipped. Smelting was considered to the extent of erecting a blast furnace, but this furnace, as before mentioned, was never operated. The applicability of the flotation process was pointed out, and a mill designed by the Minerals Separation Co. was installed. A satisfactory shipping concentrate was produced, and operations continued on a larger and larger scale. The first mill was of 150 tons' daily capacity, but was brought up to 225 tons per day. This was in 1914. In 1919 a 750-ton flotation mill was completed at the Superior mine, and in 1920 milling, as already stated, was discontinued at the upper mine and restricted to the new mill, which was completely overhauled and its operating capacity increased to 1,500 tons per day. The mill is constructed on a steep side hill. The plan of the mill is shown in Fig. 2.

The important milling operations are comminution, thickening of pulp, flotation, cleaning of flotation concentrates, dewatering, and tailing disposal. The flow sheet of the breaking, crushing, and grinding section of the mill is given in Fig. 3. To secure a satisfactory recovery and at the same time high-grade concentrates, fine crushing is essential, and at the time I visited the mill the screen analysis of the flotation feed showed 12 per cent on 100-mesh; 50 to 60 per cent on 200-mesh, and 28 to 30 per cent passed a 200-mesh screen. The tonnage ranged from 600 to 700 tons per twenty-four hours. The Dorr classifier overflow product is received in a 20 x 10 Dorr thickener, which serves as a surge tank to maintain the pulp level in the flotation machine and the proper dilution of the pulp, which is kept at a ratio of four to one. The flotation equipment consists of two M. S. machines, one 24 in., twelve cells, and one 18 in., twelve cells. In addition, there are eight Callow roughers and seven Callow cleaners. By the use of two 3-in. centrifugals, intermediate products can be returned to the cleaners or to the Dorr thickener. Final flotation concentrates are received in a 16 x 16 Dorr thickener, the overflow being caught in a 16 x 16 tank and settled (settled concentrates are pumped back to flotation by a 2-in. centrifugal). The thickened concentrates are dewatered on two Oliver filters (8 x 6 and 12 x 8) and discharged by a conveyor into storage bins, from which they are loaded into railroad cars. The flotation flow sheet is varied from time to time, but the general scheme is indicated in Fig. 4.

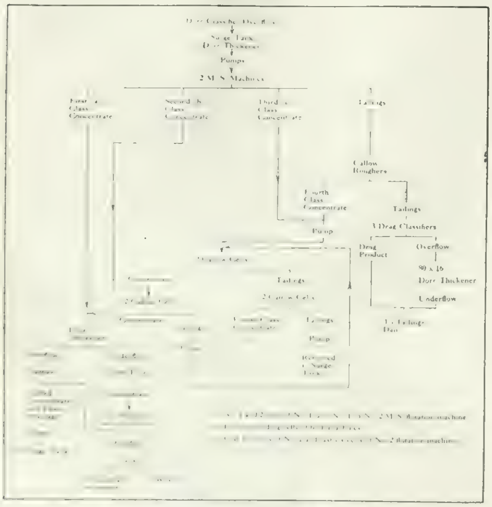


FIG. 4. GENERAL FLOTATION FLOW SHEET

During February, 1921, 22,935 tons was milled, or an average of 819 tons per day. The concentration ratio was 15.254:1, the indicated recovery 83.161, and the actual recovery 83.116 per cent. The milling costs for this month, together with significant details, are given in Table 1. An analysis of concentrate is as follows:

Copper, [illegible] per cent; silica, [illegible]; iron, 14.70; [illegible]; sulphur, 16.60, and lime, 1.40 per cent.

TABLE 1. [illegible] DETAILS AT THE [illegible] MINE, FEBRUARY, 1921

	Per Ton		Per Ton
[illegible]	[illegible]	[illegible]	$0.1012
[illegible]	[illegible]	[illegible]	.2763
[illegible]	[illegible]	[illegible]	.0058
[illegible]	[illegible]	[illegible]	.0123
[illegible]	[illegible]	[illegible]	.0302
[illegible]	[illegible]	[illegible]	.0175
Concentrating...	[illegible]		
[illegible]	[illegible]		[illegible]

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	.5861
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

From the company's annual report the tonnage milled during 1920 was 239,612, averaging 2.21 per cent copper and yielding 14,519.9 tons of concentrates, averaging 29.76 per cent copper. Tailings averaged 0.45 per cent copper. The metals recovered were 8,571,569 lb. copper, 119,165.4 oz. silver, and 1,217.9 oz. gold.

Acknowledgment is made of the courtesy of Robert A. Kinzie in supplying data and drawings, and to William R. Lindsay, W. I. Nelson, and W. E. Kyle, who assisted me during my visit to the mine and mill.

Record Phosphate-Rock Production in 1920

The phosphate-rock industry in the United States in 1920, according to figures from all producers compiled early in April by the U. S. Geological Survey, made a record far surpassing that of any previous year. The quantity of phosphate rock mined and sold was 4,103,982 long tons, or nearly a million tons more than in the record year 1913. The total receipts from sales was $25,079,572, or more than twice as much as in any other year. The average price per ton for the entire output was $6.11, as compared with $5.10 in 1919.

Florida's output more than doubled, the quantity of land-pebble phosphate increasing by more than one and one-half million tons. South Carolina produced 27 per cent less than in 1919, but Tennessee increased her output 100,000 tons, or 18 per cent. A most notable feature of the year was an increase of 223 per cent in the production in Idaho and Utah. The Western output, most of which was made by Idaho, jumped from 17,000 tons in 1919 to more than 55,000 tons in 1920.

PHOSPHATE ROCK EXPORTED IN 1920

	Long Tons	Value
High-grade hard rock	344,896	$4,496,457
Land pebble	693,355	5,593,814
All other	31,761	500,904
Totals	1,070,012	$10,591,175

The total exports in 1919 were 378,731 long tons, valued at $3,567,982. The following tables summarizes the industry for the last eight years.

PHOSPHATE ROCK MARKETED IN AND EXPORTED FROM THE UNITED STATES, 1913-1920

Year	Quantity Marketed, Long Tons	Exports, Long Tons	Proportion of Exports to Domestic Production, per Cent
1913	3,111,221	1,366,508	44
1914	2,734,043	964,114	35
1915	1,835,667	253,421	14
1916	1,982,385	245,678	12
1917	2,584,287	166,358	6
1918	2,490,760	[illegible]	6
1919	2,271,983	378,731	17
1920	4,103,982	1,070,012	26

PHOSPHATE ROCK MINED AND SOLD IN THE UNITED STATES, 1919-1920

	1919			1920		
State	Quantity Long Tons	Value	Average Value per Ton	Quantity Long Tons	Value	Average Value per Ton
Florida:						
Hard rock	285,467	[illegible]	[illegible]	[illegible]	$4,525,191	$11.31
Soft rock	14,498	[illegible]	[illegible]	[illegible]	190,551	13.66
Land pebble	1,360,235	[illegible]	[illegible]	[illegible]	14,748,620	4.99
	1,660,200	[illegible]	[illegible]	[illegible]	$19,464,362	$5.78
South Carolina:						
Land rock	60,823	$308,968	$5.08	44,141	$367,209	$8.32
Tennessee:						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$4,425,761	$7.96
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	118,234	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	$4,543,995	$7.79
Western States:						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	304,006	[illegible]
	2,271,983	$11,591,268	$5.10	$4,103,982	$25,079,572	$6.11

(a) [illegible] Utah, and Wyoming, 1920 [illegible]

Drying Fine Concentrates

POSSIBLY the greatest evil of the flotation process, at least from the smelterman's point of view, is the production of an extremely fine, sticky, slimy concentrate, difficult alike to sample, transport, dry, and roast. In America this concentrate is ordinarily dewatered to possibly 50 per cent in a Dorr thickener and then further treated in an Oliver, Portland, or American filter to from 10 to 35 per cent of moisture, dependent upon the amount of slime present, a common figure being 18 per cent. This filter cake—a black sticky mud—is then shipped to the smelter in open cars; or, if the smelter is adjacent, conveyed by a belt conveyor.

Various methods are in use to get the filter cake out of the cars, in and out of the bins, and into the furnace. In some cases, further drying is attempted before roasting, but the problem has been a difficult one, and no machine for the purpose has been an unqualified success. Possibly the Lowden drier is the best so far offered. In this machine the concentrates are mechanically rabbled along over cast-iron plates heated from below. Recently, electrically heated driers have also received serious consideration. W. C. Clark, of the Bunker Hill & Sullivan Co., Kellogg, Idaho, prepared a paper on this subject for the Columbia Section of the A. I. M. E., and excerpts from Mr. Clark's paper may be of interest.

At the plant of the Hayes Milling Co., an extremely slimy concentrate was made, so that the filter cake was much wetter than usual. A 5 x 17-ft. Lowden drier of the grasshopper type, heated with an oil burner, was installed. An average of 175 dry tons was delivered per month, the feed carrying 35 per cent water, and the product averaging 14.96 per cent. The original weight of slimes treated was 218.7 tons, out of which 43.7 tons of water was removed. For heating the drier, $300 worth of crude oil was used (amount not stated), hence the cost for oil was $6.90 per ton of water extracted. Further expenses connected with this type of drying consist in the renewal of the hearth about every five months and renewal of the furnace lining about every three months, plus attendance and minor expenses.
three months, plus attendance and incidental minor expenses.

The Gold Hunter Mining Co. has installed an electric drier on top of an Oliver filter. This drier consists of eight coils of high-resistance wire, wound on one-inch iron pipe supports and placed one foot apart across the face of the filter. Each one of the eight heating units consumes 3.95 kw., or a total power input of 31.6 kw. The bonnet is heavily insulated with asbestos to prevent radiation, and the resistance wire is always kept at a red heat. This drier acts on all the product of the Oliver filter, or about thirty tons of mixed table and flotation concentrates in twenty-four hours. Before the electric heater was installed, the concentrates averaged 11 per cent moisture upon discharge, whereas with the heater in operation this moisture was reduced to 8.7 per cent, an additional 46 lb. of water per ton being thereby extracted. On the basis of thirty tons per day, out of which the drier takes 2.3 units, it appears that 1,380 lb. of water are evaporated per day. Electric current for the drier costs $4.74 per day, and the cost per ton of water extracted is $6.86.

The filter to which this electric heater has been applied was reduced in speed to give the cake a longer application of heat. This also had a tendency to increase the thickness, the cake with the drier operating being about one-half inch thick. The power consumption of this drier was measured on the 220-volt side of the transformers and across each coil separately; hence the actual consumption would be slightly over 31.6.

The Bunker Hill & Sullivan Co. has recently been experimenting on a new type of drier, which is expected to be serviceable and economical. The machine consists of a common iron pipe, 12 in. in diameter and 10 ft. long, set in a horizontal position for rotating, asbestos being wrapped around the pipe to a thickness of ⅜ in. Over the asbestos is wound 90 lb. of No. 4 bare, hard-drawn copper wire, making 205 turns. The ends of the wire terminate on collector rings provided to deliver current to the winding while the pipe slowly revolves. The winding carries 82 amperes at 282 volts and the heat is generated by eddy currents or hysteresis in the shell of the pipe, and is prevented from radiating by asbestos. The copper wire remains fairly cool.

This pipe is turned at a speed of about 7 r.p.m., and inside the pipe is a shaft provided with rabbles, which move the ore from one end to the other. The rabble blades extend to within ⅛ in. of the sides of the pipe. The rabble shaft turns at 1.36 r.p.m. and the whole apparatus is driven by a 2-hp. motor.

An air preheater is also provided to discharge hot air into the discharge end of the 12-in. pipe, where it is forced by means of a small fan through to the feed end, where another fan takes the moisture-laden air away.

The slime concentrates are transferred from the filter to a hopper at the feed end of the pipe by a belt conveyor. These concentrates contain 11.4 per cent of moisture as they leave the filter, and are dried to 6 per cent, which makes a product easily handled. The capacity of this machine is about 17 tons per 24 hours.

In a 48-hour test period, the machine consumed 1,220 kw.-hr., evaporated 2,686 lb. of water, and treated 46,766 lb. of wet feed, reducing the moisture from 11.4 to 6 per cent. The cost per ton of water evaporated was $5.66.

The rolling or trommel motion of the heated pipe, plus the action of the rabbles, causes the concentrates to form into balls, first as large as grapefruit; then, as the drying progresses, the blades cut up and push along the material, so that each ball is broken again and again, and the finished product consists of small pellets from ¼ to ⅜ in. in diameter, which are so hardened as to retain their form even after lying in the ore bins for several days. The dried concentrates flow from the ore bins like corn.

Experiments are under way to vary the capacity of this drier, one method consisting in providing means to raise or lower the discharge end of the 12-in. pipe. Among the difficulties which were encountered was the over-drying or dusting which takes place when the feed is interrupted. Also, if the filter discharges spasmodically, some material is produced which is not properly dried.

The method of producing heat in the shell of a pipe by means of the hysteresis and eddy current losses set up by a coil wound about the pipe has also been used in the Bunker Hill lead refinery and for heating the pulp feed to an Oliver filter. From experiments which were conducted, it was found that a 4-in. pipe 6 ft. long, filled with cold lead, could be melted out in a few minutes; also, that wrought-iron or steel pipe was preferable to cast-iron pipe. Application has been made for patents to cover the application of this electrical phenomenon for the purposes mentioned.

BY THE WAY

Farming the Abandoned Mine

Don't throw away the old and abandoned mine! Turn it into a mushroom farm. When hope seems faltering and prospects dark a new use for the old workings appears. The New York *Sun* of May 11 records the fact that the old Schuyler copper mine at Arlington, N. J., which produced the copper from which were minted the first United States pennies, has been cleaned out and the 65 and 100 levels planted with mushroom spawn on suitably prepared beds. Eureka! A new use for hot ill-ventilated stopes, drifts, adits and tunnels. The heat from the bosom of old Mother Earth will start a vigorous germination and electric light will substitute for Old Sol. Immunity from depredations, neighbors' chickens, sudden frost and excessive drought is assured, and an eager market awaits. Most miners know that fungi will grow in a mine. Why not encourage the edible variety to do business on a commercial scale? Even the mill classifiers may come in handy—and the jigs. Truly, a hole in the ground is not necessarily a mine; it may be a truck farm. Why not raise gold fish, or silver fish—or suckers—in the flooded parts?

Modest Requirements

"W'en I wuz in Leadville years h'ago, m'son," said Cap'n Dick, "there wuz a chap, Billy Trembath, 'oo wuz a brave h'eater an' wuz most 'andy at tha boardin'-'ouse table. W'en Billy wuz night shif' sometimes 'ee would go daown town in the moornin' an' would'nt get back till time to go on shif' again. One day I said to 'im, 'Billy,' sez I. 'don't 'ee get 'ungry goin' daown town an' stayin' h'all day like that?' 'No,' sez Billy, 'not w'ot you'd call 'ungry, but sometimes I feels like 'avin' a bite. Then I gaws to tha bake-shop an' get a loaf o' rye bread, an' at tha butchers I get a paoun', paoun' an' a 'alf o' sausage. H'after that I gaws to the stoor an' get a paoun,' paoun' an' a 'alf o' cheese, an' a gert red h'onion, w'ich with a 'alf a gallon o' beer at tha Pick an' Dag saloon makes h'as pretty a lunch h'as a man could wish for.' "

Oregon's Gold Bonanza

Romance, gold, blind luck, and a gambling chance are combined in the story of the Boswell mine, in Josephine County, Ore. The mine, an important discovery, is on the ancient stamping ground of the argonauts and prospectors. A man named Anderson prospected the ground, near Holland, seven miles north of the California line. He found some gold and traced it up the mountainside for quite a distance, but finally lost it. He staked out a claim and took in as partner "Dry Wash" Wilson, and it is reported that they recovered about $100,000 from the claim. Anderson wrote his old friend Boswell in Montana, inviting him to come to Josephine County, as "it's a nice looking country." Boswell, arriving, asked him where he should stake a claim. "Anywhere," said Anderson. Boswell staked out the claim adjoining Anderson's.

It was within twenty feet of Anderson's [illegible] that Boswell made the strike. He and his son did a little mining by hand. They were making up about $6,000 in gold monthly, when two masked and armed men held them up, bound the pair and decamped with the gold. Later, the two took about $50,000 from the mine, when the son was drafted into the army. The father promised that he would not work the property until the boy returned. Young Boswell went over seas and lost his life on the front. The elder man, refusing to consider that death cancelled the promise, kept the mine closed. Recently he let it be understood that, though he would not work the mine, he would sell it for $100,000.

The first nine days that the new owners operated the property they recovered $30,000 in gold. At 20 ft. in depth the vein showed 12 in. of high-grade and 23 in. of quartz running $125 per ton. At 30 ft. there was a 16-in. strip of high-grade and four feet of quartz running better than $125 per ton; or, so it is reported.

Calling a Spade a Spade

"Dids't ever 'ear tell o' Mrs. Tregoning, 'oo ran tha boordin' 'ouse to tha Green 'Ill mine?" said Cap'n Dick as the mine volunteer fire department was coiling up the hose after putting out a small blaze that started in a shed behind the blacksmith shop. "Well, m'son, she wuz a fine woman an' 'ad a good boordin' 'ouse. One day she gaws daown to the company store an' bought a pair o' stockin's. At tha h'end o' tha month h'in comes tha bill, an' they 'ad charged one pair o' 'ose, fifty cents. So she put on 'er bonnet an' went h'over to tha stoor. ' 'Ere,' she sez to Billy Smith, tha 'ead clerk, 'W'at's thee mean with chargin' me h'up with this 'ere 'ose? Never got no 'ose any'ow, an' isn't goin' to pay for un, nuther. W'at do I want with a 'ose? Got nothin' but two by four garden, an' I waters un with a 'and bucket.' "

The Gold Miner

Written for Engineering and Mining Journal

A bard there sat on Market Street
  And twanged a twanging lyre;
In wavering tones his trembling voice
  Mounted higher 'n higher!

* * * * * * *

A miner bold once found some gold
  Outcropping in a ledge;
A crosscut long he drove like mad,
  A-pounding steel with sledge.

And when he felt he had enough
  Of ore reserves blocked out,
Sold some stock to equip the mine;
  Success he could not doubt.

The plant complete, ready to treat
  The ore reserves galore,
Came stalking through the land one day
  Old Mars, the God of War,

With leering look, he sat him down
  And called the miner bold,
And said, "My lad, let's deal the cards
  I'll play you for your gold."

And when at last the game [illegible] end
  The miner looked around;
His ore was gone! His plant was scrap!
  His mine a hole in ground!

He tore his hair and ground his teeth,
  And raved and cursed and swore,
And knew too late he'd been unwise
  To buck the God of War.

And Mars looked on with heartless gaze,
  His face was cold and grim,
For ages past he'd broken men,
  Who dared match wits with him.

HANDY KNOWLEDGE

Milling Details

By W. R. CANTON

Written for *Engineering and Mining Journal*

A Launder Classifier

In the course of working out a concentration system, there arose the need for a fairly close classification. There was not room enough to install a manufactured classifier, and it appeared that the solution of the problem lay in a launder classifier. It was to meet this need that the classifier shown in Fig. 1 was devised. It is constructed of materials easily accessible around a large plant and is inexpensive. The outside is of 6-in. pipe, and the feed inlet is of 3-in. pipe, to which is welded the top of ¼-in. plate. A 1½-in. pipe brings in the hydraulic water on a tangential line. The bottom is formed by a bell reducer reducing from 6 in. to 3 in. Into this is screwed a 3 to 1½-in. flat reducer. A 1½-in. pipe forms the discharge which carries away the sands.

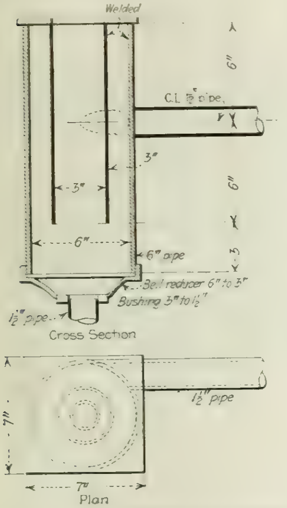


FIG. 1. A LAUNDER CLASSIFIER

Fig. 2 is a sketch to scale showing the installation. This classifier has given efficient service in making a separation at 40 mesh, and will give good results over a range from 6 long tons to 13.6 long tons per hour. Nine months' use has shown no appreciable wear except that of the discharge spouts.

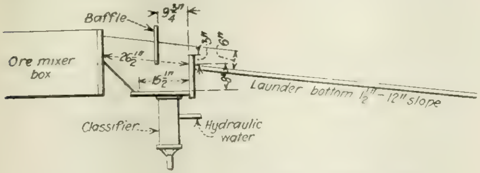


FIG. 2. LAUNDER CLASSIFIER INSTALLED

An Ore Wetter

Often the need arises for an efficient method of wetting an ore. It was to meet this need with a simple appliance that the ore wetter shown in Fig. 3 was designed. The water flushes over the top plate upon which the ore drops in such a way that the ore is always falling on a sheet of water. The top plate is made larger than the others so that it may be reversed when worn. This installation has given good results in practice, handling as much as 13.5 long tons per hour.

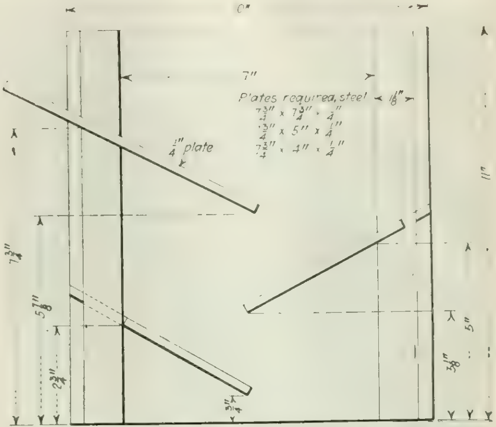


FIG. 3. DEVICE FOR WETTING AN ORE

An Ore Gate

A detail drawing for an ore discharge gate is shown in Fig. 4. Instead of the 6-in. pipe discharge shown, a bell reducer followed by a bushing with any desired opening may be used. The apparatus is bolted to the bottom of the bin and attached to the 6-in. drop pipe by a 6-in. flange. The only wearing part is the discharge bushing. This gate will give a steady flow of material.

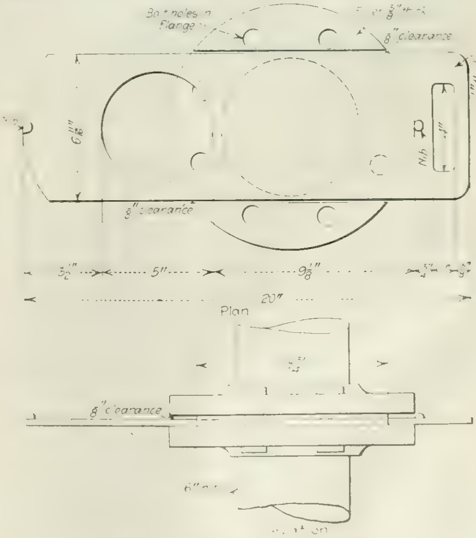
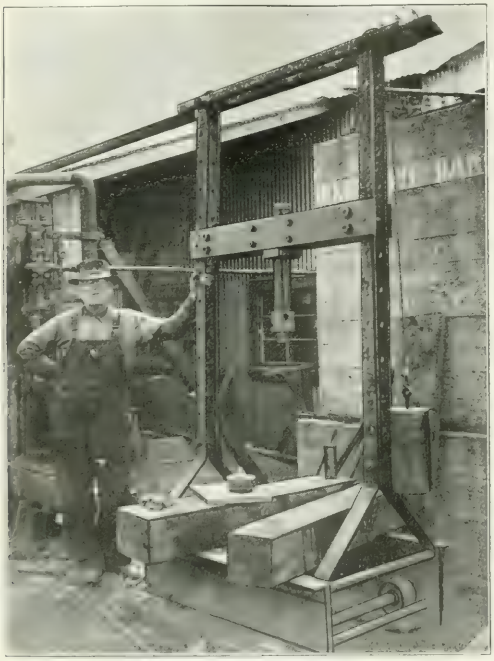


FIG. 4. ORE DISCHARGE GATE

A Screw Press

Written for *Engineering and Mining Journal*

A simple and practical screw press that serves a number of useful purposes about the mine shop is shown in the accompanying photograph. It was made by Andrew Riley, master mechanic of the Plymouth mine, Plymouth, Cal. The tension members are attached to two short lengths of channel iron which form the body of a four-wheeled truck. The crosshead is supported by cast-iron counterweights, and can be adjusted for vertical height within a range of approximately 7 ft.



A HOME-MADE SCREW PRESS FOR SHOP WORK

Estimating Irregular Areas

By Sam Soddy

Written for *Engineering and Mining Journal*

The area of a plan drawn to scale may be estimated approximately by determining its weight. To do this cut out from a thin sheet of zinc or any other suitable metal or homogeneous material the outline of the plan whose area is desired. Weigh this accurately. Then cut out a large square section from the middle, weigh it, and as it is of regular form it can easily be measured. The area of the entire plan can then readily be calculated by proportion.

Handy Fire Extinguishers

Written for *Engineering and Mining Journal*

At the Central Eureka mine, at Sutter Creek, Cal., a fire extinguisher is placed in a convenient position in the midst of a group of compressors and other machines. It is supported at such a height as to be readily visible from almost all points in the building. In placing such extinguishers, careful study of the fire risk should be made and the extinguishers should be easily within reach.

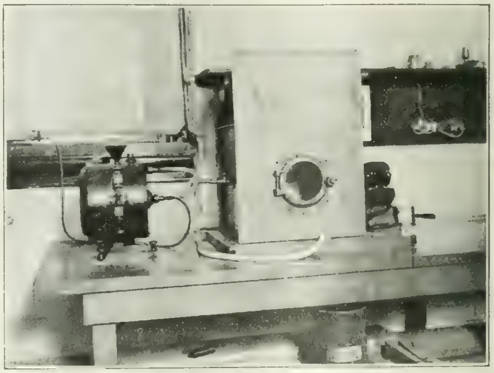
Gas Box for Safety Lamps

By Walter S. Weeks

Written for *Engineering and Mining Journal*

A piece of apparatus necessary for a mining laboratory is some sort of box into which gas may be introduced so that the flame caps on safety lamps may be observed. The accompanying illustration shows such a box, which I had made for the laboratory in the University of California. The box is cubical and is made of galvanized iron which is .048 in. thick. It holds two cubic feet. The glass observation door is a ship's port light 6 in. in diameter. This is bolted on and soldered.

A safety valve to relieve the pressure in case of an explosion is necessary. This is made by placing in the top of the box another port light, from which the glass has been removed. A piece of bond paper can be placed over the hole and clamped tightly by the door. If the door of the port light enters the hole far enough to tear the paper it should be ground off.



GAS BOX FOR OBSERVING FLAME CAPS ON SAFETY LAMPS

At the right in the illustration is shown a small motor which turns a shaft which enters the box through a stuffing box. On the shaft inside of the box is a small disk fan. This fan mixes the gas and air.

At the left is an "American" wet test-meter. One revolution of the arrow on the dial indicates one-tenth of a cubic foot. Gas is passed from a tank through a reducing valve through the meter and into the box as shown.

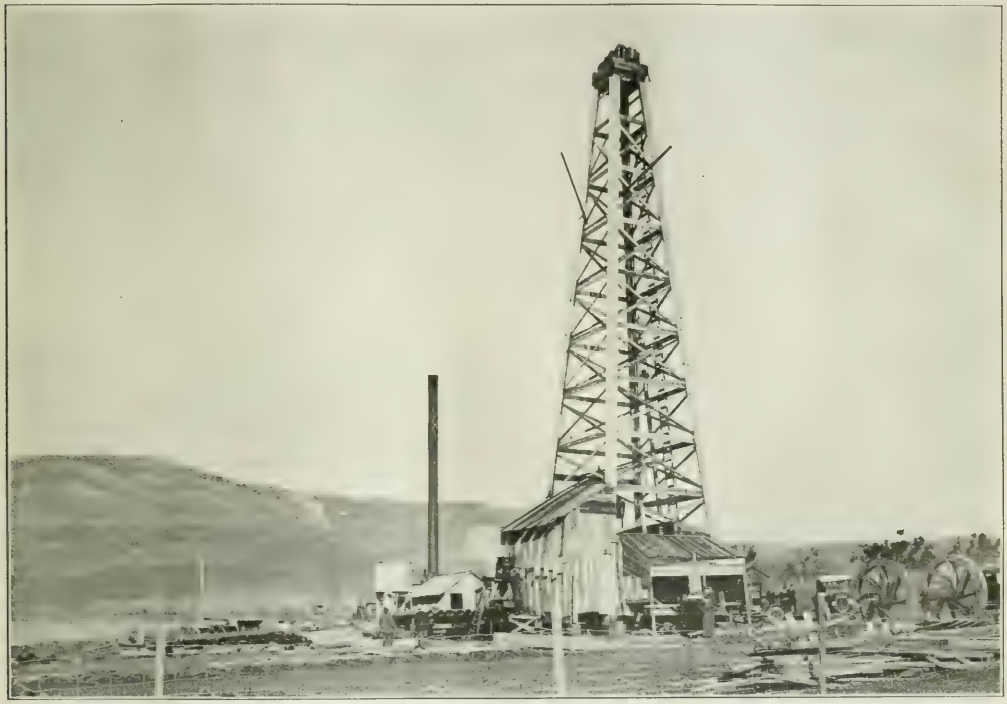
The safety lamp is placed in the box. The desired amount of gas is introduced and mixed with the air by the fan. The flame caps may then be observed. If methane or natural gas cannot be obtained, acetylene makes a good substitute for demonstrating the principles.

A small hose connected to a compressed-air line should be at hand for cleaning the box after a test. The shield in front is to protect the observer from an explosion.

A black cloth, such as photographers use, should be fastened to the front of the box to shut out the light. A piece of black cloth should be laid on the explosion door to exclude light.

A few years ago methane was encountered in a tunnel in Berkeley, Cal. Several men were killed by an explosion. It became necessary to work in the tunnel under rules such as prevail in gaseous coal mines. We were obliged to educate the whole crew in a subject of which they had never heard. This gas box proved most useful in the work of instruction.

THE PETROLEUM INDUSTRY



THE TRIGONIA OIL WELL WHICH IS BEING DRILLED IN ROGUE RIVER VALLEY, OREGON, SHOWING SANDSTONE BLUFFS CAPPED WITH BASALT LAVA IN THE FOOTHILLS OF THE CASCADE MOUNTAINS ON THE EAST

Oil Developments in Rogue River Valley, Oregon

By A. E. Kellogg

Written for *Engineering and Mining Journal*

ALTHOUGH nothing of spectacular nature is evident, there is steady activity and increasing interest in oil exploration in the Rogue River valley, southern Oregon. Three companies having extensive leases, locally financed and actively engaged in drilling for oil in the valley, are the Trigonia Oil Co., the Vulcan Oil & Gas Co., and the J. F. Munday Co. All of these have headquarters at Medford, Ore. The Trigonia Co. has made the greatest development since operations generally begun last summer.

The Trigonia well has reached a depth of over 1,000 ft. at a cost of $50,000, which includes equipment and a large supply of casing for an additional well. This amount has been furnished by the business men of Medford, and they have guaranteed further funds to go to a depth of 2,100 ft., which the engineer in charge, E. W. Liljegran, of Medford, Ore., estimates will bring results.

The log of the well down to 695 ft. shows that black and gray lime shale predominated and gave a paraffin residuum. Water strata with a heavy flow was struck at 50 ft. and 150 ft. Indications of gas appeared at 125 ft. At 695 ft. the black and gray lime shales were mixed with silica sand, and down to 800 ft. the limestone changed in color to gray, green, and red, accompanied with silica sands. At 800 ft. gray and black sand appeared, with a flow of water, and some indications of gas, and continued to 822 ft., to which point the well is cased with 12-in. casing from a depth of 241 ft., where 16-in. casing is used. Drilling from this point is continued with an open hole and passes through a hard formation of limestone, cut with thin strata of gypsum and asphaltum, showing indications of gas, and giving an increased paraffin residuum. The recent drilling gives more pronounced asphaltum beds.

The oil prospects in the valley are closely associated with its coal deposits, which occur at numerous places. The valley is situated between the Cascade Mountains on the east and the Siskiyou Mountains on the west. The coal belt is long and narrow, and begins in the Umpaqua Mountains north of the valley, stretches to the south and southeast through Sams Valley into the valley east of Medford and Ashland, and continues through the Siskiyou Mountains into California, a total distance of 100 miles.

The Cascade Mountains, east of the coal belt, are made up mainly of Tertiary lavas; the Siskiyou Mountains on the west are composed of granular igneous rocks and a smaller proportion of pre-Cretaceous sediments.

The soft rocks in which the Rogue River valley has been cut are sandstone, shales, and conglomerates. They dip generally eastward, extending beneath the greater portion of the lava fields of the Cascade Mountains. The older sediments along the western portion of the valley, by Bear Creek from the foot of the Siskiyou Mountains to Ashland and Jacksonville, are Cretaceous and do not contain coal. The coal-bearing rocks lie east of Bear Creek as far north as Medford, but beyond this point they overlap the Cretaceous rocks and occupy the entire northern part of Rogue River valley. Tests of shale and sandstone from all over this territory give a paraffin residuum.

The Oregon Bureau of Mines and Geology made an extensive geological study of the Rogue River valley last summer for oil and gas, and last winter made an unfavorable report for the production of petroleum products in commercial amounts in the valley. A final paragraph of this report has not dashed the hopes of the Rogue River valley interests:

"The Cretaceous and Eocene deposits of Rogue River valley are well exposed for study, and all through its entire thickness offer no horizons favorable as a source of commercial quantities of petroleum. This region, with its gentle monoclinal structure and its open plunging anticlines, should show innumerable indications of petroleum if such ever had existed in any quantity in the valley. This region is such an open one and so easily studied that a careful examination is conclusive that it offers no favorable territory for the production of petroleum products in commercial amounts."

This report is confirmed by local geologists, who claim that seismic disturbance in the past had in all probability so broken up the underlying strata as to permit the escape of whatever oil might have been stored in the valley. This is controverted by oil men, who point out that the shale, coal, and sandstone were undisturbed when the mountains were formed, that the sandstone anticlinals are still intact, and that the stone is of a coarse-grained variety, which is considered favorable.

Oil-Shale Company Starts Reduction Plant

SPECIAL CORRESPONDENCE

The Monarch Oil Shale Co. has begun the operation of a reduction plant near De Beque, Col. The initial operation of the plant shows a capacity of over 60 bbl. of oil every twenty-four hours, and with suggested improvements, the management states, it will soon be brought up to 100 bbl. daily. Tankage capacity at the plant is exhausted, and arrangements are now being made for trackage and tank cars to bring the product to Boulder, where it will be refined by the Apex company. It is claimed that the shale oil yields a much higher grade of gasoline, kerosene, and lubricating oils than natural oil from wells.

The shale is ground to one-half-inch mesh, and automatically fed to the retort. The Ginet retort is horizontal, 25 x 3 ft., and set in firebrick. The shale is advanced from the front to the rear of the retort bottom by revolving agitating shovels, and the spent shale is discharged automatically. The retort is heated by combination oil and gas burners, the most efficient heat considered to be from 550 deg. F. at the front to 770 deg. F. at the rear end.

The gases are drawn out from the top of the retort chamber to a collector and thence to the condensers by an exhauster fan. The condensers, four in number, are water-jacketed, so that varying degrees of heat can be maintained in each one, this being necessary so that the heavier oils containing the paraffin content will flow from the condensers into the storage tanks. The gases, from the time they leave the shale until the remaining fixed gases are finally used under the retort for heating the same, must travel a distance of approximately 250 ft.

Oil-Shale Investigations

WASHINGTON CORRESPONDENCE

Oil shale constitutes by far the most likely source from which petroleum products may be derived when our present sources of oil supply decline to the point where requirements no longer can be satisfied, in the opinion of the Secretary of the Interior, as expressed in a letter to Chairman Rhodes of the House Committee on Mines and Mining, who had asked for his conclusions in regard to pending legislation providing that $140,000 shall be made available to the U. S. Bureau of Mines for investigating oil shale. Extracts from Secretary Fall's letter are as follows:

> An adequate national supply of petroleum is essential to assure prosperity to the United States of America. The U. S. Geological Survey estimates that we have produced 40 per cent of the oil recoverable under present operating methods, which leaves only 60 per cent to be recovered for all the future. . . .
>
> A great many reports have been received recently from Mexico which indicate that the present producing fields soon will seriously decline in production. The oil fields so far developed in Mexico are exceptional in that the individual wells are such large producers. Many of these large wells have recently turned from producing oil to producing salt water. There are, of course, other undeveloped fields in Mexico, but it is not at all certain that they will yield as much oil as is being produced by the present wells.
>
> As the United States cannot depend on its own oil fields to produce all the oil it needs, and with the probability of decreasing imports from Mexico within the next few years, it is time for this Government to give serious attention to possible future petroleum substitutes.
>
> The most likely substitute for our present crude oil is to extract the oil from our oil-shale rock, by distillation. The potential supply from this source far exceeds in quantity all proposed oil substitutes from vegetable and other non-mineral sources. The U. S. Geological Survey estimates that there are in the oil shales of Colorado, Utah, Neavda, and Wyoming about 60,000,000,000 bbl. of oil, an amount many times the possible oil to be recovered from our oil fields.
>
> To recover this oil from the shale at a profit is no simple problem. Before it can hope to be a commercial success, many fundamental technical problems must be solved. Up to the present, efforts to establish the oil-shale industry on a commercial footing have been unsuccessful, largely because of the lack of this fundamental information, and undoubtedly much money is being wasted. The important problem is to produce from the shale an oil which can be refined into gasoline and other products without a great

loss. (The Scotch shale-oil industry has been established for over fifty years, and even today the refining loss is almost 25 per cent.) . . .

The oil-shale industry will eventually be developed into one of the large industries in the United States. This, however, will be a matter of many years; first, on account of the great amount of technical knowledge and practical experience which must be obtained, and, second, on account of the large amount of capital which will be necessary for development on a commercial scale and which will be available only as the price obtained for the products justifies the expenditure. Unless fundamental investigations are started, the development of the oil-shale industry will be delayed, and as the need for the oil becomes pressing, large installations will be made hastily. It is a safe prediction that if these are erected without sufficient fundamental knowledge, much avoidable waste will result. If the Bureau can within three years place at the disposal of the many companies and the public interested in oil shales the basic facts on which the commercial industry can be built, the investigation will justify itself many times over.

During the last two years the Bureau of Mines has spent about $8,000 per annum from the regular petroleum and natural gas allotment in order to carry on work in the oil-shale industry. In addition, this sum has been supplemented by an appropriation of $10,000 from the State of Colorado and $10,000 from the State of Utah, which has been expended under Bureau supervision. Even with this small appropriation, the Bureau has been able to work out a few of the problems in the laboratory, with results which will ultimately save American business large sums of money.

There are 4,000,000 acres of private and public land subject to leasing for oil shale. When the industry is developed, the Government can expect a return from royalties which will far exceed the appropriations asked for the investigative work.

The Director of the Bureau of Mines has advised Secretary Fall that the following investigations in regard to oil shale should be carried to completion:

1. What is the best kind of process for recovering the greatest amount of oil of the best quality at the lowest cost?
2. How should shale oil be refined? (Shale oil differs materially from ordinary petroleum and requires special refining methods. In Scotland the refining loss is 25 per cent. It is imperative that this refining loss be reduced, in order to make the industry profitable.)
3. How may ammonia and other byproducts be recovered from shale, and under what conditions can they be made profitable?
4. What are the best methods of mining shales, in accordance with their occurrence?

Further outlining the needs of oil-shale research, the director of the Bureau of Mines says:

In order to supply the fundamental engineering data to cover these points, the Bureau of Mines contemplates, under the appropriation of $140,000 requested, to extend its laboratory investigations and experiments, to start semi-commercial investigations and experiments, and to co-ordinate the investigations now being made by various states, universities, companies, and individuals, compiling and making available all possible information on the subject of oil shales to those interested and to the general public. The Bureau of Mines contemplates the establishment of an oil-shale station at a suitable locality, including the necessary grounds, laboratories, and equipment. It also contemplates the acquisition of a small tract of suitable shale land, to be set aside as a permanent standard of oil shale for comparative purposes, now and in the future. The Bureau would erect a one-unit Scotch retort, the design and the operation of which are well understood, to provide a means of comparing one retort against another and one shale with another and with the Scotch industry. By means of the completed retort and a standard shale it will be possible to compare various processes one with another, various methods of retorting one with another, and various shales one with another. These comparisons will be invaluable to the industry and can be done only by a Federal agency.

It is expected that the Bureau of Mines will receive the hearty assistance and co-operation of various states and institutions and that it will be possible in this way to considerably increase the amount of work done. The Bureau does not contemplate commercial operations; first, because the necessary fundamental engineering data are not yet available, and, second, because to make a commercial demonstration adequate, it would have to be carried on for a sufficient time to provide cost data, develop markets, and establish labor sources. This would be an elaborate undertaking, and it is felt that it should not be undertaken by the Government, because it would conflict too much with commercial developments.

Auction of Wyoming Oil Lands

The Department of the Interior has announced the sale at public auction, under Section 17 of the oil-leasing act, of 6,480 acres of land in the Salt Creek oil field of Wyoming. The sale will be held at the United States Land Office at Douglas, Wyo., on June 15. The lands have been divided into blocks of 160 acres each and consist of sixteen "inside" tracts in the highly productive area and twenty-five "edge" tracts, each having an approximately equal value. The tracts will be sold to the bidder who offers the largest bonus. No one person, association, or corporation may purchase more than 640 acres. A base royalty of 33⅓ per cent on the oil produced is fixed on the "inside" tracts, and of 25 per cent on the "edge" tracts. The base royalty on gas is the standard royalty fixed by the Secretary of the Interior on Dec. 20, 1920.

One-fifth of the bonus must be deposited in cash or certified check by the successful bidder on the day of the sale, and the remaining four-fifths must be paid in four equal quarterly installments, subject to the condition that the successful bidder deposit bank certificates of deposit, Liberty bonds, or corporate surety bond in the amount of the deferred payments.

Under the terms of the leasing act the United States Reclamation Fund receives 52½ per cent of all bonuses and royalties paid under this sale, and the State of Wyoming will receive 37½ per cent of them for use on public roads and in education.

A map showing the Salt Creek oil field and the blocks to be leased may be obtained from the General Land Office, Washington, D. C.

Notes From the Salt Creek Field

SPECIAL CORRESPONDENCE

The Midwest Refining Co. has secured full title to a lease on Sec. 26-40-79 in the Salt Creek oil field, Wyo., as the last remaining counter claim, that of Lee Stock, has been thrown out by the Department of the Interior. The New York Oil Co. will also be benefited by this decision, as it holds a royalty on 480 acres in this section. Sec. 26 is believed to be the richest section in the Salt Creek field, and now that the title is cleared it is expected that a large production will be developed.

On May 11 the Midwest Refining Co. paid to the State of Wyoming the sum of $162,338, which was the value of the state's 10 per cent share of the oil production from the Ridgeley lease in the Salt Creek field. The money had been impounded for a number of years pending a decision by the Government on the title to this land. The Ridgeley syndicate of twelve shares will receive approximately $35,000 per share.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Bradley Stoughton Resigns as A. I. M. E. Secretary

Relinquishes Office After a Notable Record of Successful Achievement In Promoting Growth and Prestige of the Institute

The resignation of Bradley Stoughton as secretary of the American Institute of Mining and Metallurgical Engineers will come as a surprise to many of the members. Mr. Stoughton has been the secretary since 1913, and during his incumbency has rendered signal service to the Institute. As some indication of the advances that have been made in the past eight years the following comparison is of interest:

The paying membership has grown from about 3,500 in 1912 until it now exceeds 9,000. At the same time the number of local sections has increased from four to twenty-six at the date of writing, and a number of additional sections are being formed.

Technical committees to the number of eighteen now cover every department of the Institute's activities, including industrial relations. Up to and including 1912 the Iron and Steel Committee was the only one of this kind fostered by the society. At that time, also, there was no regular employment department, a branch which has now grown to large volume and importance to the profession.

As to the publications of the Institute, in 1912 and previously the *Transactions* per year averaged one volume; from 1914 to 1921 inclusive the yearly average has been three; while the monthly magazine has about quadrupled in size during that interval.

The increasing interest on the part of members is partly reflected in the growing attendance at meetings, from 220 to over 1,100; and the increased membership and activities has entailed a growth in the annual budgets of receipts and expenses from $55,000 in 1912 to an estimated volume of $203,000 receipts and $198,000 expenses in 1921.

There was no activity in public affairs in Institute life in the year 1912 or previously. At present this department of the Institute's work includes, besides its representation and financial support of American Engineering Council, committees on mine taxation, on [illegible], support of the Naval Consulting Board, the National Research Council, and the American Engineering Standards Committee.

There were twenty-two affiliated student societies in 1912, but they had little connection with the Institute, and the mutual exchange of advantages was slight. In 1921 there are thirty-[illegible] affiliated student societies in most active communication with the Institute, through correspondence, publication of meetings in the monthly magazine, and on visits and addresses of the President and Secretary. In this way the younger men of the profession are connected at an early date with the national society of mining and metallurgy.

Secretary Stoughton's letter follows:

May 17, 1921.

To the Members of the Board of Directors of the American Institute of Mining and Metallurgical Engineers, 29 West 39th Street, New York City.

Gentlemen:

About two years ago, I indicated to the president and some members of the board my belief that the office of secretary of the Institute should not be a permanent one. It is my observation of events, not only in our own Institute, but also in several sister societies, that too long a tenure of office by the secretary inevitably leads to a situation which is not good either for him or for the society. After submitting this in writing to the directors on Feb. [illegible], I was overpersuaded by members of the board to defer resignation until a more convenient time for the Institute. The action of the directors on Feb. [illegible], 1921, [illegible] secretary. "The engagement to be terminated at the pleasure of either [illegible]" was satisfactory to me, because it [illegible] possible to tender my resignation [illegible] convenient for the board [illegible] a successor. As the time has [illegible] I tender my resignation herewith. [illegible] office in 1913 at a loss of [illegible] dollars per year income [illegible] [illegible] To all of [illegible] co-operation [illegible] rendered me. [illegible] be accepted [illegible] of the board. I am [illegible] self with the details of the work and the matters of routine.

Yours respectfully,
BRADLEY STOUGHTON,
Secretary.

BRADLEY STOUGHTON

The Board of Directors of the Institute accepted with regret the resignation of Mr. Stoughton as secretary, and put upon record its appreciation of his long and efficient service to the Institute as well as of his willingness to postpone an actual severance of relations until it may be convenient for the board to elect a successor, and even until such successor shall have had an opportunity of becoming acquainted with the details and routine of the office.

The board recognized the fact that the duties of the office of secretary have been greatly increased since Mr. Stoughton accepted office eight years ago. The board also expressed its appreciation of the fact that while Mr. Stoughton's predecessors were not frequently called upon to travel except when meetings were held outside of New York City, under the policy introduced some years ago of visiting the local sections or having the Institute adequately represented at the meetings of other scientific bodies, Mr. Stoughton has been called on to travel. The board was convinced that in his bearing and in his speeches he had worthily represented the Institute and had enhanced its appreciation among the many members who are not able to visit New York headquarters frequently.

The Board of Directors also expressed the hope that in a new field of activity Mr. Stoughton may have the great success which his abilities deserve, and put on record its appreciation of the self-sacrifice with which he had devoted himself to the interests of the Institute at the expense of his own professional preferment and financial advantage.

State Department Extends Courtesies to M. and M. S. A. Members Working Abroad

Members of the Mining and Metallurgical Society of America who contemplate traveling abroad on professional business in behalf of American interests can avoid the annoyance of finding themselves without satisfactory introductions, by communicating with the secretary of their society, F. F. Sharpless, 115 Broadway, New York City.

Arrangements have been perfected whereby the consular and diplomatic representatives of the United States in the districts to which the engineer is going will be advised concerning his pending visit. It is anticipated that the arrangement will prove of mutual benefit.

Mitke Leads Discussion on Mine Fires for Boston Section

The sixty-eighth meeting of the Boston Section of the A. I. M. E. was held at the Engineers' Club at Boston, Mass., on Monday, May 9, with thirty-seven members and guests present. W. Spencer Hutchinson, chairman, presided. Edwin Ludlow, president of the Institute, gave an interesting account of his recent visit, in company with Secretary Stoughton, to some of the other sections. He then turned to the work being done by Mr. Hoover and the American Engineering Council and the part now being taken in national affairs by engineers. Mr. Ludlow expressed the hope that these activities would not cease, now that the war is over, but would increase still further. He is of the opinion that the engineering profession can render particularly valuable assistance to the country by combating bolshevist tendencies and supplying the country with information, so that the weight of public opinion may be thrown on the side of justice rather than on the side which, through better organization, frequently has caused the public the most discomfort.

Bradley Stoughton followed Mr. Ludlow, adding to his description of their Western trip. Mr. Stoughton also discussed the necessity for concerted action by the engineering profession. He described the development of class consciousness by labor and capital and the failure of the brain workers to develop it to the same extent and the consequent difficulty the latter experience in securing a hearing. To correct this condition he urged united effort and strong support of the movements to link the engineering societies and organizations.

The chairman next introduced Charles A. Mitke, who spoke on "Fires in Metal Mines." His talk covered the causes of mine fires, the methods of preventing and extinguishing them, and the trouble and expense they involve. Mr. Mitke also called attention to the importance of considering the fire hazard when selecting a mining method.

Some discussion followed as to whether chalcocite or pyritic ores are the more dangerous, and whether it is oxidation or friction that is responsible for the greater part of the heat generated. Mr. Ludlow related some of his experiences with mine fires in the anthracite coal fields of Pennsylvania.

Columbia School of Mines Improves Ore-Dressing Plant

The Miami Copper Co. has given the Columbia University School of Mines $2,500 for the purchase and installation of new equipment for the school's ore-dressing laboratories. A like amount has been given by Arthur S. Dwight, and important loans of machinery have been made by the Dorr company and the Hardinge company. These reinforcements, together with much remodeling and rearrangement of other appliances, including some eliminations of out-of-date pieces, bring the laboratories at Broadway and 116th St. up to present-day needs for instruction, research, and effective co-operation with the mining and milling industries.

The generous attitude of many company officials toward the engineering schools is further evidenced by these gifts and loans. According to Prof. A. F. Taggart, of the Columbia School of Mines, one of the aims of the Miami Copper Co. in transferring the above fund to that school is to insure the maintenance in New York City of a modern, well-equipped laboratory for the study of problems in the treatment of ores.

Washington College of Mines Seeks Students of Metallurgical Problems

The College of Mines of the University of Washington offers four fellowships in co-operative work with the Northwest Experiment Station of the U. S. Bureau of Mines at Seattle, Wash. They are open to properly qualified graduates of universities and technical schools, and have a value of $900 per year of twelve months, beginning July 1. Their purpose is to undertake the solution of problems of special importance to the Pacific Northwest and to Alaska, and the incumbents will be assigned chiefly to laboratory work under the experiment station technologists. The subjects for 1921-22 are: Beneficiation of coal, especially by washing; electrometallurgy; ceramics; and the survey of the clay resources of the Northwest.

Applications, accompanied by copies of collegiate records, professional experience, and three personal references, should be addressed before June 1 to The Dean, College of Mines, Seattle, Wash.

Kansas University Celebrates Founding of Its Engineering School

The thirtieth anniversary of the organization of the School of Engineering at the University of Kansas was celebrated on April 19 and 20 with a "Conference on Engineering Activities in Kansas" by visiting engineers, and with an elaborate "Engineers' Day" program by the students.

In the conference on engineering activities Prof. C. M. Young made a special report on Kansas coals, and State Geologist Raymond C. Moore spoke on oil and gas. It was generally agreed that the most helpful line of research open to the engineering department of the university is the study of the deterioration of materials and structures as the result of exposure to the weather. Major-General William M. Black, chief engineer, U. S. A., retired, spoke on the education of engineers.

A. I. M. E. Members Form a Philadelphia Section

Forty members residing in or within fifty miles of Philadelphia met at the Engineers' Club in Philadelphia on the evening of May 16, the semi-centennial of the founding of the Institute at Wilkes-Barre, Pa., on May 16, 1871, and organized the Philadelphia Section of the Institute.

There were present two of the three surviving founder members of the original body, Willard P. Ward and Dr. Henry S. Drinker. E. C. Pechin, the third, expressed in a letter much regret at not being able to attend.

The organization of the section had been duly authorized by the board of directors, following a petition signed and presented by twenty-nine local members. By-laws were adopted, and an organization was effected by the election of an executive committee composed of Guillaem Aertsen, H. M. Chance, G. H. Clamer, Henry S. Drinker, F. Lynwood Garrison, E. W. Parker, A. A. Stevenson, L. H. Taylor, Jr., S. D. Warriner, and Morris Williams. This committee elected the following as officers for the first year: Chairman, Dr. Henry S. Drinker; vice-chairmen, H. M. Chance, A. A. Stevenson, S. D. Warriner; secretary-Treasurer, F. Lynwood Garrison, 982 Drexel Building, Philadelphia. Mr. Ward was elected an honorary member of the Philadelphia Section.

Dr. Drinker gave a condensed résumé of the founding and early days of the Institute, and his address was followed by some interesting reminiscences by Mr. Ward.

A general discussion followed, covering the proposed activities of the section, and the meeting closed with a smoker, which gave the members present an opportunity to meet informally, and to discuss the founding of the section and plans for its future growth.

Utah Steel Industry Grows

The Utah Society of Engineers was addressed recently by Morris Rosenblatt, manager of the plant of the Utah Steel Corporation at Midvale. Mr. Rosenblatt spoke of the present work of the plant, and of the future extension of the steel and iron industry in Utah, based upon the iron deposits of Iron and Carbon counties. The Midvale plant is producing 200 tons of standard steel bars and rods daily. Preparations are being made to increase this output, and also to make light-weight steel rails. In 1917 the company, which for some time had been producing wrought iron, installed an open-hearth furnace, which has since continuously produced steel from scrap material collected throughout the inter-mountain region. Three hundred and fifty to 450 men are employed, and in 1920 the payroll amounted to $750,000. Steel to the value of $3,000,000 was produced. A larger output is expected for the coming year. The Western States, Japan, China, and other foreign countries offer a market for Utah's steel.

Men You Should Know About

M. I. Goldman has completed a study of salt domes on the Texas and Louisiana coast.

William Parsons has joined the engineering force of the Darwin Silver Co., at Darwin, Cal.

Norman Carmichael, general manager for Arizona Copper Co., Clifton, Ariz., is in New York City.

W. A. Coughlan, of Sault Ste. Marie, Ont., is now with Consolidated Asbestos, Ltd., at Thetford Mines, Que.

Benjamin D. Stewart has been reappointed by Governor Thomas Riggs as territorial mine inspector for Alaska.

B. M. Walton has accepted the position of manager for Porcupine Paymaster Mines, Ltd., at South Porcupine, Ont.

C. E. Siebenthal, geologist, of the U. S. Geological Survey, is doing geologic work in the Joplin district, Missouri.

James P. Porteus, superintendent of the Bonney mine, Lordsburg, N. M., has returned from a business trip to New York City.

G. C. Bateman, manager of La Rose Consolidated Mines, addressed the Toronto Board of Trade recently, on the mining industry of Ontario.

W. C. Campbell, mining engineer, of Toronto, who was in Africa for several years previous to his recent stay in Mexico, has returned to Toronto.

Thomas L. Chapman, who has been making examinations in the Lordsburg, N. M., and Patagonia, Ariz., districts has returned to Los Angeles, Cal.

F. W. Holler, recently superintendent for the Belmont Surf Inlet Mines, Ltd., at Surf Inlet, B. C., may now be addressed at 2145 Goodrich Ave., St. Paul, Minn.

S. C. Thompson recently appointed consulting engineer for Kirkland Proprietary Mines, Ltd., has been examining its Tough-Oakes and Burnside properties, Kirkland Lake.

Moses Johnson, formerly district inspector of mines at Lethbridge, Alta., has been appointed to a similar position in the Drumheller district. He has headquarters at Calgary.

W. H. Crago and **Frank Hutchinson**, of Duluth, Minn., with **L. D. Davenport**, of Boston, Mass., will sail from Seattle, Wash., early in June to examine iron ore and coal deposits in Manchuria.

Wilfrid Kilian, professor of geology at the University of Grenoble in the Dauphiné, France, has been awarded the Gaudry gold medal, the highest distinction conferred by the Société Géologique de France.

Raymond Guyer, mining engineer, of Spokane, Wash., who recently visited Caliente, Nev., and Ely, Nev., districts, has gone to La Jara district, Tepic, Mexico, where he is interested in a gold property.

Duncan McDonald, district inspector of mines at Calgary, Alta., is now general superintendent of the Mine Rescue and First-Aid Department of the Canadian Department of Mines, for the province of Alberta.

Charles D. Walcott, secretary of the Smithsonian Institution, was awarded the Mary G. Thompson gold medal by the National Academy of Sciences, on April 26, "for distinguished research in geology and paleontology."

Stewart Campbell, of Hailey, Idaho, who was elected mine inspector for the State of Idaho last fall, is making his first official visit to the mines of northern Idaho. He recently spent about three weeks in the Cœur d'Alene district, and expects to return in the fall to make a more extended investigation.

C. V. Corless, president of the Canadian Institute of Mining and Metallurgy, Dean **R. W. Brock**, of the University of British Columbia and former director of the Geological Survey of Canada, and **J. J. Denny**, metallurgist at the Nipissing mine, recently received honorary degrees from Queen's University.

Dr. M. Y. Williams, professor of paleontology in the University of British Columbia, Vancouver, B. C., and formerly geologist on the staff of the Canadian Geological Survey, is in charge of one of three parties sent out by the Canadian Geological Survey to make a geologic survey of the Mackenzie River district.

Dr. Mariano Ospina Perez is now director of the national school of mines at Medellín, Colombia. Dr. Perez, who succeeds the late Dr. Tulio Ospina in this position, is a mining engineer of experience and the president of several mining companies. He is also the recently elected head of the firm Tulio Ospina y Cia., mining factors, Medellín, Colombia.

Mining and metallurgical engineers recently in New York included: **Edouard L. Foucar**, of San Francisco, Cal.; **A. B. Shutts**, of the American Ores & Asbestos Co., Globe, Ariz.; **D. S. Clements**, of Pittsburgh, Pa.; **P. W. Donovan**, of E. J. Longyear Co., Minneapolis, Minn.; **C. Vey Holman**, of Rockland, Me.; **W. A. Rukeyser**, of Montreal, Que.; **Frank A. Edson**, of the Oklahoma Geological Survey; **Erskine Ramsay**, of Birmingham, Ala.; **Edward H. Cook**, of Culiacan, Sinaloa; **R. H. Barksdale**, of Richmond, Va.; **Prof. R. W. Brock**, dean of the University of British Columbia, Vancouver, B. C.

Society Meetings Announced

Executive Board of Federated American Engineering Societies meets in St. Louis, Mo., on June 3.

Arizona Chapter of American Mining Congress meets at Bisbee, Ariz., on June 13. J. E. Curry, of Bisbee, is secretary.

Ontario Mining Association meets at Cobalt, Ont., in June. Arrangements are in charge of Balmer Neilly, 120 Bay St., Toronto.

Great Lakes meeting of **American Society of Mechanical Engineers** will be held at Cleveland, Ohio, on June 13 and 14. Further information may be had from C. E. Davis, 29 West 39th St., New York City.

Obituary

Edward B. Rosa, chief physicist of the U. S. Bureau of Standards since 1910, died suddenly in his office at Washington, D. C., on May 17, at the age of sixty. Dr. Rosa first attained national prominence by developing the respiration calorimeter used in Professor Atwater's nutrition experiments. Most of his chief work has been in the advancement of electrical science. Among his notable contributions was the establishment of the laws governing electrolytic corrosion. During the war he developed a number of instruments of great usefulness, including the geophone, for accurately locating mining operations. He also devised improved direction finders for radiotelegraphy. Dr. Rosa was secretary of the International Commission on Electrical Standards, a member of the American Engineering Standards Committee, and of many learned societies, including the United States National Academy of Science.

In the death of **William S. McCornick**, on May 18, Salt Lake City, Utah, has lost one who for almost fifty years was a beneficent and forceful influence in the development of the state. Mr. McCornick, who was eighty-four years old, went to Utah in 1873, and engaged in a banking business first known as White & McCornick and later as McCornick & Co. From that time onward he gave generous support to worthy enterprises of all kinds, so that he was justly regarded as one of the builders of Utah. Mr. McCornick early recognized the mining opportunities of the state and the potential value of the mining industry. Among other things, he helped to further the development of such properties as the Silver King Coalition, the Daly West, and the Centennial Eureka. In 1899, when the United States Mining Co., bought control of the Centennial Eureka, a check for $1,385,000 passed through the McCornick bank and was cashed there, and this hung for years in Mr. McCornick's office. At the time of his death Mr. McCornick was a director in the Silver King Coalition, the Utah Power & Light Co., and in the American Smelting & Refining Co., as well as in many enterprises not connected with mining.

THE MINING NEWS

LEADING EVENTS

Safety Campaign Undertaken in Utah

State Industrial Commission and U. S. Bureau of Mines Unite in Effort To Reduce Number of Accidents

A safety first campaign to reduce the number of accidents in Utah mines has been inaugurated by the state industrial commission co-operating with the U. S. Bureau of Mines, C. A. Allen, state mine inspector, and Dr. A. L. Murray, of the bureau, being in charge of the work. As approximately 40 per cent of fatal accidents in Utah mines are attributed by state and federal inspectors to carelessness on the part of the workers themselves, and only from 10 to 12 per cent to faulty conditions, it can readily be seen what may be expected from a campaign of education.

First aid and mine rescue classes have been given by instructors and crews of the mine rescue car, following the usual custom, and this instruction made to fit in with the general educational movement. From Jan. 16 to April 19, in all 376 men have taken first-aid training and 42 men mine rescue work; 1,790 men have attended safety rallies at which the ideals of "safety first" were emphasized and the dangers of carelessness illustrated by moving pictures furnished by the Bureau of Mines and the Red Cross.

The school children are being interested, and 1,219 have enlisted as "safety and health scouts," pledging themselves to be careful and to urge their parents to be careful. In the case of each child joining the movement the parent or guardian signs his personal approval of the movement toward increased safety in Utah, and pledges his support. The full campaign is being carried on in Ophir, Eureka, Park City, Coalville, and Bingham and other camps. The Garfield and Murray smelters have permanent safety organizations and so were not visited. The industrial commissioner is furnishing funds for posters, literature, pledge cards, buttons, rental, and incidental expenses; also some of the speakers. The Bureau of Mines supplies the mine rescue car and the workers.

C. & H. President Heads Copper Export Association

John D. Ryan resigned as president of the Copper Export Association at the meeting of the stockholders. Mr. Ryan has been president of the association since it was formed and declined re-election, but will continue as a member of the executive committee. R. L. Agassiz, president of the Calumet & Hecla Mining Co., was elected to succeed Mr. Ryan.

WEEKLY RÉSUMÉ

The Silver King Coalition Mines Co. and the Daly West Mining Co., both of Park City, Utah, have decided to resist the recent attempt of the American Smelting & Refining Co. to abrogate its smelting contracts with them, under the plea that the rates are too low to permit it to earn a profit. A safety campaign has been undertaken in various camps in Utah by the State Industrial Commission and the U. S. Bureau of Mines in an effort to reduce the number of accidents. At Tonopah and Divide strike conditions have changed but little, although the operators are endeavoring to bring in workmen from other districts. The striking miners at Rochester, Nev., have returned. At Bisbee, Ariz., the Night Hawk Leasing Co. has discovered an important body of high-grade bornite. In Minnesota the Palatine Mining & Development Co. has been organized to operate the Paulson mine in the Gunflint Lake district, near the Canadian boundary. Word has come that the Mount Lyell copper company in Tasmania will shut down June 16.

At Washington the draft of the proposed revision of the mining law is still held up. The Committees on Mines and Mining are said to favor delaying making any changes in assessment work requirements until the revision referred to is considered. Representative Hayden has introduced a bill granting exclusive rights, in certain states, to prospect for copper deposits under certain conditions.

F. H. Brownell, vice-president of the American Smelting & Refining Co., was elected chairman of the board. All other officers and members of the executive committee were re-elected.

Republic Iron & Steel To Abolish Eight-Hour Day With Overtime

Iron-Ore Properties of Company Not Affected by Order

Announcement has been made by the Republic Iron & Steel Co. that hereafter the basic eight-hour day with overtime will be abolished at its plants near Youngstown, Ohio. Where the working day constitutes ten to twelve hours, straight time on an hourly basis will be paid. For some time prior to this order, all overtime was settled on a basis of time and one-half. It has been indicated that other independent manufacturers will take the same course, and if they do so more than 15,000 employees will be affected. Such orders affecting the iron ore properties of the company in the Lake Superior district have not as yet been received.

A. S. & R. Abrogates Contracts With Two Park City Companies

Refuses To Smelt Silver King Coalition and Daly West Ores at Rates in Existing Contracts

A controversy over a proposed increase in smelting rates between the Silver King Coalition Mines Co. and the Daly West Mining Co., both of Park City, Utah, on the one hand, and the American Smelting & Refining Co. on the other, is being watched with much interest by the mining men of the state. Both mining companies, which hold contracts with three and four years still to go, respectively, have been notified by the smelting company that smelting charges on ores and concentrates shipped after May 15 will be raised. The matter hinges about the interpretation of the disabling clause in the smelting contracts, which, as quoted by W. Mont Ferry, of the Silver King company, reads as follows:

"In cases of acts of nature, strikes of any kind, affecting the operations of the contracting parties, fires, floods, shortage of cars, financial crises, war or insurrections, or any cause whatsoever which, being beyond the control of the contracting parties or either of them, shall make it a disability on the part of the mining company to ship the product herein contracted, or for the smelting company to receive, purchase and treat such product, the parties hereto shall be relieved of all responsibility or claim for damage for failure to ship or receive the product; but shipments and receipts shall be resumed as soon as the disabling cause is removed and the period of such interruption or interruptions shall be added to the time provided for in this contract."

According to Mr. Ferry, "as far as the language of the contract pertains, the only disability under which the American Smelting & Refining Co. can possibly be laboring is disability to make a profit treating the King Coalition ores and concentrates under the schedule of rates agreed upon." G. W. Lambourne, of the Daly West company, has asserted that his company will take a determined stand with the Coalition in the controversy. In his opinion the advance in the cost of smelting would not make the disability clause operative. When the smelters were making large profits, he says, mining companies were not — to his knowledge — approached with an offer of a more reasonable reduction charge.

The point of view of the smelting company is given by J. M. Bidwell, manager of the Salt Lake office of the American Smelting & Refining Co., as follows:

"Each contract contains a provision that when and if conditions arise in the smelting business beyond the control of the company, which render the smelting of their ores unprofitable at the contract rates, or make it a disability or serious hardship to receive and smelt them, then the contracts may be suspended. The contracts also provide that in case market or mining conditions make it a serious hardship for the mining companies to ship ores, they shall not be obligated to ship them. In other words, if the cost of mining became excessively high, or the metal prices extremely low, and the mining companies cannot ship at a profit under the contract, they are not obligated to ship their ores. . . . Of course, the smelting company can shut down and avoid all dispute, but that is a situation which it is now using every effort to avoid, because of the effect that course would have on the mining industry and on the people of the state. . . . Since the contracts were made, smelting costs have gone up tremendously and the result has been that for a considerable period of time the smelting company has been receiving and smelting ores from these properties at a heavy loss. The smelting company has borne these losses without complaining until they are unable to do so any longer, and on account of the present existing financial and metal market conditions, the smelting company feels that it is not fair for the mining companies to ask them to continue taking these ores at such heavy loss. Since these contracts were first made the freight rate on lead bullion has increased approximately $12 per ton. The price of coke has increased over $5 per ton. The cost of labor, limestone rock, coal, steel, and other products, and all other factors entering into smelting the ores have increased materially."

Mr. Bidwell further states that the company offers to treat the ores of the two protesting mining companies at cost, and would figure these costs each month, and that as soon as these costs were lowered, as the company expects will soon be the case, the mining companies would be given the benefit, and adds that the smelting company feels that the welfare of mining and smelting enterprises are so interwoven that only by the most cordial co-operation can these industries survive present conditions.

On the other hand, in regard to the rise in production costs, it is pointed out by the mining companies that this increase has extended to all branches of enterprise, and it is stated that mine operators have suffered as heavily or even more heavily than the smelters. The new rates proposed by the smelter are stated to be 75 per cent higher than those in force at present, that is, [illegible] a ton higher. It is intended to continue to offer ores to the smelting company, according to official statements, at the old rates, and if these are refused the ores will be sold on the open market and legal action will be taken to collect from the A. S. & R. the difference in the price received for the ores, as compared with the price received if smelted under the A. S. & R. contract. The A. S. & R. are short of lead ore at present, so that it is said to be especially a poor time to ask an increase in smelting rates.

B. H. & S. Co. Completing Tests on Electrolytic Zinc Processes

Tainton Method Likely To Be Selected for Proposed New Plant, According to F. M. Smith

Final tests are now being made by the Bunker Hill & Sullivan Mining & Concentrating Co. to determine which of two electrolytic processes will be adopted for the proposed zinc plant to be erected by the company at Kellogg, Idaho. The two processes are the Anaconda and the Tainton, the latter being in successful use in a plant at Martinez, Cal. Frank M. Smith, director of the Bunker Hill smelter, states that the Tainton process seems to have some advantages over the Anaconda process and will probably be adopted. It will be almost a year before construction begins on the new electrolytic zinc plant. It will have an initial output of 25 tons per day, and is intended primarily for treating zinc-lead ores from the Star mine. The company plans however, to accept custom business, and as soon as conditions justify the capacity of the plant will be increased to handle the ores from Pine Creek and all others that are offered.

Marsh Mines Recent Settlement A Lucky One

Vein East of Fault Proved Not To Cross East End Line — Point Immaterial Now

Since the settlement of the litigation between the Marsh and Hecla companies, the first-named company has continued drifting on the Russell vein to prove its position with respect to Marsh ground, and when this has been accomplished work will be transferred 1,000 ft. below to the Gertie tunnel, from which a crosscut will be run which should cut the vein in about 450 ft. According to the statement submitted to the stockholders at the recent meeting, after paying all debts the company had a cash balance of $89,699. A dividend has since been declared of 2c. per share, amounting to $40,000, which leaves a balance of almost $50,000 for development purposes. It will be recalled that the Hecla company paid Marsh $112,500 in settlement of the apex litigation, and it is this payment that makes the dividend possible.

In closing a letter to stockholders outlining plans of the company, Edward Pohlman, president of the Marsh, states that development work on the Russell claim has located the vein east of the fault and that "it has been conclusively shown that the vein will pass out through the north side line of the Russell claim instead of crossing the east end line. Now that the settlement has been effected, it is immaterial whether the apex of the vein crosses either line, but had no settlement been reached before proving the vein in the position in which it was located east of the fault, the company would have found itself in a compromising position, as it would have been difficult to sustain its claim of extralateral rights against the Hecla company."

Paulson Mine at Gunflint Lake, Minn., To Be Reopened

Palatine Mining & Development Co., Recently Organized, Also Acquires Atikokan Furnace

A new company known as the Palatine Mining & Development Co. has been formed for the development and operation of iron-ore properties in Minnesota. The company has acquired the Paulson mine, in the Gunflint Lake district, in Cook County near the Canadian boundary. The company has also acquired the blast furnace formerly owned by the Atikokan Iron Mining Co. situated at Port Arthur, Ont., Canada, which will be enlarged and modernized to treat all ores coming from the new property.

The ore in this district is generally magnetic, with traces of sulphur and a high percentage of silica. Owing to the complexity of the deposit, some of the ore will require concentration and roasting before it reaches the furnace, but it is expected that it will be possible to ship some direct to the furnace without treatment.

Party of Engineers Will Go to Manchuria

A group of engineers and geologists will sail from Seattle on June 3 for China, where they will make a geological examination and report for the South Manchuria Railroad Company, covering the iron and coal deposits owned by the company in the vicinity of Anshan and Mukden, Manchuria. The party will be composed of W. H. Crago, Duluth, Minn.; Frank Hutchinson, Duluth, Minn.; Dean W. R. Appleby of the school of mines at the University of Minnesota; W. R. Emmons, geologist for the State of Minnesota; Warren J. Meade, Madison, Wis., and L. D. Davenport, of Boston, Mass.

New 100-Mile Railroad Proposed for Northern Ontario

Provided the Ontario government will guarantee the bonds of the company to the extent of $3,500 per mile for the construction of 100 miles of railway, the Northern Light Railway Co. proposes to commence operations as soon as possible to provide transportation for several new mining camps of North Ontario. It is planned to run westward from Swastika on the Timiskaming & Northern Ontario line to Gowganda, Matachewan and West Shining Tree, and later to build a loop from the same point eastward touching Kirkland Lake, Larder Lake and Skead Township camps, returning to the T. & N. O. at Boston Creek.

Mount Lyell To Shut Down

The Mt. Lyell Mining & Railway Co. will shut down June 16, according to a cable dispatch received by the Department of Commerce. It is said that this is the result of the refusal on the part of the miners to accept a reduction in wages. About 1,500 men are affected.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Draft of Revised Mining Law Still Held Up

Mining Committees Favor Withholding Assessment Work Legislation — Action on War Minerals Also Delayed

The draft of the proposed revision of the mining law has not been delivered to the Committees on Mines and Mining as had been expected, owing to the necessity of perfecting some of the language from a legal viewpoint. The law officer of the Bureau of Mines was sent to New York to assist in that work.

Both the Senate and House Committees on Mines and Mining have decided, in view of the imminence of general revision of the mining law, to withhold legislation with regard to assessment work. The committees favor a change which will permit assessment work to be done during the fiscal rather than the calendar year.

In this connection the delegate from Alaska has introduced in the House of Representatives a bill providing that assessment fees on mining claims may be diverted for road-building purposes. The bill provides that the $100 annual payment on each mining claim may be made direct to the Treasurer of Alaska for road improvements in the vicinity of the claim or that the owner may do road or trail work in the vicinity of his property and receive the same credit as would have accrued to him had he done improvement work on the claim itself.

Former soldiers would be relieved from assessment work on any mining claims that they may hold for a period of five years, from July 1, 1921, if a bill introduced by Representative Lineberger should become a law.

The House Committee on Mines and Mining met in executive session on May 20, but none of the bills before the committee was reported out. It was decided to postpone final action on legislation bearing upon supplemental war minerals relief awards so as to give the Comptroller of the Treasury an opportunity to review the Dolbear case. This action was taken in the hope that the Comptroller may interpret existing law so as to permit a supplemental award when new evidence shows that the claimant should receive the amount asked despite the fact that he had accepted a previous award as full settlement of the claim.

Government's Silver Purchases

Purchases of silver under the Pittman Act amounted to 302,000 fine ounces for the week ended May 21. This brings the total purchases of silver since the enactment of the Pittman Act to 54,120,197 fine ounces.

Exclusive Prospecting Rights Proposed in Hayden Bill

To Encourage Search for Copper Deposits—Permit Limited to Three Years and 1,280 Acres

In an effort to encourage prospecting on the public lands in Arizona, New Mexico, Nevada, and Utah, Representative Hayden, of Arizona, has introduced a bill authorizing the Secretary of the Interior to issue prospecting permits which will give the exclusive right, for a period of three years, to prospect for copper on the public lands in the states mentioned, in an area not to exceed 1,280 acres. The bill provides that operations must begin within one year of the date of the permit and that within two years after the date of the permit at least one drill hole or one shaft must have been sunk to a depth of not less than 500 ft., unless a deposit of copper be discovered at a lesser depth. At the end of three years the holder of the permit must have a drill hole or a shaft with an aggregate depth of not less than 1,500 ft., unless copper should have been discovered at a higher level.

Provision is made for the extension of the permit. The same conditions apply to a tunnel or a drift. On any claim held under the mining laws, the holder of that claim will have a preference right to a prospecting permit. In the case of the discovery of a valuable deposit of copper the permittee is to be given a patent upon payment of $5 per acre.

Souvenir Gold Dollar for Grant Centenary

A bill has been introduced in Congress providing for the coinage of a souvenir gold dollar in commemoration of the centenary of the birth of General U. S. Grant. The Secretary of the Treasury is authorized by the bill to purchase in the open market the quantity of gold bullion necessary to coin 200,000 of these memorial dollars.

Mme. Curie at Dedication of New Cryogenic Laboratory

Next in importance to the gathering at which the President presented Mme. Marie Curie with a gram of radium on behalf of the women of the United States, was the ceremony in connection with the dedication of the new Cryogenic Laboratory of the Bureau of Mines. At that ceremony Director Bain, of the Bureau of Mines, presented Mme. Curie with a carefully selected specimen of the carnotite ore typical of the ore from which the gram of radium had been extracted. Mme. Curie was also presented with a jar of the first ore taken from the Colorado deposit.

$35,000 Appropriation Approved for Non-Metallic Inquiry

Industries To Benefit Will Also Contribute Substantially—Director Bain Explains Need

An appropriation of $35,000 "for inquiries and scientific and technologic investigations concerning the mining, preparation, treatment and utilization of heavy clay products, cement, feldspar, slate, and other non-metallics," has been approved by the Appropriations Committee of the House of Representatives. This practically insures its ultimate approval. The Director of the Bureau of Mines had asked for $47,000 in order to carry on this work.

To the sum appropriated by Congress will be added a substantial fund contributed by the industries which hope to benefit from the result of this work. This study will be conducted in cooperation with the Bureau of Standards. The Bureau of Mines intends to devote its work to the mining and preparation of the materials, whereas the Bureau of Standards, which has an appropriation of its own for the purpose, will look after qualities and standardization of the finished product.

Director Bain of the Bureau of Mines appeared before the committee to explain the need for this appropriation. He said that comparatively few studies of the non-metallics have been made. He pointed out that there is a special need for research on the items covered by this appropriation. Despite the shortage of housings, and great demand for brick, he said, there had been a decrease of 35 per cent in production as compared with 1913. This is despite the fact that the price of common brick has increased in that period from $5.54 per thousand to $25 a thousand in New York. He told the committee that from 30 to 50 per cent of the cost of brick was represented by the cost of fuel. As the total value of the brick and tile output is $184,000,000 a year, great opportunity is given to reduce the costs by effecting greater efficiency in the use of fuel.

The problem in slate, Mr. Bain explained to the committee, is to utilize the waste. He believes that much of the slate which is not suitable for slabs can be utilized. The Bureau already has developed the fact that it is a valuable constituent of road surfacing materials and is also used for roofing compounds.

Mr. Bain also pointed out that there is a tendency on the part of large users of cement to erect their own plants, which create a demand for fundamental data as to the character of the raw materials.

Senate Gets Montana Resolution Urging Passage of McFadden Gold Bonus Bill

Senator Walsh presented to the Senate on May 17 a joint resolution by the Montana Legislature urging the Federal Congress to secure the immediate enactment into law of the McFadden Gold Bonus Bill. The resolution called attention to the fact that the gold-mining industry of the United States is lagging and production is shrinking. Attention was also called to the fact that the character of gold mining has changed since the coinage value of gold was fixed, more than 100 years ago. At that time gold was obtained from placer gravel and from shallow workings in rich quartz veins. Labor was cheap, long hours were in vogue and supplies inexpensive. On the other hand, the resolution points out, practically all gold today is obtained from deep mining and from low-grade deposits. The operation now requires expensive machinery and appliances, skilled labor and expensive supplies.

Senator Walsh also presented a resolution of the Montana Legislature stating that it is the sense of that body that the Federal Government should place a tariff upon the importation of chrome ores at the earliest possible moment, so as to protect the domestic producers of that ore.

Frelinghuysen Bill Would Put Coal Statistics in Department of Commerce

By proposing to transplant the division of coal statistics of the U. S. Geological Survey in the Bureau of the Census, the Frelinghuysen coal bill, now on the Senate calendar, promises to precipitate one of the major issues involved in the reorganization of the Government departments. The matter is of interest to all mineral industries. All statistics on mineral resources of the Geological Survey are obviously in the same category.

Senator Frelinghuysen's action is based on the belief that statistics as to coal production and distribution are commercial rather than scientific in character. Therefore he believes they should be placed in the statistical bureau of the Department of Commerce.

It is certain that this provision of the bill will meet with opposition on the ground that such statistics should be gathered in close co-operation with the technical men who utilize them. The point also is made that no fault has been found with the accuracy of the mineral statistics gathered by the geologists of the U. S. Geological Survey, whereas the statistics of the Bureau of Census covering technical subjects have been generally regarded as possessing little value.

NEWS BY MINING DISTRICTS

Special London Letter

Waihi Gold's Latest Report Indicates Several Years' Life Remaining—Negotiations With Soviet Government Arouse Interest

By W. A. Doman

London, May 13—Although the Waihi gold mine is not the great and valuable property it formerly was, it still apparently has several years' life ahead of it. At least the superintendent states in his latest report that the company is now assured of adequate supplies of mining timber for some years. In its early career the Waihi was regarded as one of the great investment mines of the world, and to date it has distributed over £5,000,000 in dividends and paid £646,000 in income tax, from gold and silver obtained of a value of £12,987,000. The interesting point now is the ore reserves. Owing to higher wages, shorter working hours and lowered labor efficiency, no less than 175,950 tons of ore are temporarily written off the quantity of developed reserves. The mine management calculates on a basis of [illegible] per oz. for gold and [illegible] for silver. At Dec. 31 last the ore reserves stood thus:

General
[illegible] tons assay value [illegible]
[illegible]
254,737 tons assay value 38.8/-

Total .... [illegible] tons assay value 38.73/-

[illegible] considered, it will be [illegible] cannot now be estimated, as a [illegible] proportion of it must be in the form of pillars. It will be noted, too, that the [illegible] contains the higher values. In all, the mine has about [illegible] separate reefs, the principal being the Martha, the Royal, the Edward and the Empire. Extraction is maintained at a fairly regular level. In 1918 it was 91.7 per cent, in 1919, 91.1 per cent, and last year 91.9 per cent. Recent developments have not shown a high grade of ore, apart from some small rich vein strikes. Dividends have been reduced from 1/- per quarter to 1/- per half year. The directors hope soon to return 10/- per share and write down the capital by that amount. The number of shares issued is 495,907 out of 500,000 of £1 each.

The Robinson Deep prospects are not so healthy looking as they were thought to be when the capital was rearranged at the end of 1915. By the scheme something like twenty-six annuities were provided for. It seems doubtful whether the mine will last out this period. In these deep areas money has a nasty knack of running short, and the Robinson Deep already owes the Consolidated Gold Fields and the Central Mining Corporation £150,000 each. This joint loan should be repaid at the end of next year, but a big "if" has arisen. To continue operations most profitably it will be necessary to sink a new vertical shaft further to the south, which means to a greater depth, and at an estimated cost of £290,000. There does not seem much probability of the lenders getting back their £300,000 at anything like date.

A good deal is expected within the next fortnight from the visit of M. Krassin to Moscow. The Soviet government has discovered that financiers and mining engineers are essential to the welfare of the country, and its emissary [illegible] endeavoring to negotiate an agreement. Great hopes are entertained in London that all mining and allied properties that were "nationalized" will be returned to the respective companies plus the value of the plant and machinery that was destroyed or removed. I understand that the British Government has supported the demands of the different companies. In the event of restoration and reparation the Russo-Asiatic Corporation would benefit and no long period should elapse before production of the precious and base metals is again in full swing. An estimate made of the value of the company's properties is in the neighborhood of £56,000,000

CANADA

Ontario

Iron Ore Reported Near Elk Lake

Elk Lake—A discovery of hematite iron ore has been made in Jarrow and Morel Townships in the Temiskaming district, northern Ontario, within 14 miles of the Temiskaming & Northern Ontario Ry. at Elk Lake. The ore is a massive hematite, occurring in sedimentary rocks of conglomerate and slate formation. It was discovered by Frank Westcott, of Elk Lake.

Kirkland Lake—The 18,702 tons of broken ore in the main stope of the Lake Shore at the 400-ft. level is sufficient to keep the 60-ton mill in operation for one year, it is said. The management has adopted the policy of keeping the mill going on development ore, and the ore in the stope will be kept as part of a large reserve in anticipation of an enlargement of the mill. With this object in view a second stope which will be 300 ft. long is being opened up.

Representatives of English interests have been making an examination of the claims owned by the Highland Kirkland company, about half way between Swastika and Kirkland, with a view to acquiring an interest. Some surface work has been done on the property the results of which are stated to be satisfactory.

The option held by American interests on the Kirkland Townsite has been allowed to lapse, as plans for financing the operation of the property could not be carried out. Surface work disclosed the occurrence of seven veins carrying low gold content.

Cobalt — At the Coniagas arrangements are made for the treatment of 200 to 300 tons per day of sands and slimes, in addition to about 300 tons of milling rock. The slimes are cyanided and the old sands re-ground and treated by oil flotation.

West Shining Tree—The Wasapika is said to have made financial arrangements by which sufficient funds have been secured to put the property on a producing basis with a 200-ton mill. Contracts have been made for machinery and supplies for the first of two mill units. A start will soon be made in opening up the 100 and 200 levels.

British Columbia

Decision Expected Soon in Insinger-Cunningham Case

Nelson—Justice Murphy, who presided over the recent session of the local assize court, has promised decision within a few weeks in the cases of Insinger *vs.* Cunningham and Insinger *vs.* Bank of Montreal. The litigation arose out of a lease and bond taken by Clarence Cunningham, mining operator of the Slocan, on the Hewitt and Lorna Doone group of claims, near Silverton, B. C., in 1918.

Kaslo—Leasing operations at the Whitewater mine have been temporarily suspended, because of the usual spring troubles with water underground.

Trail—Ore received at the Consolidated smelter during the week ended May 14 consisted of 8,676 tons from company's mines.

ALASKA

Alaska Treadwell Shipping Equipment To Nixon's Fork Property

One hundred tons of mill machinery was recently shipped from Treadwell, Alaska, on the steamship "Almeda" to Anchorage, where it will be transshipped to the Alaska Treadwell's new gold property near McGrath, on the Kuskokwim River. Operations are in charge of Livingston Wernicke, one of the Treadwell's engineers, who has been at work on the property for the last two years.

The Maid of Erin Mining Co. has started moving an air compressor from Haines to the Rainy Hollow district, where the claims of the company are situated. The property has been taken under bond by capitalists from Portland, Ore., who plan to do considerable development work during the summer.

The Vermont Marble Co., of Tokeen, Alaska, recently purchased the holdings of the Alaska Marble Co. at the same place. The new company will employ between 50 and 100 men in the quarry during the present season.

MEXICO

Sinaloa

Los Tajos Mine, in Badiraguato District, Being Opened Again—Sinaloa River Power Project Will Aid Mining

Badiraguato—In the vicinity of Santiago de los Caballeros, in the Badiraguato district, there is considerable activity. The Los Tajos mine, belonging to J. B. Sheppard, of Denver, Col., is under option to some California capitalists. This property has been abandoned for eleven years, and will now be cleaned out and put in condition to produce the necessary ore on which to operate a reduction works. This has been a famous producer of high-grade silver shipping ore in years past. It is opened up principally by a tunnel on the vein for about 1,700 ft. Former reports show that there is blocked out more than 20,000 tons of 50-oz. silver ore, not considering the high grade, which will run up to 1,000 oz. per ton and better. The same syndicate will operate several other properties in the same vicinity. It is planned to install a mill immediately after the rainy season, which begins in July and ends in September.

Development work on the famous San Luis Ganzaga mine, recently purchased by an Eastern syndicate, is progressing rapidly under the superintendency of E. B. Holt. A 75-ton flotation mill will be installed after the rainy season. This mine is supposed to contain large quantities of milling ore of a grade better than 30 oz. silver per ton. The property is also in the district of Badiraguato.

The Shreveport Mining & Development Co. is working actively on its properties at La Tuna in the Badiraguato district. These have records of production, but have been abandoned since the revolution began. Water power is to be used to operate the compressor and air drills. Milling machinery will be on the ground by Oct. 1.

Mocorito—The Palmarito Leasing Co., in the Mocorito district, is still sinking its three-compartment shaft to cut the vein at the 200 level. It is said to be the intention of the company to install a 500-ton mill, with a new power plant complete. This vein is about 90 ft. wide, and has indications of proving one of the biggest silver deposits in Mexico.

The Potrero Mines Co., also in the Mocorito district, has curtailed operations on account of water shortage. This is one of the few gold mines in this district and has a good gold production record.

Sinaloa—In the Sinaloa district there is a project under way for developing the water power of the Sinaloa River. The natural conditions are favorable. This river, at the point known as Bacubirito, makes a "horse-shoe" curve of about nine miles. At the mouth of the horseshoe the distance is only about 300 ft. and the vertical fall is about 130 ft. With the completion of the tunnel, it should be possible to develop several thousand horsepower, which would be a great relief to the mining industry in this state, and would undoubtedly put in operation a number of mines which are unable to operate on account of the high price of wood fuel.

Bacubirito—The placers at Bacubirito are known to contain large quantities of "place gold," and some large nuggets have been found by the natives, who wash the gravel in pans and rockers. It is stated that the parties interested in the power project will also make an exhaustive examination of the placers with a view to making them commercially profitable when worked on a large scale.

In all the mining agencies of the state great activity in denouncements is reported. Virgin properties are being denounced as well as those which were producing before the revolution. With the looked-for increase in the price of silver, it is expected that there will be a marked increase in mining activities before winter.

Coahuila

Certain Mining Agencies Closed Owing to Changes in Districts

Torreon—Recent changes have been made in the mining districts in this section. The mining agencies at Mapinni and San Juan de Guadalupe, in Durango, and those of Viesca, San Pedro and Parras, in Coahuila, have been closed. The agency at Torreon now embraces the municipalities of Torreon, Viesca, Matamoros and San Pedro in Coahuila, and Mapimi, Lerdo, San Juan de Guadalupe and San Bartelo in Durango. The agency at Concepcion del Oro, Zacatecas, embraces the municipalities of Concepcion del Oro, Sierra Hermoso, San Pedro Ocampo and Mazapil.

Saltillo—La Sultana Mining Co., failing to have a quorum at a recently called meeting, issued a second call for stockholders to meet May 22. According to Mexican laws official business can be transacted on a second call regardless of the number of stockholders present.

Sonora

The Ahumada Lead Co., of which Dr. L. D. Ricketts is president, J. C. Greenway and H. C. Dudley vice-presidents, John F. Bankered secretary-treasurer, and William D. Thornton, of New York, a director, has taken over, in the Sierra de los Lamentos, in northern Sonora, several groups of mines including the Erupcion ledge, which is said to have been explored for 1,300 ft., with 200 000 tons of high-grade lead developed, carrying 6 or 7 oz. silver. The Ahumada company, organized in Delaware, is represented south of the line by a number of Mexican corporations, but especially by the Erupcion Mining Co.

Durango

Tamazula—Walter C. Minsch is operating his silver property in the Tamazula district, and has a remarkably good showing.

ARIZONA

Night Hawk Leasing Co., at Bisbee, Strikes High-Grade Bornite Below 650 Level

Bisbee—The Night Hawk Leasing Co. has struck some high-grade bornite ore in a winze from its 650 level. The ore is on the Lone Star claim, which is a small fraction between the Night Hawk and Boras claims. It is probably a part of the sulphide orebody opened up by the Boras Leasing Co. on its 600 level. The winze is 21 ft. below the level and has so far opened up 15 ft. of solid ore. Development of this ore is being pushed as rapidly as possible. There is no doubt that it is an important discovery for the company. According to its annual report it has blocked out 10,000 tons of 12 per cent copper ore in one orebody and 5,000 tons of 8 per cent in a second body, besides a considerable amount of lower grade ore. Last year the company produced a little over 1,000,000 lb. of copper. Ore shipments were discontinued Dec. 1, but development work has been going on since then. The Boras Leasing Co. is continuing work on the 700 level. Two raises are being driven under the stopes on the 600 level.

The installation of a hoist is progressing at the Cole No. 3 shaft of the Calumet & Arizona Mining Co. The old headframe is to be replaced by a new one. The results obtained by the Boras and Night Hawk leasing companies have been so good that the C. & A. has mapped out a program of prospecting and development which will be started as soon as the installations now under way are completed.

Tombstone—The Bunker Hill Mines Co. has arranged with the El Paso smelter for the treatment of 1,000 tons per month of silver-lead and silver-manganese ore with a high percentage of lime. Several lessees that were idle will begin work again at once. The Co-operative mill will be ready to start within a week. This will give much work to miners here that have ore of too low grade to ship to El Paso.

Clifton.—Arizona Copper Co. has resolved to discontinue operations for the present in view of the accumulation of stocks and the general condition of the copper market.

Globe—Miami Copper will shut down its steam power plant this month and use hydro-electric power from the Roosevelt dam, brought by the wires that have served the Inspiration and Magma, now closed. The Roosevelt system at present has an excess of power available.

Jerome—The new Verde Central ore strike has been demonstrated to be at least 30 ft. wide and the crosscut is still faced in chalcopyrite and bornite of very good value. The drift is to be pushed onward about 200 ft., to get under a good ore showing found in the tunnel at 4,500 ft.

Dundee-Arizona is receiving machinery for its experimental leaching mill, which is to be in operation within a month. It is claimed that the process will require only five pounds of acid to each ton of carbonate ore treated.

Phoenix — Representative Carl Hayden has written from Washington that no further exemption from mining claim assessment work can be expected. He states opposition to the extension measure introduced by Senator Bursom of New Mexico has been expressed to him and to Secretary Fall and Chairman Rhodes, of the House Committee on Mines and Mining, though both favor a bill, introduced by Mr. Hayden, that changes the period for doing assessment work from the calendar to the fiscal year.

Operation of the industrial commission bill passed by the last State Legislature has been suspended, owing to submission of a suit brought by interests understood to be associated with the Arizona State Federation of Labor and with attorneys whose principal business has been prosecution of personal injury actions. Opposition also is understood to have come from accident insurance companies. The commission, already appointed by Governor Campbell, includes Herbert H. Hodgson of Morenci, L. L. Henry, of Globe, and Joseph Lord, of Phoenix, the last considered the labor representative. Each is to receive $4,000 a year. Compensation for injuries will be provided by a fund based upon an appropriation of $100,000, this to be repaid by premiums. Especially in the mining counties, most of the court business has been furnished by damage suits, which were expected to be almost eliminated under the new system.

Nogales — Luis A. Martinez, vice-president of the Sonora Bank & Trust Co., has entered suit in the Federal court, at Nogales, Sonora, for restitution of the historic Planchas de Plata mines, on the ground of failure to comply with a contract of sale.

NEW MEXICO

Octo Mining Co. Reorganized — J. H. White Takes Over Last Chance Property

Lordsburg—H. G. Green, of Colorado, and associates have taken a thirty-day option for a lease and option on the Robert E. Lee claim owned by Small and Brial.

Smith and Reynolds have given a thirty-day option on the Ruth claim to Frank G. Kaerwer. This property has been a shipper, and has a strong showing of lead-silver ore exposed in several 100 ft. shafts.

The Great Eagle mine has shipped a car of 90-mesh ground fluorspar running 98 per cent CaF_2, this being a preliminary mill-run sample from the only fluorspar mill west of the Rosiclaire-Kentucky field. Additional tables are being installed to meet the demand for high-grade ground material. The completed mill will have a capacity of 100 tons daily. J. R. Hibbs is in charge of construction.

The enlarged mill on the Co-operative silver property is running regularly and is reported to be satisfactory. The capacity has been increased to 100 tons daily. Insurance on the company store at Lordsburg, which burned several weeks ago, has been adjusted. About forty men are reported at work.

George Foreman, of Los Angeles, general manager of the Octo Mining Co., has returned from a conference with eastern stockholders. He reports that a new organization composed of old stockholders has been perfected, to be known as the Anita Copper Co., of which George Bill, of El Centro, Cal., is president. The new company holds $25,000 in notes against the Octo company, which will be taken care of. New stock will be issued for old, share for share, leaving a large block of stock in the treasury for development purposes. Work is expected to begin about July 1, and a new shaft will be sunk on the good ore showings on the east end of their ground. A new assay office will be installed.

John H. White, formerly of the Climax Molybdenum Co., of Colorado, and two associates have taken over the Last Chance silver property from Robert F. Fitz, of Los Angeles. The mine, which is opened to the 300 level, has been unwatered and sampled. Indications point to favorable returns, and a development force will be put to work soon. At present about ten men are employed. The ground will be thoroughly explored at depth, and a concentration-flotation mill installed when conditions justify. The property has a favorable record. Mr. White will remain, with Arch Storke as mine superintendent.

COLORADO

Portland To Deepen No. 2 Shaft — Vindicator Opens New Shoot

Independence—A rich ore shoot has been opened on the 2,000 level of the Vindicator. A drift has been advanced 200 ft. on a vein averaging 4 ft. in width. Selected samples assay 1,000 oz. of gold and 75 oz. of silver per ton. A large flow of water was met when the new ore shoot was opened. As soon as this is under control, the shaft will be sunk another 100 ft. and the ore shoot will be explored on the new level. The discovery has served to increase confidence in the value of deep-level development in the district.

Victor — The Portland Gold Mining Co. will sink its No. 2 shaft another 300 ft. from the present 2,450 level. This new deep-level development, for the purpose of prospecting the rich orebody now opened on the bottom level, is being watched with interest by officials of neighboring companies, and the success of this work will no doubt be the signal for resumption of shaft sinking at several other mines.

The Index mine is being developed and operated by lessees, who have opened shipping ore on the 600 level. The present hoisting equipment may be replaced in the near future by an electrically operated plant with a view to increasing capacity. J. S. Anderson is superintendent.

Gold Hill—The Victory Gold Mining Co. is operating a lease through the Howard shaft of the Mary McKinney Gold Mining Co. The ore is being shipped to the Golden Cycle mill. E. P. Arthur, Jr., is manager.

Cripple Creek — The Columbine Granite Mining Co. will develop the Sangre de Christo property on Tenderfoot Hill. David Heaton is president and Sam MacDonald superintendent.

IDAHO

Cœur d'Alene District

New Company Leases Sidney—Paragon Shaft Being Deepened

Pine Creek—The recent strike on the Sidney, practically on the surface and on a vein parallel to the one which was supposed to have been the main fissure, has attracted much attention, and a company of Kellogg business men has taken a lease upon the property for two years. The vein has been exposed by open cuts for a distance of 150 or 200 ft., showing in places 8 ft. of ore, much of it of shipping grade. The leasing company is now engaged in taking out ore from the surface, samples of which run as high as 54 per cent lead and 86 oz. of silver. Shipments will be made by auto truck to the Bunker Hill smelter.

Murray—The shaft on the Paragon, now down 60 ft., is being extended to a depth of 300 ft. Good shoots of lead-silver and zinc ore have been found in tunnel levels and on a level driven from the bottom of the present shaft, the company in past years having shipped 30 carloads of lead-silver and zinc concentrates. At a depth of 300 ft. the vein will again be opened up, and results above stated indicate an increased amount of lead. The company owns a 100-ton mill, which has been placed in good condition in anticipation of early shipments. L. W. Stedman, manager of the Paragon Consodiated Mining Co., died two weeks ago. Following his death the property was visited by F. O. Hammer, of St. Paul, secretary of the company, who announced that development plans would proceed without interruption. Control of the Paragon is owned in St. Paul.

Adair—The great crosscut being run by the Montana-Idaho Copper Co. to explore what is commonly known as the Monitor ground is expected to cut the Monitor vein in about 1,100 ft. and at a depth of 1,700 ft. This tunnel, when completed, will be about two miles long and its extension is of great advantage to the copper section around Adair, as none of the properties have been proved at depth. The Monitor ground covers the divide between Idaho and Montana. It was developed years ago by a shaft started practically on the summit and which was extended to a depth of 700 ft. Ore was taken from the various levels, hauled seven miles to Saltese and shipped with profit. The showing of ore on the lowest level is reported to be fully as good or better than that in the upper levels. It is to tap this orebody that this long tunnel is being run.

MONTANA

Butte District

Butte & Plutus Cuts Norwich Vein on 400 Level—Part of Timber Butte Mill May Be Reopened

Butte—More attention than heretofore is being given to silver mining by the Anaconda Copper Mining Co., particluarly in the western part of the Butte district, a section at one time the principal producer of the metal. The company is now crosscutting on the 600 level of the Nettie mine for the Burlington vein, a large fissure which has outcroppings about 50 ft. wide.

Operations have been resmued at the Nettie. It would occasion no surprise were the Anaconda to resume the mining of silver ore at the Emma mine, as this property has been kept free of water and a considerable tonnage of silver-zinc ore is available for immediate mining.

Butte & Plutus has cut the Norwich vein on the 400 level about 325 ft. north of the station, disclosing from 6 to 7 ft. of 12-oz. silver ore. This ore body will be drifted upon and further crosscutting will be done.

A hoisting plant and air compressor are to be installed soon at the West Butte Mining Co. property in the western part of the Butte district. A power line will be built. Pittsburgh capital is behind the project, this being a recently organized corporation.

Churn drilling is being used by East Butte in an effort to determine the thickness of quicksands in a portion of the company's property through which it is planned to raise to the surface. The new shaft will serve to lessen materially the distance through which it is necessary to crosscut before the orebodies are reached.

Little is being done by North Butte aside from keeping the mine workings in repair and some development work. Drifting is in progress on the Edith May vein on its deeper levels, with the results said to be satisfactory.

It is expected that a portion of the Timber-Butte Milling Co.'s concentrator, where the Elm Orlu's ores are treated, will be reopened in consequence of the development of a good tonnage of 20-oz. silver ore on and above the 800 level.

NEVADA

Tonopah Operators Attempting To Break Strike—Rochester Silver Corporation's Men Return

Tonopah — Strike conditions in the Tonopah and Divide districts remain unchanged so far as getting together of employer and employee is concerned. The companies are now importing men to take the places of the strikers. On May 9 about fifty men came in on the train, but none remained to work. The men were met at the train by several hundred strikers and persuaded that conditions had been misrepresented to them by the employment agencies. Automobiles were loaned or rented, and practically all the men started on the return trip to the place from whence they came or desired to go. On May 14 another delegation of about fifty men were brought in via train, and being more carefully guarded than previously against the abusive and persuasive tongues of the strikers, a fair proportion of them were retained and started to work May 16 at the Tonopah Extension. More men are to be imported, and a determined effort is to be made to break the strike. There is no indication of a possible compromise, as is evidenced by the tone of the reply by the operators to a letter addressed to them on May 16 by an association of the business men of Tonopah, the letter urging the operators to adjust their differences with their former employees for the welfare of the community as a whole. The reply was "that the operators can make no recession from the scale of wages offered, and that the effort to bring in men to operate the mines will be continued. If by reason of intimidation or lack of protection this effort fails, the operators will be convinced that the community does not desire the properties opened, and they will be indefinitely closed down."

This, it is said, leaves no room for argument as to the present state of mind of the operators, although it is quite generally conceded by the public that a compromise by wage reduction of 50c., instead of the 75c., per day could be effected. If this be true, the condition exists that for the sake of 25c. per day 800 men are losing at the rate of $120,000 per month in wages, and the companies about the same amount in strike expenses and loss in earnings. This would indicate that despite the apparent prevalent disregard for the value of money, the two-bit piece still holds a prominent place in local popular estimation.

A few of the smaller companies are doing limited work by contract. West End continues to operate normally, mine production being 200 tons per day. The last bullion shipment by this company, representing the result of operations for the latter half of April, was $70,000. Work has been resumed by the West End in Tonopah "76" ground. Crosscutting is being done on the 800 level in favorable formation.

Many small properties are working in the Divide district, with no new developments of importance reported.

Klondyke—The Knox Divide, on May 6, made the third payment, amounting to $10,000, on the Golden State group of claims in this district. The last payment is due in August of this year. The Knox Divide took over the Golden State group on a bond and lease in May, 1920, and during the last several months has been shipping about 500 tons of ore per month to the Desert mill at Millers. A considerable tonnage of broken ore has accumulated in the stopes since the labor strike closed the custom mills at Tonopah and Millers. The condition of the mine is said to be good, development work being done on a fissure vein in lime.

Lessees are working in the Original Klondyke mine. The Ben Hur Divide is drifting on a vein on the 70 level, its property being between the Knox and the Original Klondyke properties.

Pioche—The Telephone mine of the Amalgamated Pioche Mines & Smelters Corporation has been leased to Tony Mitsoff, and work has been started on the property.

Rochester—On May 11 the employees of the Rochester Silver Corporation returned to work, after having been on strike for less than two weeks against a 50c. reduction in wages. At a second meeting the men voted unanimously to return, basing the decision on present economic conditions. This brings the Rochester scale of wages 25c. above the Tonopah reduced scale.

Round Mountain—The Round Mountain Mining Co., employing about fifty men at its hydraulic placer mine at Round Mountain, about sixty-five miles north of Tonopah, is having a prosperous season. There is more water available this year than usual, which means a longer operating period. A new and possibly valuable vein has recently been uncovered by placer operations. It is estimated that at present rate of operation it will require fifteen years to work out the proved placer ground belonging to the company.

Nevada Hills—It is reported that the old Nevada Hills mine, near Fairview, is to be reorganized by Reno people, recent geological investigations having disclosed a possible continuation of the rich orebodies which were faulted and lost.

JOPLIN-MIAMI DISTRICT

Missouri-Kansas-Oklahoma

American Metal Co.'s First Year's Operations Successful

Success of the American Metal Co.'s mining operations in the Joplin-Miami zinc and lead district is apparently assured, for although the initial drainage cost on the leases developed by its subsidiary, the Chanute Spelter Co., west of Baxter Springs, Kan., was large, the results of the first year's operations were particularly satisfactory.

Production at the company's Hartley mine, above mentioned, was begun April 14, 1920, and on April 14, 1921, a recapitulation of the year's work showed the following:

Dirt mined and milled, tons....	115,700
Zinc concentrates	[illegible]
Lead concentrates	[illegible]
Total concentrates	[illegible]
Percentage of concentration....	17.3
Prospect drifting during year, ft.	[illegible]
Prospect drilling during year, ft.	[illegible]
Average cost per mill ton	[illegible]

It is further stated that the average depth of the orebody mined was [illegible] and the height from 25 to 70 ft. The total length of the stopes opened was [illegible] ft., and the total area of land mined was 1.1 acres.

It is estimated by the officials of the company that [illegible] in five years of work [illegible] has already been blocked out for this mine, with excellent possibility of [illegible] more development later. One of the orebodies developed by drilling during the year is approximately half a mile from the mill, but the plan at present is to have the dirt run over this plant.

The Chanute company is now moving the Velie Panther mill, formerly near Tar River, Okla., to what is known as the Brewster lease, a short distance to the northeast of the Hartley mine. It is expected this mill will be ready for operation about Aug. 1. The company itself is handling the construction work.

D. F. Haley is general manager for the Chanute company, with G. B. Corless, assistant manager, and T. J. Rightly, superintendent.

WASHINGTON

Hearst-Chichagof Company Seeks Permit To Erect Dam

Seattle—The Hearst-Chichagof Mining Co., 316 First Avenue South, Seattle, has filed application with the Federal Power Commission for permission to erect a dam 34 ft. high and 100 ft. long at the outlet of an unnamed lake, and 36-in. wood-stave pipe 1,800 ft. long to a power house at the head of Didrickson Bay, Chichagof Island, Alaska.

MICHIGAN

Marquette Range

Surface Water Shuts Down Barnes-Hecker Mine—Few Properties Shipping

Ishpeming—Water from two small ponds has been finding its way into the Barnes-Hecker mine. A drainage ditch is being dug to divert it from the ponds into one of the rivers flowing to Lake Superior. It has been impossible to carry on mining work, because the pumps could not handle the heavy flow.

Only a few of the mines on the Marquette Range are shipping ore to the docks. These are sending out the daily hoist. Shovel work has started at but one property. The independents are awaiting orders from their sales departments, with 1921 prices unannounced as yet.

The valuation of the mines on the Marquette Range has been placed at $35,831,000 for 1921, as compared with $33,252,000 for 1920. The total valuation of the three Michigan ranges for 1921 is $117,694,708, as against $113,945,439 last year, the Marquette Range bearing the greatest part of the increase. The state tax commission recently completed hearings on all of the iron ranges in Michigan and the operators were given the opportunity to present their grievances.

Menominee Range

Air Line from Quinnesec Falls to Chapin Mine Damaged by Dynamite

Iron Mountain—The Oliver Iron Mining Co. is making shipments from the Chapin, at Iron Mountain; the Aragon, at Norway, and the Delta, at Iron River. All the ore is going to the Escanaba docks. Thus far the corporation is the only operator making regular shipments. It is unlikely that the Clifford and Munro pits will be operated at all during 1921.

Unknown persons tried recently to hamper operations at the Chapin mine by blowing up the 24-in. pipe line which carries air from Quinnesec Falls to the mine, and they partly succeeded. Two great holes were torn in the pipe by dynamite, cutting off the mine's supply of air, and it was impossible to operate the hoist, compressors or drills until the damage was repaired. One skip broke away, there being no air for the brakes, and dropped until it had pulled an empty skip into the headframe. The company laid off a number of men a few weeks ago, and it is thought that someone who was let go set the charge.

The assessed valuation of the Menominee Range mines, exclusive of the two operating properties on the Wisconsin side, has been placed at $32,938,000 for 1921, as compared with $32,550,000 in 1920.

MINNESOTA

Mesabi Range

Mesabi Iron Co.'s Temporary Power Plant Destroyed by Fire

Babbitt—The temporary power plant of the Mesabi Iron Co. was recently destroyed by fire, which will delay the final completion of the first unit of the concentrator. At present this is approximately 80 per cent completed, but it is feared that, owing to this accident and to the failure of some of the machinery to arrive, it will be impossible to complete the plant for operation until the next shipping season.

Virginia—Plans have been made and some machinery has been installed for dewatering the Lincoln mine, a property of the Interstate Iron Co., which was flooded owing to an accident to the pumping system. The present temporary equipment will be electrically driven.

Ely—The development at the La Rue mine has progressed to such a point that a spur track of five miles is being built from the Duluth & Iron Range R.R. to the property. It is expected that the mine will be operating and shipping in the near future.

Nashwauk—The Hawkins mine, operated by the Wisconsin Steel Co., again started operation last week. The present plans also include the shipping of the stockpile, which is being forwarded daily.

KENTUCKY

Kyva Ferromanganese Corporation Resumes Operations

Winchester—The Kyva Ferromanganese Corporation, of Winchester, has resumed making ferrosilicon, spiegeleisen and ferromanganese at the 10-ton electric furnace recently taken over, which is at Cleveland, Tenn. It is planned to enlarge this furnace. According to its letterhead, the company has mines at Seven Mile Ford, Va.

THE MARKET REPORT

Daily Prices of Metals

May	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
19	12.75@13.00	31.875	32.875	5.00	4.85	4.80@4.85
20	12.75@13.00	32.25	33.25	5.00	4.80	4.80@4.85
21	13.00	32.00	33.00	5.00	4.80	4.80
23	13.00	31.75	32.75	5.00	4.75	4.80
24	13.00@13.25	31.25	32.25	5.00	4.75	4.75
25	13.00@13.25	31.375	32.25	5.00	4.75	4.75

*These prices correspond to the following quotations for copper, "delivered": 13@13.25c. for May 19 and 20; 13.25c. for May 21 and 23; 13.25@13.50c. for May 24 and 25.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

May	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
19	74⅞	74⅜	75	181¼	182¼	24⅜	24½	28	28¾
20	75¼	74⅞	76	183¼	183½	24½	24½	28¼	28¾
21	...	...	...	....	....	..	..	..	..
23	75½	75¼	76	184	184½	24⅜	24⅜	28	28½
24	74	74	76	181	181½	24	23⅞	27¾	28
25	74¾	74½	76	182	182¼	24⅛	23⅞	28	28⅜

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

May	Sterling Exchange	Silver New York, Domestic Origin	Silver New York, Foreign Origin	Silver London	May	Sterling Exchange	Silver New York, Domestic Origin	Silver New York, Foreign Origin	Silver London
19	400	99¼	58¼	33¼	23	397	99¼	58⅛	33⅞
20	399½	99¼	58⅜	33⅛	24	393¾	99¼	58	33⅜
21	396	99¼	58⅝	33¼	25	396	99¼	58⅛	33¼

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, May 25, 1921

The last week has been marked by exactly the same tendencies which characterized the market during the preceding week; namely, increasing firmness in the price of copper and easier tendencies for lead and zinc. Tin, as usual, has closely followed London. Domestic demand from consumers of all these metals is exceedingly small.

Copper

The larger producers are confident of higher prices, and are holding their metal at premiums of ⅛@¼c. over the prices at which most of the small sales have taken place. Today they are unconcerned sellers for June delivery at 13.50c., delivered. Some of the smaller interests have let a little metal go at the prices which we quote, but the business has been of small volume. Today, a small amount of spot copper could probably be had at 13.25c. delivered, June at 13.25@13.37c., and July at 13.50c. It is difficult to buy forward copper. The only reason for selling copper at present prices is to raise cash, and the sale of forward metal does not do this.

Export demand continues of fair volume at correspondingly advancing prices. France, Germany, and Japan continue the chief buyers through the Copper Export Association, but English dealers are also buying through outside agencies. It is understood that the price is now 13.75c., c.i.f. European ports. Some commotion has been caused in the London market by the reported attempt of American interests to corner the market for spot standard, London metal dealers seeming to feel that Americans should confine their efforts to producing the metal, and allow them the privilege of manipulating the prices. The New York Metal Exchange is seeking to broaden its copper market by instituting a new and more attractive form of contract.

Lead

The A. S. & R. official contract price of lead continues at 5c., New York and St. Louis, and no immediate change is expected.

Practically no lead has been sold on a New York basis during the last week, and not for some time has the market here been so quiet. Consumers seem to have provided for practically all of their June requirements during the recent buying movement. One lot of 1,000 tons was sold to an out-of-town consumer for delivery beginning next month at a slight advance over the price which we quote, but this business was exceptional. In St. Louis there has been an active selling campaign, but it has not resulted in many sales—only in reducing prices. A firm bid of 4.70c. either today or yesterday would doubtless have been accepted, but we heard of no business being done at that figure. Although the market has been inactive, further recessions in the price are hardly to be expected, as the relation of production to consumption, and present costs, do not warrant prices even as low as those now quoted. In the last two or three days there have been some inquiries from Middle-Western consumers, and also from Europe and South America. Foreign orders, however, are likely to go to Spanish producers.

Zinc

An overanxiety on the part of some producers in a market that is particularly unreceptive of virgin zinc has succeeded in reducing the quotations to 4.75c., East St. Louis. The larger producers are not pressing their metal on the market at these prices, an attitude they have maintained since the price first dropped from 5c. a few weeks ago. High-grade zinc has been selling at 6.50@6.75c. per lb., delivered.

Tin

The tin market continues of little interest. Most of the sales of Straits have been of a speculative nature. Lower grades have been bought in small volume by a few consumers, but the business is generally quiet. Some metal is finding its way into high-grade solders and babbitts, the demand for which is said to be satisfactory when judged by pre-war standards. Tin for forward delivery is quoted at the same price as for spot. Electrolytic is quiet at slight concessions over Straits.

Arrivals of tin, in long tons: May 18, London, 50; May 19, Straits, 50; May 23, Liverpool, 200.

Gold

Gold in London: May 19th, 102s. 8d.; 20th, 102s. 8d.; 23d, 103s.; 24th, 104s. 2d.; 25th, 103s. 4d.

Foreign Exchange

On Thursday, May 19, sterling reached $4, the highest figure since April 6, 1920, when the post-war advance culminated at $4.03¾. On Monday, a bad break occurred, probably owing to speculative manipulation, and yesterday sterling sold as low as $3.925, but recovered later. On Tuesday, May 24, francs were 8.55c.; lire, 5.46c.; and marks, 1.64c. Canadian exchange in New York, 10⅝ per cent discount. (Holiday in Montreal.)

Silver

The market has been influenced by selling by China and the Continent, the sharp fall in sterling exchange, and covering for bear account against exchange operations. There are no important buyers in sight, India demand being small and China still lifeless. On the other hand, supplies in this market continue only moderate, with no pressure to sell, so that tendency of the market is uncertain. A shipment of 200,000 oz. was received in New York this week from Germany, which is unusual, and was caused by tax on German imports to England, where the silver is ordinarily sold. Purchases of domestic silver under the Pittman Act amount to 55,425,697 oz. to May 24th.

Mexican Dollars—May 19th, 45; 20th, 44⅞; 21st, 45; 23d, 45¼; 24th, 44½; 25th, 44½.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 22@23c. per lb.; 22½c. for imports, duty paid. Metal being imported in anticipation of a higher tariff.

Antimony—Chinese and Japanese brands, 5¼c.; market dull. W.C.C. brand, [illegible] per lb. Cookson's "C" grade, spot, 9⅞c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony (200 mesh), nominal at [illegible] per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, [illegible]

Bismuth—[illegible] per lb., 500 lb. lots.

Cadmium—Range $1@$1.10 per lb., in [illegible] lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $4 per lb.; black oxide, [illegible]@$1.10 per lb. in bbls.; sulphate, $1.[illegible] per lb. in bbls.

Iridium—Nominal, $250@$300 per oz.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—$72@$75 per oz.

Quicksilver—Nominally, $46@$48 per 75-lb. flask. San Francisco wires $48.50. Prices are considerably below import parity and represent quotations on liquidation lots.

[1]**Rhodium**—$150 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 45@55c. per long ton unit, f.o.b. Atlantic ports.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $7.45; Mesabi bessemer, 55 per cent iron, $7.20; Old Range non-bessemer, 51½ per cent iron, $6.70; Mesabi non-bessemer, 51½ per cent iron, $6.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5.80; old bed concentrates, 63 per cent, $6.70; Harmony, cobbed, 63 per cent, $6.70; new bed low phosphorus, 65 per cent, $9.50.

Manganese Ore — 25c. per unit, seaport; chemical ore (MnO_2) $55@$60 per gross ton, lump; $70@$75 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¾@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

Zirkite—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., May 21—Zinc blende, per ton, high, $26.25; basis 60 per cent zinc, premium, $23.50; Prime Western, $22.50; fines and slimes, $20@$17.50; average settling price, all grades of zinc, $24.10.

Lead, high, $64.70; basis 80 per cent lead, $60@$55; average settling prices, all grades of lead, $59.40 per ton.

Shipments for the week: Blende, 6,564; lead, 1,062 tons. Value, all ores the week, $221,310.

The establishment of a freight differential of 80c. per ton, with a haulage differential of 20c. per ton, in favor of the Waco area against the Oklahoma-Kansas area, admits the payment of $1 higher basis price for Waco ore. As all demand for blende for zinc-rolling purposes is temporarily abandoned, ore quotations may be accepted as premium referring to Waco price and Prime Western as referring to Oklahoma-Kansas price for the present. The basis price of lead was dropped $5 and of zinc ore $2.50 this week.

Platteville, Wis., May 21—Lead ore, basis 80 per cent lead, $55@$58 per ton base. No sales or shipments of finished blende. Shipments for the week: Lead ore, 80 tons. Shipments for the year: Blende, 11,461; lead ore, 830 tons. Shipped during the week to separating plans, 495 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $2,000@$3,000; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7 per long ton, f.o.b. Cartersville, Ga. Small lots as low as $5.

Bauxite—High-grade French bauxite, $8@$10 per ton, Atlantic ports. American quotation the same. Consumers generally well supplied. Prices vary according to grade. Crude, unground, $16.50 per ton; ground, $22; calcined, ground $35; unground, $45, f.o.b. plant.

Chalk—English, extra light, 5@5½c. Domestic light, 4½@5c.; heavy, 4@4½c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$10; washed, $10@$12; powdered, $15@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $15@$20, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $15@$25, f.o.b. American ports; powdered, $35@$45, f.o.b. New York.

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c. f.o.b. New England points.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$25 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $15, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $32, New Mexico, Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 7@7½c. per lb.; chip, 5½@6c.; dust, 3¼@4c. No. 1 flake, 6½c.; amorphous crude, ¾c.@2¼c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$2 per net ton; 1½ in., $1.50@$2. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead - Burned — $38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica. slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

[1] **Monazite** — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $6.75; 68 per cent, $6.25; 68@66 per cent, $6.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 14c., c.i.f. Atlantic seaport; furnace size, 14c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 12 @ 14c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$40, talcum powder grade. Southern talc, powdered, carload lots, $10@$14 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic — White arsenic, 7½c. per lb. in carload lots.

Sodium Nitrate—$2.75@$3 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $18@$20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; $33@$35 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.50@$1.75 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 15c. per lb. of chromium contained; 4 to 6 per cent carbon, 16@17c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $80@$85, f.o.b. furnace; resale, $90, delivered; English, $75, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $30@$32, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $50@$55; 50 per cent, $80@$85; 75 per cent, $145@$150.

Ferrotungsten—Domestic, 70 to 80 per cent W, 50@55c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$5@$6 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 20½@20¾c. per lb.; wire, 15c.

Lead Sheets—Full lead sheets, 8.25c.; cut lead sheets, 8½c. in quantity, mill lots.

Nickel Silver — 31½c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets, 17¼c.; sheathing, 16¼c.; rods, ⅝ to 3 in., 14¼c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina, $35@$50 per ton, f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $75 per net ton, shipping point; arches, keys, wedges, $80; splits, soaps, $90.

Fire Brick—First quality, 9-in. shapes, $40@$50 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $35@$40.

Magnesite Brick—9-in. straights, $90@$95 per net ton; 9-in. arches, wedges and keys, $100; soaps and splits, $110.

Silica Brick—9-in., per 1,000: $45@$55 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, May 24, 1921

The demand for steel has not improved during the last week, and has, if anything, grown a shade lighter. There is buying, but it is only in small lots and for prompt shipment. The Steel Corporation's specifications against contracts are fair, and it is booking a little prompt business besides. The business of independents is almost entirely in new orders. The steel industry as a whole is hardly operating at as much as 30 per cent of capacity, which means about the same tonnage as the full operation of 1902, nineteen years ago.

Fabricated steel business let in April amounted to 31 per cent of the fabricating capacity, the highest percentage shown since last September. The steel demand of the automobile industry is tapering off somewhat. Tin plate demand is phenomenally poor for the season of year.

Steel prices are steady at the levels reached about the middle of April. Orders are small and there is no incentive to cut. Lower prices seem unlikely until the mills can secure a much heavier and more economical operation by reducing prices.

Pig Iron—Extreme dullness continues to characterize the market. Scarcely any merchant iron is being made, yet furnace stocks decrease slowly. Prices remain at $24 for bessemer, $22 for basic, and $23.50 for foundry, f.o.b. Valley furnaces, with $1.96 freight to Pittsburgh.

Coke

Connellsville—Furnace, $3.25@$3.75; foundry, $4.50@$5.

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[1] Foote Mineral Co., Philadelphia, Pa.

A Year of Pittman Act Silver Repurchases

Treasury Buying of the Metal Indicates Decline in Production—Period of Repurchases Therefore Likely To Be Extended—British Government Repaying Silver Loan—Entire Indebtedness To Be Discharged by 1924—Silver Certificates Appearing in Circulation

EDITORIAL MARKET STUDY

ONE YEAR of repurchases of silver under the Pittman Act has passed, and during that period total purchases of 53,500,000 oz. have been made. May 13, 1921, the first anniversary, marks off about one-quarter of the total repurchases to be made—207,000,000 oz. Besides indicating the rate of sales to the Government, the figure is an accurate index of the production for the year ending the middle of May. It shows a sharp drop, being smaller than for any year since 1908, when 52,440,000 oz. was produced. Peak production occurred during the war, in 1915, and according to the U. S. Geological Survey amounted to 74.961,075 oz.; thereafter, production steadily declined.

If 143,500,000 oz. remain to be purchased, it would appear that this amount can be taken up in less than three years, assuming that silver production will continue at the same rate as in 1920—53,500,000 oz. The rate will be greatly modified, however, because of recent developments in the mining industry indirectly affecting silver production; i.e., the drastic curtailment in copper production and the tendency toward lower production in the lead and zinc industries. The modification this will have upon the duration of the repurchases of the Pittman Act can be roughly estimated from statistical data.

Heavy Decline in Silver Production Probable

In general, about 30 per cent of the silver produced in the United States is derived from dry siliceous silver ores and placer operations, about 30 per cent comes from copper ores, 25 per cent from lead ores, and the remainder, 15 per cent, from complex ores such as lead-zinc-copper ores. Copper production will soon be but a fraction of its 1920 output, say 25 per cent; lead production, particularly in the Rocky Mountain region, has been appreciably curtailed; zinc production is but a fraction of normal, but its decline is not as important to by-product silver production as in the copper and lead industries. Silver mines working strictly silver or gold-silver ores will, no doubt, operate full blast.

With these assumptions, the following distribution of the source of 1920 silver production and an estimate of the probable effect of mining conditions on production in 1921 may be made:

[illegible]

[illegible]	1920	1921
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	13,375,000	11,330,000
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible] heavy decrease in Pittman Act purchases during the current year, which will have the effect, should the depression in non-ferrous metal mining continue, of extending the duration [illegible] tend well into the fifth year.

[illegible] Co., the Hecla Mining Co., the Tintic Standard Mining Co., [illegible] Tonopah Belmont Development Co., and the Bunker Hill & Sullivan Mining Co. Most of these companies, as is well known, are lead mines and are steadily producing. Of the two most important exceptions, the Anaconda and Butte & Superior (the former the premier silver producer in 1920) produced 13,748,000 oz. of silver from its manifold operations in copper, lead, and zinc. The present rate of metal production means a reduction of at least 9,500,000 oz. in annual production. Butte & Superior's complete curtailment has withdrawn about 2,500,000 oz. annually.

England's Silver Payments

On May 15, 1921, Great Britain paid an installment on the silver loan, made by the United States Government, the financial machinery which enabled the Pittman Act silver to be purchased in 1918. A total of 270,121,554 silver dollars was melted under the act, of which $11,000,000 was used for subsidiary silver coinage, leaving a net melting of $259,121,554 containing 200,414,327 oz. of silver, worth $200,414,327. This figure represents approximately the total purchases of Treasury silver by the British government.

Regardless of the exact amount of the purchases of Great Britain, $122,017,633.57 was held, until recently, by the Treasury Department, to be the amount still due the United States Government. Of this sum, $17,633.57 has been paid with interest. On the remainder, $122,000,000, the British government has made two payments, one on April 15, 1921, and the other on May 15, 1921. The first payment was the interest accrued on 60 per cent of the indebtedness from April 15, 1919, and the other the interest on 40 per cent from May 15, 1919, at the rate of 5 per cent per annum. Interest payments are to be made on each 15th of October, November, April, and May, 1922, 1923, and 1924 on the same basis, calculated on the unpaid balance.

In addition to the payments of interest, the principal is to be paid in equal annual installments in 1921, 1922, 1923, and 1924 in the proportions of 60 per cent on April 15 and 40 per cent on May 15 of each year.

The two payments referred to above totaled $42,700,000; $25,620,000 of this amount represents the payment on April 15 and the remainder, $17,080,000, the payment on May 15 last.

Distributed according to the scheme of discharging the debt, the two payments made and other payments to be made in the next twelve months analyze as follows:

[illegible] LOAN PAYMENTS

[illegible]

Date of Payment	Basis	Principal	Interest	Total
[illegible]	[illegible]	[illegible]	$7,320,000	$25,620,000
[illegible]	[illegible]	[illegible]	4,880,000	17,080,000
[illegible]	[illegible]	[illegible]	1,372,500	1,372,500
[illegible]	[illegible]	[illegible]	915,000	915,000
[illegible]	[illegible]	[illegible]	1,372,500	19,672,500
[illegible]	[illegible]	[illegible]	915,000	13,115,000

[illegible]

The scheme provides for the [illegible] discharge of the silver debt with interest, and [illegible] of any negotiations for funding the British [illegible] to the United States of approximately $5,000,000,000.

One of the [illegible] effects of the [illegible] of the Pittman Act [illegible] is the reappearance in circulation of crisp silver certificates [illegible] melted and shipped abroad in 1918 and 1919, silver certificates were retired and their place taken by Federal Reserve Bank notes [illegible] currency. They are [illegible] of the process [illegible] from circulation.

Company Reports

Bunker Hill & Sullivan Surplus Increased

A report of operations of Bunker Hill & Sullivan Mining & Concentrating Co. for 1920 states that 71,071,988 lb. of lead and 1,194,478 oz. of silver was produced, at a cost of $0.0573 per lb. of lead. Operating statement follows:

Debits:		
Production costs (of 96,489.37 tons mill product)		
Mining—409,986 tons mined		$1,307,587 43
Milling—West Mill—415,257 tons mine ore.....	$348,535 17	
Sweeney Mill, 107,850 tons tailings	61,037 84	409,573 01
Shipping expense—97,269.77 tons concentrates shipped		27,859.73
Smelting costs		
Freight and treatment, and lead and silver discounts		2,328,164 49
South Mill expense.....................		7,506 63
North Mill experimental...............		19,336 89
Mine examinations.....................		191,910.03
North and South mills—fire losses.........		55,550.42
Interest paid on bank loans......................		4,151.84
Net loss on reserve bonds sold		261,851 79
Worthless accounts charged off		574 40
		$4,614,066 66
Add: B. H. Smelter—Net operating loss after depreciation		246,744 65
Credits:		4,860 811 31
Bullion:		
Gross lead and silver value of product shipped	$7,058,394 08	
Less concentrates inventory adjustment at cost	17,526 40	$7,040 867 68
Royalties on lessees' ore................................		69,226 74
Net rentals and profit on light dept.......................		19,226 88
Dividends:		
From Caledonia Mining Co..............	$104,648 00	
From Sierra Nevada Cons. Mining Co.....	19,273 48	123,921 48
Interest:		
On Kellogg loans........................	$3,424 81	
On bonds and other reserve securities......	105,345 67	108,770 48
		$7,362,013 26
		4,860,811 31

Analysis of Surplus

Normal surplus:			
Balance Dec. 31, 1919..............................			$7,387,580 03
Net operating surplus for 1920 before depletion...		$2,501,201.95	
Less income:			
Proportion of 1920 depletion..	$120,891.02		
Accrued income taxes of 1920.	94,585.32	215,476.34	2,285,725 61
			$9,673,305 64
Deduct dividends paid in 1920.			1,962,000 00
Balance Dec. 31, 1920..................			$7,711,305.64
Revaluation surplus			
Balance Dec. 31, 1919, per annual report.			$36,999,332 10
Less proportion of 1920 depletion.........			1,238,458 56
Balance Dec. 31, 1920..................................			$35,760,873 54
			$43,472,179.18

Quincy Mining Shows Deficit

A report of operations of the Quincy Mining Co. for 1920 shows a deficit of $530,741, compared with a net income of $416,597 in 1919. Income account follows:

Production, 19,216,070 lb. of refined copper sold for............		$3,125,733.32
Profit on silver..		84,379 33
		$3,210,112.65
Mining expense..............................	$2,593,695 81	
Opening mine expense	282,955 71	
Taxes paid in Michigan.....................	114,516.66	
Capital stock tax..........................	6,990 00	
Smelting, transportation, etc................	430,440 38	$3,428,598 56
Deficit..		$218,485 91
Interest receipts..........................	$22,492 76	
Sales of real estate, Hancock, Michigan.......	2,942 00	25,434 76
		$193,051 15
Construction	$307,690 17	
Accident account..........................	30,000.00	$337,690 17
Deficit..		$530,741 32

Depreciation charges of $265,141.33 and depletion of $494,925 are not included in the above statement.

Balance Jan. 1, 1920, was $2,520,006.74; deducting deficit of $530,741.32 gave $1,989,265.42; deducting a dividend of $110,000 gives $1,879,265.42 as balance Jan. 1, 1921. Capitalization, 110,000 shares, par $25.

Magma 1920 Net Income $0.43 per Share

A report of operations of Magma Copper Co. for 1920 states that 8,854,917 lb. of copper, 303,258 oz. of silver and 4,437 oz. of gold were produced, at a cost of 18.295c. per lb. of refined copper, exclusive of depletion, but including all charges and credits. A total of 9,632,685 lb. of copper was sold at 18.022c. per lb.; and 7,152,119 lb. was on hand at the end of the year. Income account follows:

Sales of copper, silver and gold		$2,215,623 47
Add: Increase in inventory of metals		155,485 45
		$2,371,108 92
Deduct: Refined copper purchased		6,552 41
Total production of metals...		$2,364,556.51
Cost of production:		
Mine and mill operations:		
Labor and material, etc	$1,295,347 77	
Depreciation...........	147,890 70	
	$1,443,238.47	
Freight on ore to smelter....	147,494 23	
Smelting and converting.....	291,814.10	
Refining and freight on blister to refinery	167,173.80	2,049,720.60
Gross profit..............................		$314,835 91
General expenses		
Selling commission and freight.............	$48,478 71	
Administration expenses..................	62,690 09	
Expenses in connection with patent litigation.	48,410 93	159,579.73
Net profit.		$155,256 18
Addition to income		
Interest and discount earned		10,971.66
Gross income		$166,227.84
Deductions from income		
Loss on sale of Liberty Loan bonds	$53,649 43	
Corporate taxes	5,122 00	
Interest paid......................	4,910.92	63,682.35
Net income		$102,545.49

Surplus Jan. 1, 1920, was $1,627,894.14, and adding net income of $102,545.49 gave surplus Dec. 31, 1920, of $1,730,439.63. Capitalization, 240,000 shares of $5 par. Net income in 1919 was $178,077, or 78c. per share.

Plymouth Consolidated Pays Small Dividend

A report of operations of the Plymouth Consolidated Gold Mines, Ltd. (British), for 1920 states that 28,294.7 oz. of gold and 6,556.2 oz. of silver, having a total value of £121,799 9s., was produced from 91,350 tons of ore milled. Profit and loss account follows:

	£	s.	d.	£	s.	d.
Working expenses, California:						
Development......................	16,884	5	8			
Mining............................	61,889	17	11			
Milling...........................	14,520	11	5			
Realization of bullion and concentrates	6,344	11	10			
Maintenance, and general expenses ...	10,974	13	1			
Total.				110,613	19	11
General expenses, London...............				1,977	16	9
American taxes				2,352	11	3
Depreciation of machinery, plant and buildings..........................				3,501	0	11
Depreciation of war loan, Liberty loan, etc.				3,936	16	3
Balance, profit.				2,358	3	1
				£124,740	8	2
Sales of bullion and concentrates.				121,799	9	2
Rents				593	16	7
Difference on exchange				1,329	1	6
Interest......................				998	3	5
Transfer fees...................				19	17	6
				£124,740	8	2

APPROPRIATION ACCOUNT

Debit	£	s.	d.	Credit	£	s.	d.
Income tax.......	2,816	1	5	Balance, as at Dec. 31, 1919	13,156	13	8
Directors' percentage of profits	60			Profit and loss account:			
Dividend paid: 1s per share March 31, 1920	12,000			Balance as per above	2,358	3	1
Balance carried forward............	638	15	4				
	£15,514	16	9		£15,514	16	9

A 1s. dividend was paid on the 240,000 shares of £1 par outstanding.

MINING STOCKS

Week Ended May 21, 1921

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Adventure	Boston			*50		
Ahmeek	Boston	52	51	52	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	[illegible]	[illegible]	[illegible]		
Allouez	Boston	22	22	22	Mar. '19	1.00
Anaconda	New York	43⅛	41¼	41¾	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2⅝	2½	2		
Ariz. Com'l	Boston	9¼	9	9¼	Oct. '18,	.50
Big Ledge	N. Y. Curb	5/16	¼	5/16		
Bingham Mines	Boston	...	....	10¼	Sept. '19, Q	.25
Calumet & Arizona	**Boston**	52¼	51	51¾	Mar. '21, Q	.50
Calumet & Hecla	**Boston**	256	253	255	June '20, Q	5.00
Canada Copper	N. Y. Curb	....	....	*13		
Centennial	Boston	....	....	10	Dec. '18, SA	1.00
Cerro de Pasco	New York	31	29	29	Mar. '21, Q	.50
Chile Copper	New York	12¾	11⅞	12¼		
Chino	**New York**	27⅛	25⅝	26¼	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*28	*27¼	*28		
Con. Arizona	N. Y. Curb	....	....	1/16	Dec. '18, Q	.05
Con. Copper M.	**N. Y. Curb**	...	...	1⅛		
Copper Range	Boston	36½	35	35⅞	Sept. '20, Q	.50
Crystal Copper (new)	**Boston Curb**	*30	*27	*28		
Davis-Daly	Boston	7	6¾	6¾	Mar. '20, Q	.25
East Butte	Boston	9¼	9¼	9½	Dec. '19, A	.50
First National	Boston Curb	*83	*82	*82	Feb. '19, SA	.15
Franklin	Boston	2⅛	2⅛	2		
Gadsden Copper	**N. Y. Curb**	....	....	*25		
Granby Consol.	New York	24	22½	24	May '19, Q	1.25
Greene-Cananea	**New York**	24⅛	23¼	23¼	Nov. '20, Q	.50
Hancock	**Boston**	3	3	3		
Howe Sound	N. Y. Curb	2¼	1¾	2¼	Jan. '21, Q	.05
Inspiration Consol.	**New York**	37⅜	36	36	Oct. '20, Q	1.00
Iron Cap	**Boston Curb**	6½	6½	6¼	Sept. '20, K	.25
Isle Royale	Boston	22	21	21	Sept. '19, SA	.50
Kennecott	New York	22½	21½	21¾	Dec. '20, Q	.50
Keweenaw	Boston	....	.	1½		
Lake Copper	Boston	2¼	2¼	2¼		
La Salle	Boston		..	2		
Magma Chief	**N. Y. Curb**	....	....	*21		
Magma Copper	N. Y. Curb	22	20½	22	Jan. '19, Q	.50
Majestic	Boston Curb	*15	*13	*15		
Mason Valley	Boston	1¾	1½	1½		
Mass Consolidated	**Boston**	2¾	2¾	2	Nov. '17, Q	1.00
Mayflower-Old Col.	**Boston**	4½	4	4		
Miami Copper	**New York**	23¾	22⅞	23¼	May '21, Q	.50
Michigan	**Boston**	....	....	2¼		
Mohawk	Boston	54	52	53½	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5½	5¼	5¼		
Nevada Consol.	New York	12¼	12	12	Sept. '20, Q	.25
New Baltic	Boston Curb	.		3		
New Cornelia	Boston	16	15¼	15½	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	..		*5		
North Butte	**Boston**	11½	10¾	10¾	Oct. '18, Q	.25
North Lake	Boston	....	....	½		
Ohio Copper	N. Y. Curb	...	....	1/16		
Old Dominion	Boston	23	22	22	Dec. '18, Q	1.00
Osceola	Boston	32½	31	32	June '20, Q	.50
Phelps Dodge	Open Mar	†165	†155	....	Apr. '21, Q	1.00
Quincy	Boston	42	41	41	Mar. '20, Q	1.00
Ray Consolidated	New York	14¾	14½	14½	Dec. '20, Q	.25
Ray Hercules	Boston Curb	*35	*35	*35		
St. Mary's Min. Ld.	Boston	39½	39	39	June '20, K	2.00
Seneca Copper	Boston	17½	17¼	17		
Shannon	Boston	0.90	0.90	0.90	Nov. '17, Q	.25
Shattuck Arizona	New York	7¼	6¾	7	Jan. '20, Q	.25
South Lake	Boston	1¼	1¼	1¼		
Superior Copper	Boston		.	4	Apr. '17,	1.00
Superior & Boston	Boston	1½	1½	1½		
Tenn. C. & C. cfs.	New York	10½	9½	9½	May '18, I	1.00
Tuolumne	Boston	*57	*50	*57	May '13,	.10
United Verde Ex.	Boston Curb	27	26	27½	Mar. '21, Q	.25
Utah Consol.	Boston	4	4	4	Sept. '18,	.25
Utah Copper	New York	51½	51	51½	Mar. '21, Q	1.00
Utah Metal & T.	Boston	1½	1¼	1½	Dec. '17,	.30
Victoria	Boston	*75	*75	*75		
Winona	Boston			*50		
Wolverine	Boston	11¼	11	11		
NICKEL-COPPER						
Internat. Nickel	New York	16	15½	15¾	Mar. '19,	.50
Internat. Nickel, pf.	New York			[illegible]	Mar. '21, Q	1.50
LEAD						
National Lead	New York	75	73	73	Mar. '21, Q	1.50
National Lead, pfd.	New York	104½	103	103½	Mar. '21, Q	1.75
St. Joseph Lead	New York	12¼	12	12	Mar. '21, Q	.25
Stewart Mining	Boston Curb			*6	Jan. '15,	.05
ZINC						
Am. Z. L. & S.	New York	10	9½	10	May '20,	1.00
Am. Z. L. & S., pfd.	New York	27	27	27	Nov. '20, Q	1.50
Butte C. & Z.	New York	5¼	5	5	June '18,	.50
Butte & Superior	New York	15¼	14	14	Sept. '20,	1.25
Callahan Zn-Ld.	New York	5¼	5	5	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb	127	127	127	May '21, Q	2.00
Success	N. Y. Curb	*3	*2	*3	July '16,	.03
Yellow Pine	Los Angeles			*60	Sept. '20, Q	.03
GOLD						
Alaska Gold	New York	[illegible]	⅝	⅝		
Alaska Juneau	New York	1¼	1⅛	1¼		
Carson Hill	N. Y. Curb.	14⅛	14	14¼		
Cresson Consol. G.	N. Y. Curb	1⅝	1½	1 9/16	June '20, Q	$0.10
Dome Extension	Toronto	....	....	*75		
Dome Mines	New York	20½	18¼	19⅛	Apr. '21, Q	.25
Golden Cycle	Colo. Sprgs.	....	....	*73	Dec. '20, Q	.02
Goldfield Consol.	N. Y. Curb	*8	*7	*8	Dec. '19,	.05
Hollinger Consol.	Toronto	7.33	7.23	7.32	Feb. '21, M	.05
Homestake Mining	New York	60	60	60	Sept. '19,	.50
Kirkland Lake	Toronto	*51	*47¼	*49		
Lake Shore	Toronto	1.32	1.31	1.32	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	2.00	1.97	1.99	Jan. '21, K	.05
Porcupine Crown	Toronto	*26½	*25¼	*25¼	July '17,	.03
Portland	Colo. Sprgs.	†*61	†*60	*62	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*4	*3	*4	May '19,	.05
Silver Pick	N. Y. Curb	*5	*3½	*5		
Teck Hughes	Toronto	*16½	*16	*16¼		
Tom Reed	Los Angeles	*80	*55	*80	Dec. '19,	.02
United Eastern	N. Y. Curb	2⅝	2 7/16	2½	Apr. '21, Q	.15
Vindicator Consol.	Colo. Sprgs.	*35	*35	*35	Jan. '20 Q	.01
West Dome Consol.	Toronto	*8¾	*8¼	*8½		
White Caps Mining	N. Y. Curb	*5	*3½	*4		
Yukon Gold	Boston Curb	....	....	*70	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*25	*20	*25	Apr. '20, M	.03
Batopilas Mining	New York	1	1	1	Dec. '07, I	.12½
Beaver Consol.	Toronto	....	....	*34	May '20, K	.03
Coniagas	Toronto	1.70	1.70	1.70	May '21, Q	.12½
Crown Reserve	Toronto	....	....	*13	Jan. '17,	.05
Kerr Lake	Boston	3⅝	3½	3½	Apr. '21, Q	.12½
La Rose	Toronto	....	....	*20½	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	....	....	*19	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.08	1.08	1.08	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4⅝	4½	4⅝	Apr. '21, Q	.15
Ontario Silver	New York	5¼	4⅞	5	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	....	....	2	Jan. '12,	.10
Peterson Lake	Toronto	....	....	*6½	Jan. '17,	.01½
Temiskaming	Toronto	*18	*18	*18	Jan. '20, K	.04
Trethewey	Toronto	*17	*16½	*16¾	Jan. '19,	.05
GOLD AND SILVER						
Atlanta	N. Y. Curb	*1	*½	*1		
Barnes-King	Butte	‡ ...	...	1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*62	*59	*60		
Cashboy	N. Y. Curb	*6½	*5	*5½		
El Salvador	N. Y. Curb	5/16	¼	5/16		
Jim Butler	N. Y. Curb	*10	*8	*9	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*7	*6	*7	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	¼		
MacNamara M. & M.	N. Y. Curb	*24	*18	*18	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1 7/16	1 5/16	1⅜	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1¼	1⅛	1¼		
Tonopah-Extension	N. Y. Curb	1 5/16	1 1/16	1¼	Apr. '21, Q	.05
Tonopah Mining	N. Y. Curb	1 5/16	1 3/16	1¼	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	1 1/16	15/16	1	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N.Y. Curb	*11	*10	*11	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	1.15	1.12½	1.12½	Dec. '20,	.15
Chief Consolidated	Boston Curb	2½	2½	2½	May '21, Q	.05
Consol. M. & S.	Montreal	17	16½	16	Oct. '20, Q	.62½
Daly Mining	Salt Lake	...	...	2.50	July '20, Q	.10
Daly-West	Boston	.	..	3	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	...	...	2¼	Apr. '21, K	.05
Electric Point	Spokane	*7½	*7	*7½	May '20, SA	.03
Federal M. & S.	New York	8½	8½	8½	Jan. '09,	1.50
Federal M. & S., pfd.	New York	27½	26½	27½	Mar. '21, Q	1.00
Florence Silver	Spokane	*12½	*12½	*12½	Apr. '19,	.01½
Grand Central	Salt Lake		.	*62	June '20, K	.03
Hecla Mining	N. Y. Curb	4½	4	4¼	Mar. '21, Q	.15
Iron Blossom	N. Y. Curb			*20	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake			3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*8	*6	*7		
Prince Consol.	N. Y. Curb	3/16	¼	3/16	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*5	*5	*5	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*12	*10	*11		
South Hecla	Salt Lake			*65	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	5/16	¼	5/16	Oct. '17,	.05
Tamarack-Custer	Spokane	1.80	1.70	1.80	Jan. '21, K	.04
Tintic Standard	Salt Lake	2.50	2.42½	2.42½	June '20, Q	.10
Utah Apex	Boston	2½	2½	2½	Nov. '20, K	.25
Walbert Mining	N. Y. Curb	*4	*3	*4	Nov. '17,	.01
QUICKSILVER						
New Idria	Boston			[illegible]	Jan. '19,	.25
VANADIUM						
Vanadium Corp.	New York	35	33½	33½	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	60½	58	58	Apr. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	83	80	80	Apr. '21, Q	1.75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	43½	41¼	41¾	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf.	New York	78½	77½	77½	Mar. '21, Q	1.75
Am. Sm. pf. A	New York	72	71	71	Apr. '21, Q	1.50
U. S. Sm. R. & M.	New York	35½	34	34	Jan. '21, Q	.50
U. S. Sm. R. & M. pf.	Boston	41½	40½	41½	Apr. '21, Q	.87½

* Cents per share. † Bid or asked. ‡ Quotation missing. Q, Quarterly. SA, Semi-annually. BM, Bimonthly. K, Irregular. I, Initial. X, Includes extra.

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Reorganization and Public Works

THE QUESTION OF REORGANIZATION of Government departments and bureaus in Washington is being actively investigated by a committee of both houses of Congress. It is a problem that will require careful study and not too breezy a method of rearrangement. Changes must be for the better: it would be easy for too casual a study to result in some changes at least for the worse. Out of these recommendations it now appears altogether unlikely that there will come any recommendation for a Department of Public Works. It is rumored rather definitely that Secretary Hoover, once strongly impressed with this plan, now no longer favors it. Our own editorial attitude has never been in favor of this proposal, which we could not recognize as constructive, and which we viewed as against the interests of the mining industry. An apothegm recently uttered regarding this formerly proposed department, by an engineer who was one of the former main champions of the idea, illustrates the case against it more succinctly than we have been able to do with all our arguments. "There is no more sense in having all the engineers in one department," he said, "than having all the stenographers in one department."

Having disposed of this engineer will-o'-the-wisp, let us see what we can do, in the reorganization, to centralize the representation of the mining industry.

The Resignation of the Institute Secretary

THE PASSING out of office of a secretary of the American Institute of Mining and Metallurgical Engineers is an event which marks a stage in the affairs of mining. The Institute represents in a broad way, and more and more completely, the engineering or technical side of the mining and metallurgical industries. The secretary is the permanent and managing officer. Presidents come and go annually: but the tone and impression of the organization are largely built up around the personality of the secretary.

In the memory of most of us there have been only two secretaries—Dr. Raymond and Mr. Stoughton. Their personalities were not similar; in a way they were antithetical; but both gained hosts of friends. Under the secretaryship of Dr. Raymond, with his enthusiasm, broad and keen intellect and dominating character, there was little room for any one else in the management of the Institute. It was natural that there should be a reaction to an organization in which administrative and executive functions and duties should be more widely distributed, and wherein the secretary, the president, the directors and the various committees contributed their share of government, and functioned smoothly together. Mr. Stoughton fitted admirably into this new order of things, and served as a well-liked, efficient, and popular guiding officer, never majestic with position, but ready to help and to serve any member.

The Institute has become very human, very popular, broad, pleasant and active during the years since Mr. Stoughton took charge. We shall miss him; and can only hope for a continuation of this halcyon period. Mr. Stoughton had the firm intention, when he became secretary, of serving only five years. He did not feel that he should make the financial sacrifice longer; but he has stayed nine. What he may have lost in funds we believe he has gained in affection.

Economic Bedlam

TWENTY-FIVE OR FIFTY YEARS from now, when, let us hope, the world will have been settled down to peaceful industrial pursuits, many volumes will have been written covering the economic lessons and deductions from the great period of readjustment through which we are now passing. We wonder if these books of the future will faithfully record the divergent views now expressed by bankers, economists, engineers, bricklayers, and others, in accounting for the phenomena of increasing and decreasing prices, inflation and deflation, the remedy for chaotic conditions of trade and the apparent contradiction of many theories fervently held dear to and preached by students of these subjects. One cannot help but be impressed, in reading newspaper accounts giving the speech of Prof. Blank, of some New England university, or Senator Bunkum, of a Middle Western state, by the inference that little unity of economic thought seemingly exists in the nation. This is true not only for individual but also for group opinion. Recently many eminent financiers and manufacturers gathered in Cleveland to further the interests of foreign trade and the expansion of the sphere of American commerce to a point never before realized, and simultaneously we note the Congressional efforts to enact heavy trade barriers, protective tariffs, which would tend to have the opposite effect. Then again, reverting to individual opinion, the statement has been repeatedly made that deflation has progressed to its limit, a contention in which the farmer—and ourselves—cannot heartily concur, as the prices of shoes, clothing—to say nothing of rent—are still up in the clouds.

Viewed internationally, economic confusion is even graver, and the problems presented by disorganized currencies, reparations, tariffs, taxes, and other subdivisions are stupendous. A wider diversion of solutions is offered for these problems than for any other, and undoubtedly more attention will be devoted to this phase of economic readjustment.

The present period of disorganization is indeed pregnant with material for future study and the better shaping of laws that govern trade, finance, and other matters. Despite the apparent contradiction of some economic laws, it is well to be guided by sane common sense rather than by half-baked theoretical expedients for the betterment of business. The history that has been and is being made will furnish a valuable guide for the future course of nations. From the Russian extreme of economic debauch to the conservative tactics of countries untouched by the frenzy of war, important lessons have been taught, which, if grasped by future generations, will lead them to avoid making calamitous economic experiments that result only in distress and disorganization of everything, from government to trade.

At present we must content ourselves with the functioning of economic laws, be they favorable or unfavorable to us, with the assurance that, as in the past, they will certainly and ultimately bring cosmos out of chaos and restore some semblance of the balance existing before the war.

The Story of the Pear-Shaped Globe

ENTER—Milton Eudaly, of Grandfalls, Tex., a "practical" geologist, according to a recent issue of the *El Paso Times*. The story of his discoveries will constitute an interesting number in our series of "Bed Time Stories for Mining Engineers"; so compose yourself to listen.

There was once, it appears, an old chemist in Finland, who, after long study and experiment, produced "a combination of chemicals that was accredited with the power of definitely locating underground oil and gases." The jealousy of scientists among one another is well known in this country, but in Finland it appears to take on more active and virile manifestations, for before the ancient chemist could cash in (or, as the *El Paso Times* puts it more euphoniously, "reap any monetary benefit from his arduous scientific studies,") he met an accident. The fact is that "he was assassinated by his rivals, whom he had refused to take into his confidence."

But it is well known that the wicked never prosper. When the murderous chemists tried to analyze the marvelously sensitive compound which the a. c. (ancient chemist) had mixed, they could not. They found that "there were certain peculiar elements therein that refused to respond to the tests of the most learned chemists of the period." Absolutely refused, we infer. In fact, it seems that the a. c. had discovered several new elements, and mixed them all up to obtain the almost (or quite) intelligent fluid. And the murderers had killed the goose, if we may say it, that had laid the egg of gold—quite an apt metaphor, for the fluid apparently works best in a "pear-shaped globe" of glass. We are coming to that.

The widow of the a. c., like all the residents of Finland, finally came to the United States. Her two beautiful fatherless children grew up; and one, a son, turned out to be a great oil operator in California. One day, however, he recalled his father, and his great discovery; and had an altogether brilliant and original idea of looking over his father's papers. Sure enough, they were found; but they were written in neither Finnish nor United States: therefore "the papers were dispatched to an eastern university for deciphering." Western universities please take notice. When the translations came back (we have no doubt by return mail), it was found that the great formula "was written in four almost obsolete languages." Only in an eastern university can you find any one who knows four almost obsolete languages. Ask any student at Williams about it.

The son, enthusiastic, was all for making a large number of the instruments made possible by the discovery of the formula; but the mother held there should be only three made—one for herself, one for the son, one for the daughter. Otherwise, she said, the world would be spoiled, for all the oil in the world would be found at once, and all burned at once—and where would you be then? This is our free translation, but what the old Finnish lady thought, to use her own words, according to the *El Paso Times*, was that these instruments "would prove inimical to the welfare of the world, as their promiscuous use would result in the location of practically all of the oil under the earth's surface, and the volume would be so immense that the supply would far exceed the demand, cease to be of appreciative value, and, because of cheapness, would not be conserved, resulting in wanton waste and rapid exhaustion of a treasure that is of inestimable value to mankind." Marvelous what a way the Finnish have of putting things.

The report leaves out one chapter of the story. Mr. Eudaly has the instrument. How did he get it? Did he assassinate the son, or the mother, or the daughter? It is important, at least it would be fascinating, to know. We cannot believe that a far-sighted and super-philanthropic family like that of the a. c. would normally let one of these three instruments pass out of their hands, for what is going to prevent Milton Eudaly now from discovering all the oil in the world?

The instrument, we learn, is "simplicity itself." The pear-shaped globe (how is a pear-shaped globe for simplicity?) inclosing the mixture of elements unknown to chemists (simple enough), is, to cut the technical language of the *El Paso Times* short, hung up where the wind will not disturb it. Then the "chemicals make movements" indicating how much oil there is below, how far below, and whence it cometh and whither it goeth. We wish we could quote the beautiful language in which this is put in the article we are summarizing, but we are so short of space. The magic globe has already revealed plenty of oil under Fort Stockton.

Our correspondent writes us that the *El Paso Times* is the most widely circulated paper in the Southwest, which we already know. He further adds, "All Texas is in feverish excitement. Wealthy Texans are offering fabulous sums for the secret pear-shaped glass oil finder, even for the use of it for a single day. They say it will show the great underground river of oil which flows up from the Tampico to the Texas fields, but whose exact location no one has discovered in the intervening territory. This stream is said to be closely connected and reacted on by the Gulf Stream through some alchemy of Nature."

Ah, the romance of mining!

Silver Prices

MOST DOMESTIC SILVER producers who have been receiving 99½ or 99⅝c. for the metal, and who have thought that this price would persist for three or four years, are now forced to accept less, but fortunately the price recession is only a slight one, the new figure being 99¼c. Senator Pittman assures inquirers that there is no likelihood whatever that the silver act which he sponsored will be repealed, and, in fact, is optimistic that domestic producers will continue to obtain 99c. or more for their silver for a much longer time than the minimum term mentioned. The slight reduction just made is to cover shipping charges from Eastern refineries to the Denver mint. Formerly, all silver bought under the Pittman Act has been used by the Philadelphia mint, but now the coinage of silver dollars is to be resumed in Denver.

WHAT OTHERS THINK

Mining Schools and the Mining Business

It seems that the reference made by the editor, several months ago, to a "Correspondence School Engineer" has been successful in bringing comments, which, more recently, have taken the form of a discussion of educational institutions and their methods of instruction.

It appears to me that Professor Peele, in his paper, "The Education of the Mining Engineer," mentioned in *Engineering and Mining Journal* of April 30, has "hit the nail on the head." Why should forty-three mining schools, with more or less complete equipment, and no common standard of teaching, be necessary to educate the members of this more or less limited profession? Two or three schools completely equipped and run by the Government, if you please, would be able to cover the ground and eliminate the waste of our present system.

We are agreed that education is, of course, desirable, but let us not forget that education without the ability to apply the same is next to worthless. The ability to apply is acquired after leaving school and getting into the field of active life. Few graduates are much sought after as soon as they have received their diploma, regardless of the school that issues it; but let them get out and prove their ability to apply the principles taught them, do things, and succeed. Then they are in demand, and it is not of paramount importance from which institution of learning they received their instruction.

There is one point on which, it seems to me, our schools (mining) and school system are all wrong. They take the raw material (applicants for scholarship), spend four or six years teaching them the principles of the various subjects embraced in the course chosen, and never teach them how to convert this knowledge into dollars and cents. We may not like to admit that an education, in ninety-nine cases out of one hundred, is sought after with the view of making money; nevertheless, it is a fact.

This subject is left untouched at school and left to the latent ability which the scholar may or may not possess. The ones who possess this "latent ability" climb to the top and are numbered with the stars of the profession. Some others continue to be life students in the rut of acquiring knowledge, only for someone else above them to get the credit and reap the monetary reward. I have known several graduates who have spent their lives doing really good work holding ordinary positions while their work has made their superiors noted—just because they lacked this one most essential ability of converting knowledge into cash.

Life is a campaign of salesmanship, no matter what our vocation happens to be. If we have a mine for sale, the marketing of it calls for salesmanship; if we apply for a position, we have knowledge and ability to sell, and so on down the line. So let us be taught something of the principles of this important subject while acquiring the knowledge of the various branches of learning.

It may be that Columbia is attempting to include this in the university's courses, by making its graduates "leaders of men." J. F. INGLIS.

Baker, Idaho.

The Possibilities of Licensing

Your two recent editorials and the communication from Mr. Barbour relative to the licensing of engineers lead me to a little arithmetic. If a mining engineer were to take out a $25 license in each of the forty-eight states it would cost him $1,200. Assuming that there are 10,000 mining engineers, this would show a cost of $12,000,000 which the mining profession would pay for the privilege of being licensed, but there is not that much money left in the profession at the present time to be expended for this luxury (Luxury! Shall we add 10 per cent war tax to this?).

I am not yet clear regarding the advantages of licensing engineers. Take your distinguished self, Mr. Editor. I do not think it would have added one bit to our respect for your geology if you had had the pseudo advantage of being licensed before you gave us your opinions. Take Pope Yeatman, or J. Parke Channing, or John Hays Hammond: is their efficiency going to be raised or their earning power increased by the possession of a license? But the bill is to protect the public. Just how licensing you illustrious men is going to protect the public from you I confess is not clear to me. At the other end of the scale, the mine or smelter rule-of-thumb-draftsman and the young college graduate, assuming that they both succeed in getting licenses, are not, in my opinion, thereby going to be enabled to drive the Spurrs and the Ingalls and the Channings and the Yeatmans and the others out of the business in case the latter should decline to apply for licenses, nor do I think the world is going to be made safer for these embryo engineers from the democracy of this country who want engineering results irrespective of a blue-ribbon license and seal.

Another consideration, Mr. Editor. You have the privilege, once you are licensed, of using a seal on your documents and reports. Imagine adding to the plunder which the mining engineer now takes with him eight or ten or a dozen or more notarial seals, so that on his trip he may complete and authenticate the various reports which he makes within different state boundaries! The more I look at this scheme of licensing engineers, the more interesting possibilities I find. We might even have the state licenses, instead of on parchment framed in our offices where few people see them, made in the form of a jewel or dog collar and suspended around our necks like a decoration.

The engineer is doubtless the best qualified man in the world to settle the big problems now confronting us. We all concede this, but the engineer himself should turn his own affairs over to some trust company or guardian *ad infinitum* to take care of for him, because he is patently unable to watch his own interests. Witness the fact that now, five years after the Founder Societies and subsequently Engineering Council started to draw up a model bill, and after about twenty states have passed such laws, the engineer "comes to" sufficiently to begin to discuss whether he wants to be licensed or not. In these twenty states, if he decides he does not, the alternative is a jail sentence. However, we are in good company. The lawyers and doctors are licensed, and so are the veterinary surgeons, dentists, and the apothecaries, and the nurses and the plumbers—and in the super-state, if you know what I mean, we shall probably all like it. M. R. PERCY.

New York.

HEADFRAME, MILL AND PART OF CAMP OF THE BENGUET CONSOLIDATED MINING CO.

Mining Progress in the Philippines

Lode Mining for Gold—Placer and Dredging Operations—Gold Output Exceeds $1,000,000 per Year—Production of Other Metals Negligible—Coal Mining of Local Importance Only

By C. M. Eye
Written for Engineering and Mining Journal

DURING THE PERIOD of Spanish domination, beginning with the discovery of the islands by Magellan in 1521 and ending with the American occupation in 1898, little attempt appears to have been made to develop the mineral resources of the Philippines, though a small annual production of iron resulted from the smelting of limonite ores at Augat, Bulucan Province, and, at one time, copper in commercial quantity was produced from the richer ores of the Mancayan deposit of northern Luzon, and considerable amounts of gold, from many and various localities, annually found their way into channels of commerce through barter. About 1883, a ten-stamp mill was erected by English capital on the San Mauricio lode, at Mambulao. Other modest attempts may have been made to work the gold deposits with small mills or with arrastres, but no success is recorded.

The growth of systematic development may therefore be said to date from about 1900, when, with the cessation of the hostilities incident to the Spanish-American insurrections, an active campaign of prospecting was initiated by men from the western United States, members for the most part of the expeditionary forces, who had been discharged in the islands. During the campaign much valuable territory was located under the new laws of Congress, passed in 1892. In fact, most of the ground now held under patent from the Philippine government by the operating companies and others was located in this early period, which was followed by a few years of small developments and attempts to work ores of low or medium grade with small mills. These operations, fostered by local capital, were generally unsuccessful, owing to low recoveries and small output. Two mills in the Benguet district[1] (the Benguet Consolidated and the Bua), using cyanidation after amalgamation, managed to maintain a small but steady output, and made a profit for several years, until both were lost by a flood late in 1909.

The first real success in lode mining was achieved by the Colorado Mining Co., in the Aroroy district, with a twenty-stamp, fine-grinding and cyaniding mill, put in operation late in 1911. This was followed several years later by the Syndicate, in the same district, with an all-sliming cyaniding plant of about ninety tons' daily capacity, and in 1915 by the Benguet Consolidated with an entirely new plant having a capacity of sixty tons per day and employing fine-grinding and cyanidation. This installation, including a 100-kw. hydro-electric unit, began operations in September, 1915, and has maintained steady and profitable production since that time, with material additions to power plant and mill resulting in increased capacity and saving. The data covering cost and production for the initial operations in 1915 are not available, but those covering 1916 to 1920 inclusive are given in Table I.

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[1] [illegible] prospecting in connection [illegible] *Mining Journal* will [illegible] 1916, a series of [illegible] which are of comple[illegible]

TABLE I SUMMARY OF OPERATIONS OF BENGUET CONSOLIDATED MINING CO.

	Tons Treated	Yield	Recovery per Ton
1916	17,360	$291,271 64	$16 88
1917	20,427	326,695 69	17 80
1918	23,529	447,519 00	19 00
1919	23,719	426,942.00	18 00
1920	35,565	534,446 15	15 02

Total, 120,600 tons treated, yielding $2,026,874.48. Average recovery, $16.80 per ton. Extractions have been around 90 per cent for the entire period. Costs are given in Table II.

TABLE II COSTS PER TON TREATED, BENGUET CONSOLIDATED MINING CO

	Operation (Including Development)	Taxes	General and Marketing	Total
1916	$6 18	$0 17	$0 12	$6 47
1917	6 17	32	68	7 17
1918	6 20	49	99	7 68
1919	7 30	45	83	8 58
1920	6 34	35	1 33	8 02

Profits, after allowing liberally for depreciation, have been as follows: For 1916, $163,581.15; for 1917, $155,082; for 1918, $265,617.81; for 1919, $210,689.81, and for 1920, $216,917.57, making a total of $1,011,888.34. A considerable portion of these profits has been reinvested in betterments, but over half a million dollars, or more than the entire capitalization of the company, has been paid in dividends; $25,000 per quarter has been paid regularly since September, 1916, with a number of extra dividends.

Shaft sinking and development of the main lead below water level have proceeded sufficiently to indicate such a continuance for several hundred feet at least. The completion of a new drainage tunnel, now under way, will assist materially in handling the heavy flow of water encountered.

During the first half of 1912, the Colorado mine, at Aroroy, produced approximately $150,000 gold from 18,600 tons of ore treated, at a cost of about $5 per ton. Later figures are not available, but, with the exception of a six-months' shutdown in 1917, for repairs and enlargements, this property has operated steadily, with an increased output and lower costs per ton. The Syndicate has also been a steady producer, and both have been profitable ventures and have paid substantial dividends.

Dredging operations at Paracale, beginning in a small way about 1905, reached considerable proportions by 1915, with a number of dredges, mostly of New Zealand type, in operation; but the output has materially fallen off, owing to exhaustion of pay ground, and many of the dredges have been dismantled. Prospects for future production from this source are not promising. There are known areas of gold-bearing ground in various parts of the islands as yet unworked, mostly at the points where streams debouch from mountain gorges onto coastal plains. These may in time furnish opportunity for production. Similarly, there are known and partially proven lodes and groups of lode claims which, under more favorable conditions than have prevailed during the last few years, may come into the producing class.

Gold production, which has been around a million dollars per year for some years, is reported by Warren D. Smith for 1919 as $1,308,224, of which Aroroy furnished $634,532, Camarines (mainly from Paracale) $217,455, and Mountain Province (mainly from Benguet) $454,672, the remainder being from other and more isolated sources. The actual amount from outside sources is probably greater than reported.

Production of other non-ferrous metals is negligible. Production of non-metallic mineral products is given by Mr. Smith for 1919 at approximately $2,260,000, salt (from sea water) leading, with $450,000; stone, clays, and coal, as well as asbestos and iron ore, being included. Data for 1920, though not available, are unlikely to show increases in mineral production.

COAL OF MAINLY LOCAL IMPORTANCE

Coal mining has never attained the position of an important industry in the Philippines, though deposits of lignite exist at various points and have been prospected. The most important developments thus far have been made on the Island of Batann, where, on the east end, a mine has been operated by private enterprise for many years. As early as 1910 coal was mined and sold to inter-island steamers at about $3.25 per ton on the dock. At about this time the United States Government carried on operations extending over several years on the west end of Batann, probably with the idea of securing a coal supply for its transports, but the results were evidently unsatisfactory. During the last few years, several attempts have been made by the Philippine Development Co., a Government corporation, to open up coal mines in various localities, but apparently such efforts have resulted in failure. The nature of the coal, a highly carbonized lignite, and the irregular and limited beds, in many occurrences faulted and tilted, make difficult or impossible economical production and marketing in competition with imported Australian and Japanese coal, under normal world conditions. Yet, with proper handling, some of these deposits may be worked with profit in supplying local markets. In 1919 only 32,000 tons was produced, worth, according to Mr. Smith, $411,000, and representing an abnormal price per ton.

POLITICAL CONSIDERATIONS HAMPER IRON MINING

Some iron ore, of a value of approximately $40,000, was sold in 1919. It appeared probable that an important industry in export of iron ore from the Island of Calambayanca, Mambulao Bay, to Japan would result from operations there by a Japanese company, but this has failed, owing largely to Government opposition, and no doubt also to market conditions in Japan.

The prospect for increased mineral production in the Philippines is not particularly promising at this time. Practically all prospecting has ceased. No new districts are being discovered and opened up. The political future is as yet uncertain, and distance from markets and difficulties in transportation make operation expensive. Most of the development thus far has been undertaken by local capital. With a guaranteed future under American protection and supervision, and with bettered market conditions, there may come a revival of the mining industry in the islands, but it is hardly possible otherwise.

Recent Supreme Court Interpretations of The Mining Law

New Decisions, Though Sometimes Settling Certain Points, Often Give Rise to Other Problems—Case of Silver King Coalition Against Conkling Company, Recently Decided, Brings Up New Questions Regarding Extralateral Rights

By Horace V. Winchell
Written for *Engineering and Mining Journal*

ALTHOUGH it is frequently asserted that there is no necessity for revision of the mining laws, because every possible question has hitherto been decided by the courts, those familiar with the subject know that many controverted points still remain undecided, and that each new decision immediately brings to the front other problems whose solution may require judicial consideration. Within the last few weeks there have been decided by the United States Supreme Court for the first time two important questions which have a vital and far-reaching bearing upon the extent and direction of extralateral rights. These decisions by the highest court settle finally some questions at issue, but at once open the gate to new ones. They reverse certain rulings of a Court of Appeals which have for some years been relied upon, and affirm the decisions of some other courts of equal authority.

In the case of the Work Mining & Milling Co. vs. the Doctor Jack Pot Mining Co. (194 Federal, 620) decided by the Circuit Court of Appeals for the Eighth Circuit some years ago, the question of extralateral rights on secondary veins was directly involved. The Court of Appeals, affirming the decision of the District Court of Denver, held that the issuance of a patent to the Lucky Corner claim established a conclusive presumption of the existence in that claim of a valid discovery, and further that there was a presumption that the discovery vein crosses an end line of the claim as located.

Although at the hearing it was shown as a matter of fact that there was no vein whatever at the point of discovery, and that the discovery shaft was in gravel in the bottom of a gulch and never penetrated to the bedrock, there was no adequate proof that no vein crossed the end line of the claim in that vicinity. The court held that a secondary vein crossing both side lines of the Lucky Corner claim was entitled to dip rights between vertical planes, passed through the respective side-line crossings at the apex and parallel to the patented end lines. A verdict was thereupon given in favor of the Doctor Jack Pot company and against the Work company for damages amounting to approximately one million dollars for ore extracted beneath the surface of the Little Clara claim, which was senior to and adjoined the Lucky Corner claim on the west. The Supreme Court declined to review this case on *certiorari*.

Decision in Silver King Coalition vs. Conkling Case Cited

In the recent case of the Silver King Coalition Mines Co. against the Conkling Mining Co. over an orebody in what is known as the Crescent fissure, which had been mined in the so-called Elephant stope, two questions have now been decided. The first question involves the construction of the rights conveyed by patent where there was an error in the language of the patent. The patent to the Conkling claim conveys, in terms, 1,500 ft. in length, but the monuments upon the ground show that the claim was shorter. The District Court held that the survey monuments controlled and that the patent was void in so far as it purported to convey a stretch of ground in excess of that covered by and included within the monuments. The Circuit Court of Appeals of the Eighth Circuit reversed the District Court and held that the patent call for 1,500 ft. was valid. A writ of *certiorari* was denied by the United States Supreme Court, and the matter appeared to be closed. In view, however, of the importance of definitely deciding the law in such matters, the Department of the Interior, through the Solicitor General of the United States, joined with the Silver King Coalition company in a second petition for a writ of review, which was granted by the United States Supreme Court. Its decision reverses the Court of Appeals and holds that the survey monuments determine the position and boundaries of a claim, regardless of the language of the patent.

Case Also Involved Question of Extralateral Rights Upon Secondary Veins

The second question decided by the Supreme Court in a subsequent opinion upon April 11 had to do with the same question as that involved in the Dr. Jack Pot case; namely, extralateral rights upon secondary veins. The Crescent fissure has its apex outside of the Conkling lode claim and dips beneath it. At its apex it crosses the parallel side lines of mining claims, the property of the Silver King Coalition company. It was proved in the course of the trial that there was no vein at the discovery points of these adjacent claims, nor any veins running lengthwise thereof. On this question the language of the Supreme Court is as follows:

> The general purpose is to give a right to all of the vein included in the surface lines if there is only one, provided the apex is within the location. It often must happen that the strike of the vein is not known, but must be conjectured at the time of discovery, and that the location is across instead of along the vein. This has been obvious always and therefore it would be wrong to interpret the words "end lines" narrowly as meaning the shorter ones in every instance.
>
> Those are the end lines that cut across the strike of the vein if it crosses the location. We see no reason for thinking that because the discoverer has not claimed as long a portion of the strike as he might have he should be deprived of even his diminished lateral right. It has been the accepted opinion of this court for many years that where, as here, the strike of the vein crosses the location at right angles its dip may be followed extralaterally, whatever the direction in which the length of the location may run. If

across the strike, as here, the side lines, as it is commonly expressed, become the end lines. Subsequent locators know as well as the original ones that the determining fact is in the direction of the strike—not the first discoverer's guess.

But it is said that where the end lines are determined they are end lines for all purposes, even if there are different veins running in different directions, having their apexes within the claim; and it is argued that there is a presumption that has not been overcome that there was a discovery vein running parallel with the side lines—that this determined the end lines and that therefore the petitioner got no extralateral rights in the Crescent fissure. The Circuit Court of Appeals, approaching the petitioner's claim as a claim of exceptional privilege, seems to have attached a weightier burden of proof to it than we are disposed to do. They were not satisfied that the discovery vein which determined what the end lines should be was not some other vein than the Crescent fissure. But we see no substantial evidence that there was another vein. We have the distinct testimony of experts that there was no such and we agree with the view of the district judge sustaining the petitioner's extralateral rights. Whether there are other answers to the contention we need not decide.

Thus we have a decision by the Supreme Court reversing what has been the interpretation of the mining law for more than ten years, based upon an erroneous decision of the Circuit Court of Appeals of the Eighth Circuit. It will at once occur to any thoughtful person that new possibilities and uncertainties arise: Suppose, for instance, that there are two secondary veins, as often happens and was indeed the situation in the Dr. Jack Pot case. Suppose, further, that one of these secondary veins crosses both side lines and one of them crosses both end lines, or one end line and one side line. In which direction, then, are the extralateral rights? Or upon which vein would extralateral rights be given?

It is a principle long supposed to be established that no mining claim can have two sets of end lines. Is it now to be inferred that the owner of a claim possessing two secondary veins may elect the direction of his extralateral rights, choosing the vein which contains the best ore or gives him the greatest sweep downward beneath the surface? Or, suppose one of these veins was discovered subsequently to the other; would the miner, after working one vein on its dip extralaterally, have the right to come in at a subsequent period and claim the right to work on another vein containing perhaps more and better ore, in a different direction, and setting up for that purpose the rights granted under the recent decision? Or if such a secondary vein should happen to cross one end line and one side line, how can anyone determine which line is the legal end line, where there is no vein at the point of discovery?

These questions are important and may arise at any time, and may involve, as in the present case, the title to ore valued at more than half a million dollars. Is it therefore strange that those of us who have much to do with such controverted questions favor discarding our present complicated mining law and the adoption of a simple law in which there shall be no such thing as extralateral "rights"?

Federal Vocational Training

Vocational education in mining work has made good progress during the present year, according to the *Vocational Summary* of the Federal Board for Vocational Education. Classes in mining subjects, with an enrollment of more than 2,000 pupils, have been organized in twenty-four training centers in thirteen states.

Madagascar Graphite Industry Quiet

The record year for the production of graphite in Madagascar was 1917, when 35,000 metric tons was produced, according to Consul James G. Carter, of Tananarive, in *Commerce Reports*. The industry has not shown any substantial signs of improvement since the middle and latter part of 1918, when the British and the French markets ceased partaking of the monopoly of the Madagascar graphite enjoyed by them throughout the war, and when the United States market ceased buying the Ceylon graphite and showed no desire to take over the Madagascar product, then anxiously offered.

Below are given the official figures of the production and exportation of graphite in Madagascar from the beginning of the industry, in 1907, to 1920, inclusive, in 1915-1920 exports representing chiefly old stocks:

	Production, Tons	Exportation, Tons		Production, Tons	Exportation, Tons
1907	8	8	1914	11,232	7,940
1908	82	109	1915	15,940	12,189
1909	197	200	1916	26,254	26,209
1910	545	554	1917	35,000	27,838
1911	1,247	1,281	1918	16,000	15,015
1912...	5,318	2,638	1919	5,000	4,050
1913...............	7,227	6,573	1920	(*a*)	14,919

(*a*) 4,000 to 5,000 tons.

The exports are given as having been slightly in excess of the production during the years 1908 to 1911. These differences are due to the fact of the production being given in net weight and the exports in gross weight. The figures for exports given in the table are taken from customs returns.

According to a published statement of the Chief of Madagascar Service of Mines, based upon an investigation made by the local government, the quantity of graphite in stock in Madagascar on April 1, 1920, amounted to 32,000 tons. Stock of 24,000 to 25,000 tons is estimated at the end of 1920. No precise data are available as to the quantity of the different grades of graphite on hand, but approximately nine-tenths of the stock is flake graphite, the remaining being amorphous. Three-fourths of the flake graphite averages 80 to 90 per cent carbon, particularly of the old stock, the tendency now being to turn out an average quality of 90 per cent and above, because of the restricted demand.

Of the graphite shipments in 1920 a total of 4,449 tons went to England, 2,127 tons to the United States, and the remainder to France, with the exception of 51 tons shipped to Belgium. Shipments have again been reduced, and the only information to be had concerning the present demand is regarding a contract held by one of the large mining concerns for 2,000 tons, to be delivered in the present year to France.

The prices obtained for the graphite shipped in 1920 averaged 600 to 700 fr. per ton, f.o.b. Tamatave and Vatomandry, for material averaging 85 to 90 per cent carbon, prices at which quantities of Madagascar flake may now be had. The freight on this material from Madagascar to New York, London, Hamburg, and other European, excluding French, ports is now quoted by one French line at 300 fr., and by another at £7 sterling, and the rate to Marseilles is 200 fr. by both lines. The Madagascar flake, however, can be produced at a cost low enough to support an f.o.b. price of 500 fr. per ton.

It is estimated that about 20 per cent of the total production of Madagascar graphite is treated mechanically. There are perhaps not more than half a dozen plants equipped with machinery, which consists chiefly of drying, separating, classifying, ventilating, and screening devices, kept more or less secret.

The Reward of Bluffing

How a Blustering "Gringo" in Mexico Won His Point, And Thereby Lost a Small Fortune

(FROM THE FIELD NOTES OF EDWARD NORCOTT, ENGINEER)

Written for Engineering and Mining Journal

MARVIN K. KETCHUM made a fortune out of a "corner" in the sponge market several years ago and repeated the procedure with certain other commodities. In consequence, he was rated and recognized as a millionaire, a fact of which he was extremely conscious. In one of his business manipulations he had found it expedient, to accomplish his financial aims, to succor a friend to the extent of a loan of $25,000, secured by the controlling stock of a silver mine in Sonora, Mexico. The money was to be used to provide equipment for the mine and make it productive on a small scale, in anticipation of enlarged operations and greater profits later.

The borrower died suddenly and the money he had received became involved in his estate. Ketchum promptly foreclosed his note, and thus made his debut into the mining business, or "game," as he called it. He engaged an engineer recommended by one of his banker friends, and, upon his advice, advanced the moderate sum needed to complete the equipment of the mine, as his friend had planned. The property was soon producing rich silver ore, and Ketchum, owning the controlling interest, was able to negotiate a sale of the property which made him a profit of nearly half a million dollars.

Having tasted the rich blood of success in mining, Ketchum naturally wanted more. He was influenced in this decision because mining seemed to him to be a somewhat more glorified business than merchandising sponges, or cork, a collateral line, which had also engaged his effective energies. He entered into negotiations for other Mexican mines, engaging an engineer to advise him, as he had been told to do by one of his fellow millionaires.

Ketchum was enthusiastic by nature and did nothing by halves. Once launched upon his new endeavors, he gave them his personal attention and put back of them his abundant, if not always well co-ordinated, energies. He went personally to Mexico and visited the principal mining camps and conferred with the prominent mining men. His [illegible] self-[illegible] and [illegible] ignorance of the mining business made him a subject of amusement with those longer associated with the interesting revival of the Mexican mining industry, then in full swing. Soon he quarreled with the engineer he had engaged to advise him, [illegible] his domineering ignorance. He then publicly declared he was going to "run the whole show" himself.

Among the mining properties [illegible] Ketchum's attention was "La Predilecta" [illegible] in the State of [illegible], owned by [illegible] [illegible] [illegible] [illegible] the [illegible]. Licenciado Sanchez [illegible], according to Mexican custom, had large property interests and was a [illegible] [illegible]. He did not practice his profession, for he was generally busily engaged in the interesting and sometimes worrying occupation of making his [illegible] [illegible] [illegible] with [illegible], but it [illegible] he had found it necessary, upon occasion, to sacrifice some of the valuable mining properties he owned to the eager and wealthy Americans, who, in the year 1910, were overrunning Mexico like a visitation of two-legged locusts.

I had been engaged in an advisory way in some negotiations for Licenciado Sanchez, and had become friendly with him and with his family, so I was not surprised to receive a telegram from him asking me to meet him in Mexico City on a matter of business. It soon developed that Licenciado Sanchez had offered his "La Predilecta" mine to Ketchum, and that, by reason of an acute hiatus in his income, he was desirous of making the sale even at a sacrifice price. He had heard of Ketchum's manner and methods, and he frankly admitted to me that he was afraid to meet him, and, besides, he had doubts of his ability to cope with the business maneuvering necessary to close the deal with such a man.

Sanchez asked me to advise and assist him, and insisted that I should be present at the interview which was arranged for that day in Ketchum's elaborate suite at the Hotel Sanz. I had not met Ketchum, but I was nothing loath to do so, for the reason that, though I disliked his methods, I respected his shrewdness and business effectiveness.

Ketchum was alone when we called at the appointed hour. He greeted Licenciado Sanchez warmly, and quite ignored me. In fact, he frankly stated that this was an affair between principals, and he did not think any assistance was necessary from outsiders. But Licenciado Sanchez, acting upon our prearranged plan, explained that he did not understand American business methods, and politely asked permission to have me remain to explain matters to him. His politeness and his meek and timid manner probably led Ketchum to feel that it would not be difficult to get his own way anyhow, and so he acquiesced to my presence during the negotiations.

At the outset, Ketchum explained that he could "hablo Español," having learned the "lingo," to use his colloquialisms, in Spain, during his sponge and cork operations. However, the preliminaries were conducted in English, and Licenciado Sanchez, notwithstanding his limited command of the English language, replied freely to the general questions asked him. Ketchum informed us that he had full reports on "La Predilecta" mine and "knew all about it." He said he would buy it, "lock, stock and barrel," if no "greaser's" trick to rob him was tried.

THE OLD, FAMILIAR "KNOCK"

Then he began to depreciate the property, calling it a "rat hole," and other non-technical epithets, to the dismay and disconcerting of Licenciado Sanchez. Finally, he asked Licenciado Sanchez to name his price, having preceded this natural step in the negotiations by more picturesque abuse of everybody in Mexico, and everything Mexican, especially the mine. By this time, Licenciado Sanchez had forgotten all his English and launched a torrent of defence and remonstration in fluid and fast-flowing Spanish, ending with the statement that he would sell the mine for "seis cien mil pesos" (600,000 pesos).

Ketchum had not understood a word of the reply, and, as I saw at once, did not even understand the price named, which was quite reasonable, and the one we had previously agreed upon for a first offer. Not wanting to acknowledge his complete flunk at real Spanish, as spoken by the natives, he said something about "business being business," and taking up a pad of paper which lay upon the desk between them, he shoved it toward Licenciado Sanchez and asked him to make his proposition in "plain English."

Quite discouraged by this time and not understanding just what Ketchum wanted, Licenciado Sanchez took the pencil and wrote on the pad, "$600,000," using the dollar sign for the Mexican peso, or money unit, as is customary in Mexico.

Ketchum roared back that it was a robber price, and that he would not pay more than "five hundred thousand dollars." Licenciado Sanchez was dismayed at this low offer, but suddenly I saw him sit up straight and I caught a quick appeal for help in his eyes. The same idea that had startled him had also come to me. Ketchum was talking about American "dollars" instead of Mexican "pesos." As the ratio was about one for two, his actual offer was far in excess of what Licenciado Sanchez had asked. It seemed too good to be true. Licenciado Sanchez and myself both seemed to come to a full realization of the critical situation at once, and to agreement on an unspoken plan to unite in playing it out. Licenciado Sanchez demurred at the price, speaking at some length of the merits and value of the mine, at the same time recounting his great personal need of making the sale. I then decided to try a bold stroke. I told Ketchum that the mine was an exceedingly valuable property, and that I would not permit my client to sell it for less than "six hundred thousand dollars." This had the desired effect, for Ketchum exploded and said some things about meddling by incompetent engineers in matters that should be left for business men to settle.

TRIUMPH OF THE MEEK

Licenciado Sanchez appeared to be really alarmed and made hasty efforts to smooth matters over. But Ketchum said that he would have no more interference by outsiders and directed another volley of rough talk and abuse at poor Licenciado Sanchez, who by this time was in a cold sweat of expectancy and fearful hope. After some more talk Ketchum blusteringly repeated his offer of "five hundred thousand dollars," and Licenciado Sanchez, waving me aside, dramatically accepted the offer.

Ketchum called in his secretary and directed him to draw the usual preliminary contract. Obviously pleased at his success in the negotiation, he condescended to ask me to help his secretary in this routine work.

Needless to say, the contract, signed in duplicate, specified the price as "$500,000," with the important symbols "U. S. Cy." after the figures. In a few days the deeds were prepared and Licenciado Sanchez was the gainer, above his asking price, by $200,000 "U. S. Cy."

The whole story was too good to keep, and soon I was told that it had reached the ears of Ketchum. What he thought of the affair he never said, as far as I know.

But this is not the end. A few weeks after the transaction had been closed I received a telegram from Ketchum, then in New York, accompanied by a substantial amount, also by telegraph. The message asked me to come to New York to meet Ketchum. I did not know what Ketchum wanted, but as there was no reason why I should not accede to the request, I accepted his invitation.

When I met Ketchum in his capacious New York offices, he did not mention Licenciado Sanchez, nor the part which I had played in the business transaction by which my client had gained a small fortune. He asked me if I would take charge of "La Predilecta" mine at a most attractive salary, and added that if I would accept the position, he would make a contract to give me a half interest after the property had paid him back "five hundred thousand dollars, United States currency," dwelling upon the last three words.

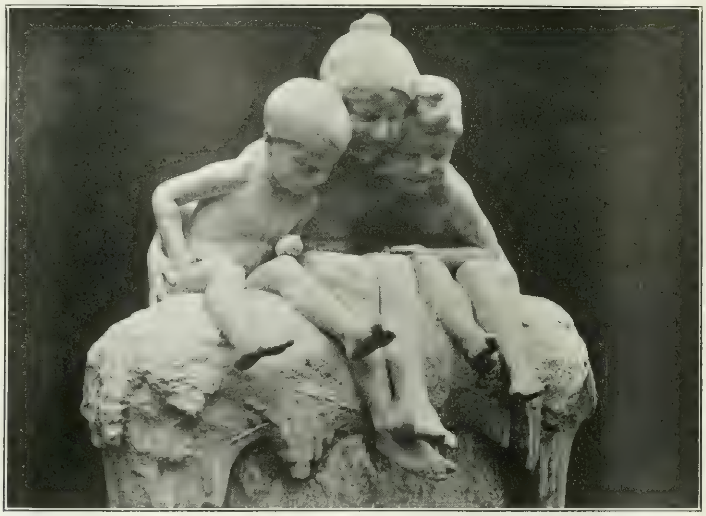
That is how I came to have an interest in "Mina La Predilecta."

Hazards From Arsenous Oxide in Copper Smelting

An article on "Perforations of the Nasal Septum Due to Inhalation of Arsenous Oxide," by Dr. Lawrence G. Dunlap, in the *Journal of the American Medical Association* of Feb. 26, 1921 (pp. 568, 569), and reviewed in the *Monthly Labor Review*, gives an account of the hazard from arsenous oxide to which many workers in copper-smelting plants are exposed. Volatile gases, principally arsenous oxide and sulphur dioxide, are given off in the process of copper smelting. When Cottrell treaters are used for recovering the arsenic, about 75 to 90 per cent of the recovered precipitate is arsenous oxide. If a higher-proof arsenic is required, this 75 to 90 per cent arsenic is treated in a refining furnace and the fumes are deposited in arsenic kitchens, where at about 420 deg. C. the arsenic is deposited in a fine white powder which is 99 to 100 per cent pure, although there may be lumps which require grinding. The men at the treaters, the loaders, railway crews, dumpers, furnace men, refiners, kitchen wheelers, and men barreling all come in contact with tons of the arsenous oxide daily. We quote from the article noted:

"This arsenic dust is breathed into the nose and, coming in contact with moisture, forms arsenous acid, which causes necrosis of the septal mucosa at Kiesselbach's area. The traumatism of the air currents alone often keeps this portion of the septal mucosa irritated, especially if there is a deflection or ridge of any sort. A white, slightly elevated area about 5 mm. in diameter develops. If proper care is taken to protect this area with a camphor-menthol-liquid petrolatum mixture on cotton, the condition will resolve to normal. However, most workmen neglect the condition till there is a perforation of from 7 to 10 mm. through the mucosa and perichondium down to the cartilage on one side. Even at this stage the process can be controlled by persistent local medication. If this is not done, the other side of the septum undergoes a similar process of necrosis and the cartilage disappears from distrophy. The 7 to 10 mm. area of cartilage rarely comes out en masse."

Some cases, it is stated, present a spontaneous physiologic cure. Failing this spontaneous cure, the case becomes one for surgical attention. In regard to preventive measures the writer states that prophylaxis by wearing a gas mask is not feasible for workers on an eight-hour shift, and nose guards and respirators result in a severe dermatitis by causing an accumulation of moisture where they come in contact with the skin, and cotton plugs in both nostrils cause pharyngitis and laryngitis. Camphor-menthol ointment and "baghouse" salve (ferri hydroxidum cum magnesii oxido) are said to be efficient prophylactics if used constantly by those exposed to the conditions noted.



"JEUNESSE," BY MAX BLONDAT, DIJON, FRANCE, THE ORIGINAL OF THE GROUP ON THE DOUGLAS MEMORIAL FOUNTAIN AT NACOZARI

The Douglas Memorial Fountain at Nacozari

By Leslie Cauldwell

Written for *Engineering and Mining Journal*

IN 1918, at a picture show held by a group of American artists in Paris, I exhibited some pastel studies of French soldier types. My pictures attracted the attention of James S. Douglas, and later, when we met as Red Cross workers, I asked him up to my studio. On my staircase walls were a number of water-color drawings made in connection with my profession as architect-decorator, and these drawings led to the following conversation:

Mr. Douglas told me that he had but lately lost his father, Dr. Douglas, and that his brother and sisters wished to erect a memorial to their father's memory in the little mining town of Nacozari, in Mexico, which Dr. Douglas especially liked. Then Mr. Douglas fixed me with a twinkle in his eye and asked me whether I would consider the idea of going out to Douglas, Ariz., and from there into Mexico to put up this memorial, which was to be a copy of a fountain he had seen at Dijon, France.

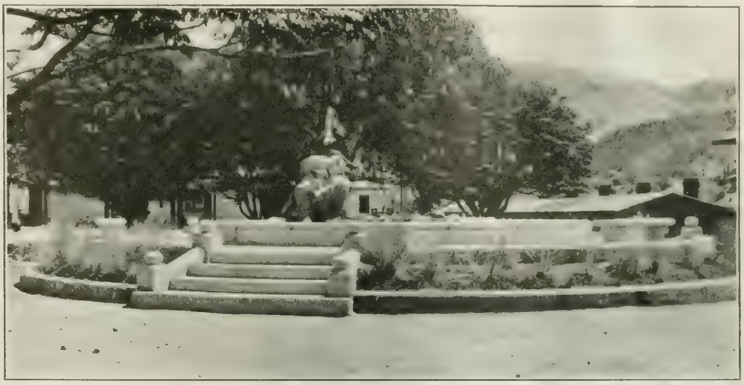
At first the thought of leaving my delightful studio in Paris and going out to what I imagined to be "the wild and wooly West" nearly took my breath away. Yet, at the same time, the idea appealed to me as interesting, and as fulfilling a long-cherished desire to visit that great southwestern country of my native land.

The difficulty was that Mr. Douglas did not know by whom the bronze group was made. He had seen it at Dijon: that was all. But, as luck would have it, a young French lieutenant, for whom I was godfather during the war, was going to transfer to an African regiment at Casablanca, and asked me to dine with him on the evening of his departure and meet his aunt and his very pretty fiancée. I accepted! One would do so for less.

The fiancée was indeed pretty, and—she came from Dijon. It did not take me long to find out that the author of the bronze group in Dijon was Max Blondat, the great French sculptor. It was an easy matter then to get in touch with Max Blondat, and after an exchange of letters I was commissioned by Mr. Douglas to order the group to be cast in bronze by the *cire-perdue* process, the most artistic and the most costly.

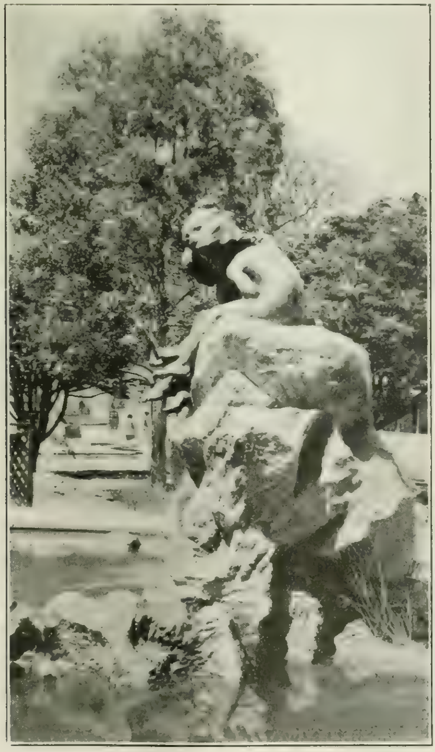
The *cire-perdue*, or "lost wax," process was that so much employed by the great Renaissance sculptor Benvenuto Cellini in the sixteenth century. In it, the original wax model made by the sculptor is covered by successive layers of clay, and when sufficient thickness is obtained, this mold, into which copper pipes have been cleverly introduced, is put in the kiln, at such and such a temperature, and all the wax runs out, leaving a perfect mold. Other tubes previously placed are then used to fill with molten bronze the mould thus emptied. Thus you have the direct touch of the sculptor in the bronze—which quality is often lost by other and more commercial processes.

It was part of my business to go to the foundry of M. Valsuani in the far away Mont Rouge quarter of Paris and make arrangements for this casting. But in the meantime I had received a blueprint showing the Plaza of Nacozari. "Here was the Garcia monument; here the bandstand, and this other square was where the fountain would be placed."



THE FOUNTAIN IN THE PLAZA AT NACOZARI

The ground was apparently absolutely level. To my Paris ideas of the West there was nothing unusual in this, but I realized that the little stone basin which formed the fountain of Dijon would be lost in this public square like a postage stamp on a table cloth. So I wrote to Mr. Douglas and suggested a new plan for the basin, and in Mr. Blondat's studio had made a *maquette*, or plaster model, to scale after the sketch I had modeled in clay, and shipped the *maquette* off to Arizona. In my plan the group of children, as at Dijon, are seated on a high rock from which the fountain gushes out. The frogs at which the children are looking, instead of being placed on the curbing of the basin, are on a small rock emerging from a little pool out of which the water falls into a large circular basin about 21 ft. in diameter. This basin is surrounded by an 8-ft. stone walk which is elevated above the level of the park about 3 ft. This walk is reached by three flights of stone steps, the number three being at the request of Mr. Blondat. The stone steps are connected by a circular stone curbing which incloses a band of rich soil slanting to the upper level of the steps. In this band will be placed hardy plants to form a circle of green about the fountain and reduce the seeming importance of the stone work. It is this model that I have been putting up in Nacozari.



THE BRONZE GROUP AT NACOZARI WAS CAST IN PARIS

On my arrival at Nacozari the night of Nov. 24, 1920, there being no one to meet me at the station, I wandered off in what seemed the right direction, and almost immediately came upon a high circular fortress which looked for all the world like the large Bosch pill-boxes I had seen in the Argonne. My Parisian stone carver, Monsieur Ratti, was with me; and, I said in French, "My God, that is the fountain!" "Never!" he replied; "It is at least five feet high."

But it was the cement foundation for the fountain, only the ground, instead of being perfectly level, as shown in the blueprint I had in Paris, slanted about two feet from back to front.

That night at the hotel I tossed and tossed, always coming up against the fortress fountain, until I found the solution of the problem and slept. The next morning I met Mr. Hamilton and Mr. Irwin, and they confessed that the aspect of that cement wall had demoralized them and that they had stopped all work until I arrived. I showed them a sketch I had made to obviate the difficulty by raising the level of the park and having steps leading to the street, and with their approval I wrote at once to Mr. Douglas on the subject. This change of level made it necessary to alter the entire layout of the park, and so I made a new plan, which Mr. Douglas accepted, thus making a setting for the fountain worthy of the bronze by Max Blondat.

This bronze, as I mentioned, represents three little girls sitting on a ledge of rock overhanging a cascade and pool of water. They are looking down at three frogs which have snuggled together on a stone and are gazing up at the children. The oldest child, about ten years old, is frankly amused; the second, about six, is smiling also; but the little tot, not yet three, is not quite sure about the situation.

Max Blondat calls his group *"Jeunesse"*—"Youth." I call it the "Fountain of Smiles," for no one can stop and look at this *chef d'oeuvre* without a sunny smile creeping from eyes to mouth. Old Mexican men and women, young girls and youths, mothers, fathers and school children, all feel the spirit of guileless happiness the group imparts.

The material difficulties in building the fountain were removed as far as possible by Mr. Hamilton and Mr. Irwin. The limestone had been cut to my plan by the John A. Rowe Cut Stone Co. of Bedford, Ind., and shipped to Nacozari. But there were of course stones to be prepared on the spot, and it was, as we say in Arizona, "some job" to educate a miner into being a good stonecutter who respected the edges of moldings and finish of surface; but even that has been accomplished.

BRONZE TABLET ON FOUNTAIN

The last wonder of all is that we are going to be able to cast in Nacozari, after the details made from my sketch, the copper lamp posts to light up the fountain and park. Near the top of each are four jolly little dolphins which wriggle downward with their tails in the air. They carry in their mouths bronze rings, which are mobile, and strung from these, from post to post, will be hung garlands of tiny lamps on the nights of *fiestas*, so that through the branches of the pepper trees they will look as if a multitude of fairy fireflies had come to dance a *saraband* about Max Blondat's group and invite the three bronze children to step down and join the fun.

Home-Made vs Standard Milling Supplies

In a contribution to the *Bulletin* of the Institution of Mining and Metallurgy, T. E. Stevens agrees with statements recently made by T. A. Wraight that the best and standardized mining and metallurgical supplies are not always the most economical. Mr. Stevens mentions the large amount of locally made steel-mill spares, especially stamp-mill and ball-mill parts, which have come into use in Australia during and since the war. Taking into account the work done and the cost, the material of local manufacture has usually proved cheaper than that formerly imported.

In contrast to this Mr. Stevens mentions the use of manganese steel cam shafts. At one plant containing a battery of fifty 1,250-lb. stamps, the 5-in. fagoted iron shafts of local manufacture were replaced with a similar size made of manganese steel. The life of the iron shafts seldom exceeded six months, but no breakage of the steel ones has yet taken place, although some of them have been in use for four years. The cost of the manganese steel is at least three times that of the iron, but it is the most economical to use.

At Kalgoorlie, balls for use in ball mills have been locally forged out of discarded battery shoes and dies, and have given equally as good service as imported balls. The scrap metal used was largely imported forged steel. Cast iron is the most economical material to use for battery dies at several plants with which Mr. Stevens was acquainted, although those plants had foundries attached.

No Wage Reductions Tolerated by Mount Lyell Miners

American copper producers feel that their lot is a hard one, but they may be thankful that they do not have to operate in Australia, where Labor reigns with a capital L. It is hard to imagine a fairer or more earnest appeal than the following, which was circulated among the employees of the Mount Lyell company in South Australia at Easter:

> The price of copper is beyond the control of any influence in Australia, as the commonwealth only produces less than 3 per cent of the world's consumption. The board has approved of further expenditure to increase the efficiency of the plant, and the staff is considering every point where further improvements can be made. There is no hope of meeting the present financial loss without a reduction of wages and salaries and a rearrangement of hours of working. Such a course cannot be undertaken without the full co-operation of the employees, and the directors desire to secure such co-operation.
>
> The directors invite the consideration of two main points: (1) The introduction of the forty-four hours' week underground at the mines has been a most wasteful arrangement, and it is satisfactory neither to the company nor its employees. The directors suggest for consideration a trial of eighty-eight hours a fortnight, forty hours one week and forty-eight hours the other. This will increase the output of ore without increasing the costs, and will give the underground employees the benefit of a full day off on alternate Saturdays. At present Saturday is a hotch-potch. (2) A reduction in wages and salaries ranging from 10 to 15 per cent of the equivalent. This proposal is made with the greatest regret, and only after endeavoring in every way to avoid it. The directors fully recognize what it means, but there is no other method of meeting the situation. In the United States mines have only been enabled to continue operations by reducing wages generally by about 20 per cent.
>
> Even if these two suggestions are adopted the shareholders will still be left without any return on their capital, and the company will still have to carry a loss. The company is willing to bear this loss so long as the financial conditions permit for the sake of holding the industry together and preserving the interests of the employees and all that this means to the people of Queenstown, Gormanston, Linda, and the surrounding districts. As a preliminary step a conference with representatives of the unions in the district has been held this afternoon, and further conferences will be necessary to consider all the conditions of working that are necessary to the continuation of the industry at Mount Lyell. It is only with the greatest reluctance that the board can contemplate the closing of the company's mines, but unless some arrangements along the lines suggested are agreed to at an early date, they will have no other option.

Chemical Engineering and Mining Review, from which we clip the above, follows this appeal with the laconic statement, "The men have decided not to accept the suggestions."

Trade Notes on Bauxite[*]

American and European Specifications for the Mineral as Utilized in the Chemical Industries—Field Tests and Manifold Uses of the Material—Organization of the Markets

BY J. COGGIN BROWN

BAUXITE is a clay-like hydroxide of aluminum regarded by some writers as a definite mineral species, having the empirical formula $Al_2O_3.2H_2O$, corresponding with $Al_2O_3 = 73.9$ and $H_2O = 26.1$ per cent. Chemical analysis shows that it rarely has this composition. It is usually found to be intermediate between $Al_2O_3.H_2O$, a mineral known as diaspore, and $Al_2O_3.3H_2O$, or gibbsite. It seems, in fact, to be a mixture of these two hydrates of aluminum in an amorphous condition. Between bauxite and laterite there is no sharp dividing line. Laterite is essentially a mixture of ferric hydroxides, aluminum hydroxides, and free silica in varying proportions. Detrital laterites are often contaminated with mixtures of clay and sand. The laterites have been divided chemically into the following three groups:

1. Laterites (including bauxite laterites) with 90 per cent or more of the hydrates of aluminum and iron.
2. Argillaceous laterites, in which these hydrates total from 50 to 90 per cent.
3. Laterite clays, with less than 50 per cent of the two hydrates.

These groups are again subdivided on the basis of mineral composition, but this need not be considered here.

The hardness, color, density, and composition of the commercial bauxites varies. In general it may be said that the material never shows any indication of crystalline structure, being compact or earthy, or often with a concretionary (oölitic or pisolitic) structure. Rarely it exhibits a granitic appearance. It may be solid and clay-like or hard and massive. The softer kinds may become harder on exposure. Its color ranges through shades of red, brown, gray, and yellow to white. The creamy and buff to yellowish tints are common in India.

FIELD TESTS

It is not easy to distinguish bauxite from clay. The former is said to granulate when rubbed between the fingers, instead of becoming plastic, and a soft bauxite to vary in its degree of granulation or plasticity according to the proportion of bauxite to clay, or, in other words, of hydrated alumina to hydrated silicate of alumina, contained in it. An American writer states that some measure of the relative quality of dried bauxite can be had by grinding a sample in an agate mortar for half a minute. A bauxite of good grade will be found hard to grind, and will stick to the mortar with such tenacity that it will have to be scoured out; a poor bauxite, or a bauxite clay, will grind much more easily and will stick little if at all. Clay or kaolin grinds with ease and does not stick to the mortar. Similar results are obtained if the sample is rubbed on glass; the glass will not be scratched even by high-grade bauxite.

Although such rough tests, coupled with the general pisolitic or round shot-like appearance, set in a fine-grained matrix, may serve to distinguish some kinds of bauxite in the field, it cannot be too strongly insisted that the only way to determine the quality of the mineral is by careful analysis. This must show not only the total quantity of alumina present, but also the silica, iron and titanium oxides, and water.

METALLIC AND CHEMICAL APPLICATIONS

The chief uses of bauxite are as follows:

1. In the manufacture of aluminum.
2. The purer varieties of bauxite are used in the preparation of salts of aluminum, notably of alum and aluminous sulphates. These are employed in water purification, dyeing, tanning, and for various other minor purposes.
3. In the manufacture of artificial abrasives. These are made in the electric furnace—notably at Niagara Falls—by fusing calcined bauxite. The product obtained is really a form of crystalline corundum, which is marketed under various trade names, such as "alundum," "aloxite," and others. The quality of the product is said to be under complete control, a factor of considerable importance in any abrasive industry. In 1918 approximately 112,908 long tons of bauxite were used for this purpose in the United States.
4. In the manufacture of bauxite bricks for furnace linings. The purer the bauxite used the more refractory is the resulting product. These bricks are said to be replacing the more costly magnesite and other refractory materials, and are made by mixing calcined bauxite or high-alumina clay with a bonding material such as fireclay, sodium silicate, and lime. Another class of high-alumina refractories is made by the electric fusing of bauxite. There is an increasing demand for them in the United States for the construction of various furnaces and cement kilns, and on account of the recent progress in the chemical industries.
5. As a filtrating medium for the decolorization and refining of mineral oils and various organic substances.

The only statistical data obtainable as to the amounts of bauxite used in the different industries are those of the United States. For 1918 they were as follows:

	Per Cent of Total Bauxite Output
Aluminum manufacture	69
Chemical manufacture	10
Abrasives manufacture	19
High-alumina refractories	2

ANALYSES OF GREAT IMPORTANCE

Bauxite is graded according to its chemical composition and is sold to consuming industries on the basis of its analysis.

The French bauxites are roughly classified into red, white, and siliceous groups. The red bauxite owes its color to ferruginous impurities, and is used in the manufacture of metallic aluminum. The white bauxites are employed in the preparation of aluminum salts and refractory materials.

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[*] Abstracted from the February, 1921, *Journal of Indian Industries and Labour.*

According to Pitaval and Ganet, who wrote in 1913, bauxites for aluminum manufacture are often obtained by mixing pure and impure materials. Their composition, carefully fixed by analysis in each particular application, may vary between certain limits, which are usually as follows: The average percentage of alumina is from 57 to 60 per cent, but it may reach 75 or even 80 per cent. The number of units of alumina above 60 gives rise to a bonus paid by the buyer. The percentage of silica must not be over 3 per cent. When it is below 2 per cent the buyer pays a bonus in proportion to the decrease. The percentage of iron oxide may be between 10 and 15 per cent or even up to 25 per cent. Above 15 per cent the seller generally accepts a reduction in the price for each supplementary unit of Fe_2O_3. Finally, bauxites contain 10 to 20 per cent of water, 1 to 2 per cent of titanic acid, with a little lime, magnesia, and organic matter.

General conditions of the sale of French bauxite for aluminum manufacture are as follows:

Al_2O_3 equal to or greater than 57 per cent. Above 60 per cent, a bonus of 0.20 to 0.40 fr. per unit.

SiO_2 equal to or less than 3 per cent. Below 2 per cent, a bonus of 0.20 fr. per $\frac{1}{10}$ unit, maximum 3 per cent.

Fe_2O_3 equal to or greater than 14 per cent. Below 14 per cent, a penalty of 0.20 fr. per unit; maximum 17 per cent.

American practice limits bauxites of commercial grade to at least 52 per cent of alumina. It is stated that low contents of silica and titanium are essential to the makers of metallic aluminum, but the iron content may be fairly high. Bauxites low in iron and titanium are preferred by the chemical manufacturers who produce alum and aluminum sulphate. Makers of artificial abrasives appear to be able to use lower grades containing larger amount of silica and iron oxides than are permissible in bauxite for other purposes, though abrasives are also made from bauxites low in silica and iron. The bauxite required for refractory purposes must be low in iron. Current American specifications follow:

For bauxite containing about 52 per cent alumina, less than 2 of iron and up to 20 per cent silica, and artificially dried to contain not more than 4 per cent free moisture, \$10 per gross ton at mine; 54 per cent Al_2O_3 and about 15 per cent SiO_2, \$11; averaging 57 per cent Al_2O_3, 8 to 12 per cent SiO_2, less than 3 per cent Fe_2O_3, \$13 on basis of 8 per cent free moisture. Ores of low silica content suitable for manufacture of aluminum oxide and hydrate of alumina command a fancy price.

One of the large English aluminum-producing concerns states that the grade of bauxite most suitable for aluminum manufacture should contain:

	Per Cent
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

Another company, also engaged in aluminum manufacture, writes that bauxite used for the production of aluminum should contain a minimum quantity of silica. It is generally stipulated that it shall not exceed 3 per cent.

[illegible]

cent. The alumina content should be from 55 to 60 per cent.

A large firm of English alum makers states that for the production of aluminum sulphates a quality of bauxite containing a minimum of iron and a maximum percentage of alumina is desired. The following may be taken as a representative analysis of a satisfactory quality:

	Per Cent
Alumina	60
Ferric oxide	3
Insoluble acid	12 or less
Combined water	25

Another firm of manufacturing chemists regards the most suitable grade of bauxite as one of the following typical composition:

	Per Cent
Alumina	60–65
Ferric oxide	5 maximum
Silica	10 maximum

It is, however, willing to consider lower grades, containing, say, 50-55 per cent of alumina.

A third chemical firm writes that as there is at present a plentiful supply of bauxite to be found in Europe, any material from overseas would be of interest only if it was of a high quality; that is, containing 60 to 65 per cent of Al_2O_3 or more, and less than 1 per cent of SiO_2. The price of course would have to compare favorably with the present price of European bauxite.

The large aluminum-producing companies of the United Kingdom control their own bauxite mines. As far as can be gathered, when such concerns purchase ores from external sources no general form of contract is used. A price is fixed, for a given analysis, and a unit price fixed for each per cent of alumina and silica above or below both figures. Test samples are taken by both seller and buyer, and in the event of dispute the analysis figures given by a chemist of standing are accepted by both parties. Payment is usually made on presentation of the documents in London.

Bauxite for other purposes, as, for example, for use in the manufacture of aluminum salts, is bought under contract, and the period covered is arranged between seller and buyer. Such contracts generally guarantee a percentage of Al_2O_3 and SiO_2, with possible allowances of a stated per cent above or below the figures agreed upon. Delivery dates are given and shipping weights taken as a basis. The usual "Force Majeure Clause," as recognized by merchants in the United Kingdom, is added. It is customary to weigh and sample the mineral during discharge of the steamer at the port of destination, and an English chemist of repute is appointed to settle the analysis.

Payment is made at the price per unit of Al_2O_3 in the mineral, "as delivered," per ton of 2,240 lb.

The French bauxites are sold to French and other manufacturers of aluminum. These manufacturers, including the foreign ones, own nearly all the bauxite deposits of France. Direct sales are mainly to the United States and Canada.

Besides the large producers, there are many small operators, for the mineral is easily won and anyone may open a quarry, after making a simple declaration to the authorities.

French business methods, both for deliveries at home or abroad by rail, demand full settlement of bills without discount within thirty days of the end of the month of delivery, and in the case of deliveries by sea, either in France or abroad, payment of 80 per cent of the total cost, free of discount against the bills of lading, and the remainder immediately after receipt of the merchandise at the unloading port.

The weights taken are those in the trucks at the point of departure in the case of rail-borne bauxite, and those inscribed on the bills of lading for sea-borne mineral.

Sampling by both parties is done at the point of departure, and analysis on the mineral dried at 100 deg. C., with no deductions for moisture. In cases of dispute a second analysis is made, for which both parties pay.

The market for bauxite in the United States of America is east of the Mississippi River, and the largest consumers are situated in or near the cities of East St. Louis and Aurora, Ill.; Detroit, Mich.; Cincinnati, Ohio; Knoxville, Tenn.; Philadelphia and Erie, Pa.; Niagara Falls and New York City, N. Y.; and Boston, Mass. Of recent years a number of small plants for the manufacture of aluminum sulphate for local use in water purification have been installed by municipal water works in the various states.

The only publication with which I am acquainted regularly quoting the market prices of bauxite is the *Engineering and Mining Journal*, of New York.

The price received for bauxite in 1919, as reported by the producers, and as given in an official publication of the U. S. Geological Survey, ranged from $5.45 to $12 per ton, the average being $5.85 per long ton at the shipping point. This price is much below the open market rates which ruled during the period. It is explained by the fact that in the United States, as elsewhere, the larger consumers work their own mines, and the value assigned to the output is merely an arbitrary one, presumably being based on operating costs.

CHIEF SOURCES OF SUPPLY

The bauxite deposits of commercial importance in the United States of America are situated in Arkansas, Georgia, Alabama, and Tennessee. The Arkansas deposits were discovered about 1887 in Pulaski and Saline counties. They have an average thickness of 10 to 15 ft., are closely associated with syenite intrusive rocks, and are overlain by Tertiary materials. The ores are high grade, and have supplied 80 per cent of the bauxite mined in the United States.

The Georgia deposits are found near the margin of the Coastal Plain, about thirty miles east of Macon. They form beds up to 10 ft. in thickness and are overlain by sands and clays. Georgia bauxite is more suitable for the manufacture of chemicals than for other purposes.

Magnesite Production Almost Double in 1920

The production of magnesite in the United States in 1920 increased 94 per cent in quantity over that of 1919. The entire output was made by two states, California and Washington. California mined more than eight times as much as it mined seven years ago. Washington increased its production 109 per cent over that of the preceding year, making by far the largest output it has yet made. The accompanying table, compiled by the U. S. Geological Survey, shows the production by states.

Most of the output of California was calcined and used as plastic material, only a small part being natural ferromagnesite used as a refractory lining of steel furnaces on the Pacific Coast. On the other hand, practically all the magnesite mined in Washington was dead-burned into synthetic ferromagnesite and used as a refractory lining for furnaces and settlers.

The largest producers in California were the Tulare Mining Co. and the Sierra Magnesite Co., at Porterville; the White Rock mine, operated by Frank R. Sweasy, in Napa County, and the property of the Western Materials Development Co., on Red Mountain, operated by C. S. Maltby.

CRUDE MAGNESITE PRODUCED AND SOLD OR TREATED IN THE UNITED STATES, 1913–1920

	California		Washington	
Year	Quantity (Short Tons)	Value	Quantity (Short Tons)	Value
1913	9,362	$77,056	. .	.
1914	11,293	124,223		
1915	30,499	274,491	.	....
1916	154,259	1,388,331	715	$5,362
1917	211,663	2,116,630	105,175	783,188
1918	84,077	761,811	147,528	1,050,790
1919	50,020	504,973	106,206	743,442
1920	81,782	1,083,262	221,985	1,664,888

The Northwest Magnesite Co., of Chewelah, Wash., was the largest producer in the United States. It shipped in 1920 more than 90,000 tons of dead-burned ferromagnesite, most of which was sent to steel companies and manufacturers of refractory products east of the Mississippi. The American Mineral Production Co., of Valley, Wash., sold its output crude to the Northwest Magnesite Co., whose quarries are near by. The Western Materials Co. operated the Double Eagle magnesite mine, near Valley, and shipped the calcined product to the American Refractories Co.

At the end of December, 1920, all the operations in Washington were stopped, principally, it is believed, on account of a lack of orders from the steel companies, many of which were idle or were not working full time. Some of the California producers were discouraged at the end of the year on account of the high cost of labor and supplies, the high freight rates, and by the belief that there will develop formidable competition of foreign material.

The imports of magnesite in 1920, reported by the Bureau of Foreign and Domestic Commerce as calcined, not purified, amounted to 43,154 long tons, valued at $780,078. These imports came from the following countries:

MAGNESITE IMPORTED INTO THE UNITED STATES, 1920

From	Quantity (Long Tons)	Value	From	Quantity (Long Tons)	Value
Austria	. .	$4	England.........	28	3,511
Germany........	713	28,566	Scotland.........	190	13,720
Italy............	21,185	241,220	Canada..........	6,028	184,060
Czecho-Slovakia.	3,829	126,827	Mexico	500	6,300
Greece..........	4,000	38,418	Venezuela	2,300	11,500
Turkey in Europe	3,528	70,540	Australia........	34	417
Netherlands.....	819	54,891	Str'ts Settlements	. .	4
			Total.........	43,154	780,078

The magnesite imported from Italy was mined in Austria, and that from Czecho-Slovakia was obtained from the former Hungarian deposits. That imported from Mexico came from Santa Margarita Island, and was calcined near San Diego, Cal. A shipment from Greece received in November was the first sent from that country since 1916. The arrival of 2,300 tons from Venezuela in September, 1920, was a notable event, as the recorded imports of magnesite from that country are meager.

Although the quantity of magnesite imported in 1920 was nearly three times as great as in 1919, it was only about one-seventh of the quantity commonly imported before the war.

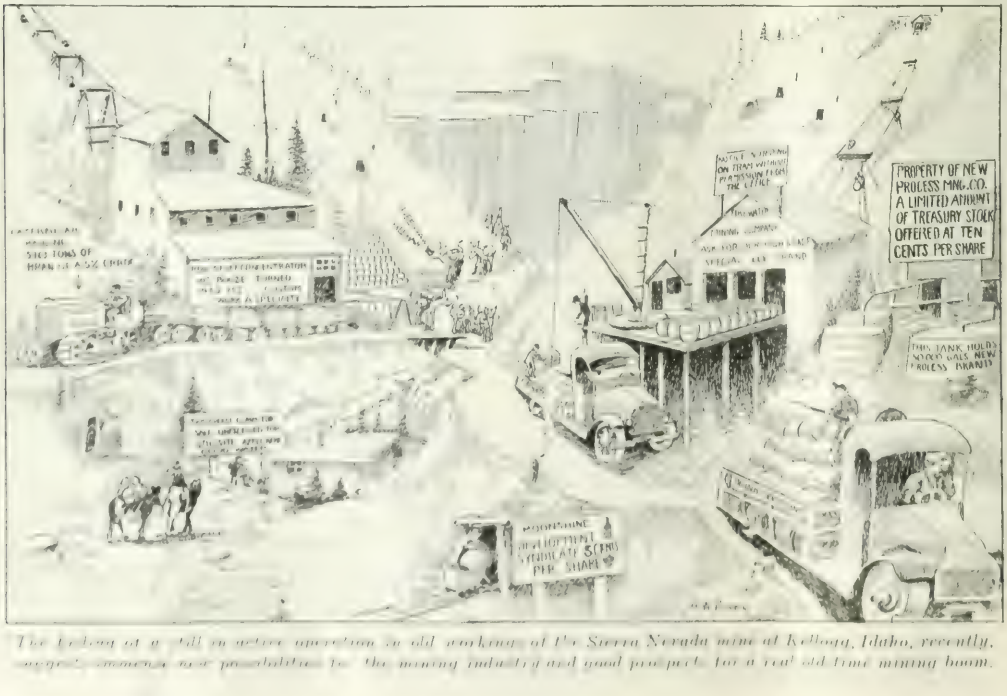
BY THE WAY

An Optimistic Phenocryst

"Things are down in mining," said old Birdseye Porphyry, as he shifted his chair and glanced out of the window down the almost deserted street. "Copper's down, the Germans are selling their zinc here and have knocked the tar out of the zinc business, and if it weren't for the cousinly action of silver in parading out of the mine with lead, there wouldn't be any work in some bang-up lead mines. Our friend George Otis Smith is praying for people to buy coal. The coal miners are going to movies and listening to phonographs and just working enough to remember where the mine is. What's it all coming to, Phenocryst?" "Well, it strikes me you're a misanthrope and a trifle petrified this morning," said Phenocryst Jones as he stared coldly at his questioner. "Haven't you got the Pittman Act and dollar silver? How about the $20.67 for an ounce of gold. That's not down, is it? I heard you raving about the low metal prices the last time you read the market report in the *Journal*. Do you expect that metal prices are always going to be high enough to pay handsome profits every minute of the year? How about the farmers and the horticulturists? The lemon growers of California aren't having a cheerful time looking out of their back windows at the kind of lemon handed to them. There are a lot of people in the same stew as the miners. Now, you old horn-rimmed, joy-killing piece of pyrite, come out of your vug and chase a smile over your face. Life wouldn't be worth living if there weren't some ups and downs. Copper, lead and zinc have had a fine big up; now they're down. The gold miners were so far down that they were yelling to McFadden to bring on the oxygen. Now they're perking up, and some folks are wondering why they ever quit gold mining. Prices are beginning to get weary, roosting on the top rungs of the economic ladder, and are going to join their metallic confrères on the ground floor soon. Harding and Hoover are just getting their sleeves rolled up and have started the fires in the national kitchen range. Soon they'll have the chimney red hot, and then some of you frozen-up pessimists will be taking your coats off and going to work. Anyway, don't you think it's time we were mucking out that shaft? Rock won't walk out of the mine, and a little elbow grease is going to cheer you up and stir up your liver. Let's go! Come, sweat out your liver and bacon in twisting that windlass."

Where Ignorance Is Bliss

" 'Ere's a bit I over'eard tha h'other day, m'son,' said' Cap'n Dick. "Jan Trevarthan and Tommy Penglaze were walkin' 'ome from shif', w'en Tommy sez to Jan, 'Look ee 'ere, Jan; I got sumthin' to tell 'ee, an' I do pray thee won't be put h'out baout un. But let me warn thee to keep tha bloody shades daown w'ile thee art raoun' tha 'ouse at night.' Jan, ee flares right h'up, an' sez, 'Wot's thee got to say baout un?' 'W'y I'll tell ee,' sez Tommy. 'Tha h'other h'evenin' I wuz a'passin' o' tha 'ouse, an' I see thee in a h'upstairs winda a'kissin' o' tha wife an' 'uggin' 'er too. Naow coorse that's h'all right for thee, but it h'aint nothin' for tha neighbors to be gapin' at.' 'Then so much tha fool be thee,' sez Jan, 'Gos on baout thy business. Tha shoe's on tha h'other foot, an' tha joke's on thee—I wuzn't 'ome tha h'other night.' "


NOTICE NO RIDING ON TRAM WITHOUT PERMISSION FROM THE OFFICE
PROPERTY OF NEW PROCESS MNG.CO. A LIMITED AMOUNT OF TREASURY STOCK OFFERED AT TEN CENTS PER SHARE
THIS TANK HOLDS 50000 GALS NEW PROCESS BRAND
MOONSHINE SYNDICATE 5CENTS PER SHARE

The finding of a still in active operation in old workings of the Sierra Nevada mine at Kellogg, Idaho, recently, suggests numerous new possibilities to the mining industry and good prospects for a real old time mining boom.

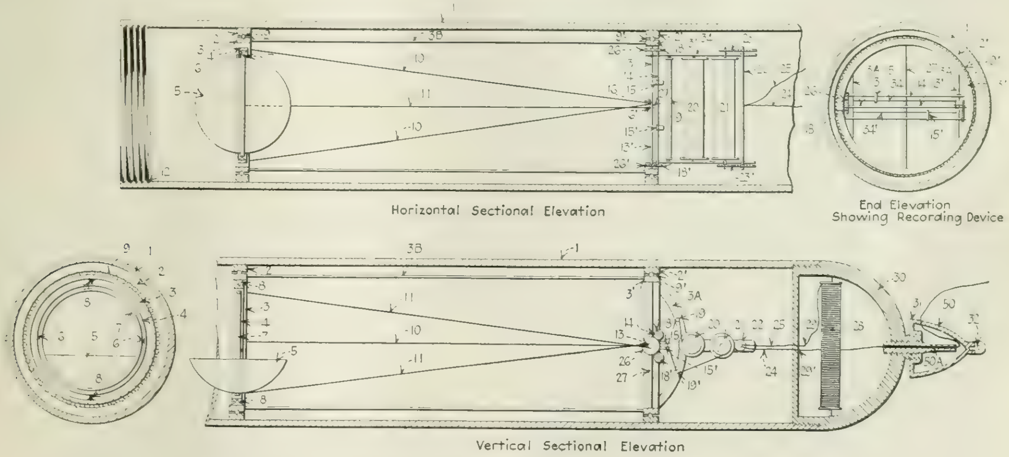
HANDY KNOWLEDGE

The Wuensch Bore-Hole Graviscope

By C. Erb Wuensch

Written for *Engineering and Mining Journal*

The bore-hole graviscope is a device proposed for automatically surveying and recording on a small paper ribbon the course of bore holes. At present bore holes, or diamond-drill holes, are seldom surveyed, because of the tediousness and expense of the work, as well as on account of the questionable accuracy of the survey. All methods thus far used for obtaining the course of bore holes depend upon the magnetic needle, which cannot be relied upon, because of the possibility of local attraction and difficulties due to oscillation. It is therefore evident that any device which would record the strike and dip of a bore hole accurately along every part of its length would have decided advantages over either the Oehman photographic, the George gelatin tube, or the Maas bore-hole compass method.



Horizontal Sectional Elevation

End Elevation Showing Recording Device

Vertical Sectional Elevation

FIG. 1 DETAIL OF WUENSCH BORE-HOLE GRAVISCOPE

The graviscope is nothing more than a new application of the principle of the plumb bob as used in clinometers. These instruments are used for determining the dip. The clinometer will always seek the maximum dip. The graviscope, however, differs from the ordinary clinometer in that it is mounted in a ring having two inner rings (gimbals) carefully pivoted at right angles to each other, which enables the plumb bob to seek the maximum dip regardless of the orientation of the instrument itself. In the ordinary clinometer the rotary movement is only in one plane, and to get the true dip it is necessary to orient the instrument in that direction.

The strike and dip are always at right angles to each other. By referring to the sketches of the graviscope, it can be seen that because of its construction (the plumb bob within two gimbals, with their mountings at right angles to each other) one ring will give the dip, whereas the other will give the strike by virtue of the fact that the plumb bob will always seek the maximum dip and orient the graviscope so that the axis through pivot, Part 8, will always be vertical. Therefore in passing the graviscope down a bore hole, the graviscope will seek the maximum dip, and hence there will be a relative movement between the two gimbals and the mounting. This relative deviation in strike and dip is recorded graphically on a paper ribbon by the use of two small stylographs.

As indicated in the accompanying sketch, the graviscope is inserted in a thin protecting tube, which incases it and supports the mechanism, Part 1.

Parts 2 and 2′ are rings with a small groove cut in them to act as a ball-bearing raceway, No. 9. These rings are made of various widths, so that the same graviscope may be inserted in bore holes of various diameters. Part 3 is a light metal frame with a groove cut in it so as to accommodate the ball bearings in the raceway of Part 2. This is made as frictionless as possible, so that the rings Nos. 3 and 3′ are free to rotate in any direction in the plane of the raceway. These two rings, 3 and 3′, are joined together by four light metal rods, 3-B, spaced at 90 deg. to each other. The purpose of these is to cause the two rings, 3 and 3′, to rotate in unison.

There are two jeweled bearing pivots, Part 8, mounted on Ring 3, which in turn are used to support the small gimbal, 4. Ring 4 contains the jeweled bearings, pivots No. 6, which serve as a mounting for the inner gimbal, Part 7. The lower portion of this gimbal contains the plumb bob, Part 5. This should be made of a metal of heavy specific gravity, such as tungsten or gold, so as to make the plumb bob as heavy as possible for a small volume of material. The form of the plumb bob is that of a segment of a sphere.

These taken together constitute the graviscope proper. Referring to the portion of the device at the other end of the tube which is used to record the movement of the graviscope graphically on a small paper ribbon, Ring 3′ contains the supports 3-A and 27. These are used to support the bearings of the various minute shafts such as 13, 14, and 34.

The paper ribbon on which the graph is recorded is wound on Roll 20. The paper ribbon is then drawn over the small Roll 19 down past the two stylographs 15 and 15′, then around Roll 19′ and back to Roll 21. Roll 21 is connected with a small shaft, 22, by virtue of the gears 23 and 23′. No 22 has a few turns of fine fish-line cord wrapped around it. This cord is mounted in a spindle, 28, which serves as a storage spool. For deep holes there may be several reserve spools, similar to 28, placed in series in the cap, 30. In this event, the cap, 30, would be more elongated. The thread is taken from Roll 28, passed through the small eye, 29, in the cap, 30, and then passed over the spindle, 22, back through small eyelet, 29′, and thence out of the cap, 30, through the duct, 50A, in Part 50.

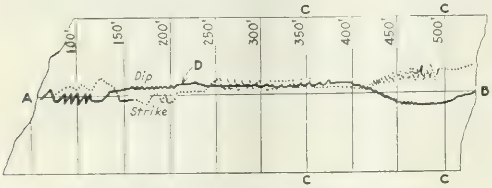


FIG. 2. SECTION OF PAPER RIBBON SHOWING HYPOTHETICAL GRAPHS

The purpose of the hydraulic diving bell is to prevent the water in the bore hole from entering the instrument and injuring the delicate mechanism.

By virtue of the fact that the tension (which causes the small Roll 22 to rotate) is applied through the center of gravity (through the eyes, 29 and 29′) the graviscope is able to operate without interference. The plumb bob 5 is of sufficient weight to cause the whole graviscope and recording device to be subject to its governing influence under the action of gravity. The loose end of the twine is fastened at the top of the bore hole; therefore as the device is inserted in the hole the thread is gradually unwound from the reserve spool, 28, and the shaft, 22, is rotated. This causes the paper ribbon to be fed from Roll 20 on to Roll 21. The gears, 23 and 23′, are of such sizes that there is a definite ratio between the amount of paper ribbon that is fed past the stylographs so that each inch of paper will correspond to a definite number of feet of hole traversed.

The movement of the graviscope is transmitted to the recording device thus: There are two sets of threads, 10 and 11. Set 10 is attached to Ring 4, which gives the course of the hole. Set 11 is attached to Ring 7, at a point at right angles to the pivots 6 and 6′. This set of strings records the dip of the hole. Therefore, by virtue of these strings, any movement of rings 4 and 7 will cause shafts 13 and 13′ to rotate. These in turn will actuate the small countershafts, 18 and 18′, which in turn cause the stylographs 15 and 15′, respectively, to move back and forth on the shaft. Shafts 18 and 18′ contain small threads of a steep pitch. The stylographs 15 and 15′, besides engaging the shafts 14 and 14′, engage simultaneously the shafts 34 and 34′. These prevent the stylus from rotating and hence cause a movement of translation rather than of rotation.

In Fig. 2 there is a paper ribbon showing the graphs. Line *AB* is the center line and corresponds to the course and dip of the hole at its mouth. The stylographs 15 and 15′ are both set so they will coincide with the center line as shown at *A*, regardless of the dip or direction of the hole. The transverse lines, *CC*, are those corresponding to a certain unit of length traversed. Therefore, it is possible to tell what the deviation is from the original course and dip of the hole as shown by the center line, at any point in the hole.

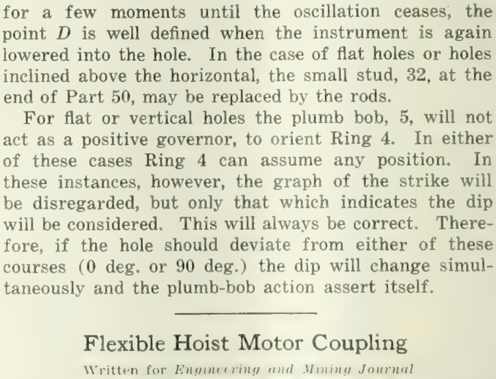
By having a set of calipers, properly graduated, one can tell the angular variation by measuring the distance the graphs are at any point from the center line. In this connection it might be well to call attention to the fact that, even though the plumb bob may oscillate, it will be easy to determine the true strike and dip from the graph. For instance, at the point *D* will be noted the oscillations on the graph of the dip. By allowing the apparatus to remain at a point in the hole for a few moments until the oscillation ceases, the point *D* is well defined when the instrument is again lowered into the hole. In the case of flat holes or holes inclined above the horizontal, the small stud, 32, at the end of Part 50, may be replaced by the rods.

For flat or vertical holes the plumb bob, 5, will not act as a positive governor, to orient Ring 4. In either of these cases Ring 4 can assume any position. In these instances, however, the graph of the strike will be disregarded, but only that which indicates the dip will be considered. This will always be correct. Therefore, if the hole should deviate from either of these courses (0 deg. or 90 deg.) the dip will change simultaneously and the plumb-bob action assert itself.

Flexible Hoist Motor Coupling

Written for *Engineering and Mining Journal*

At the Fremont Mines, Amador City, Cal., a simple flexible coupling was constructed and placed between the motor and the pinion shaft of the double-drum hoist. The motor is 200 hp. The bolt holes of one side of the coupling were enlarged from 1¼ in. diameter to 2¼ in. Special bolts were made, the upper part of the bolt next to its head being made of [illegible] in. greater diameter than the lower portion. A sleeve made of rubber hose was placed in the annular space between the bolt and the inner wall of the bolt hole, as shown. The coupling, designed by Edwin Higgins, cost $75.



FLEXIBLE COUPLING FOR HOIST MOTOR

THE PETROLEUM INDUSTRY

Our Future Oil Supply

By David White

Written for *Engineering and Mining Journal*

THE RECENT DISCUSSIONS of the oil resources of the world, of their political control, and, in particular, of the situation of the United States as to oil, have developed the existence of misapprehensions on both sides of the Atlantic. The confusion is due largely to the mental reaction caused by the close conjunction of the claims of British economists and statisticians, that Great Britain has acquired control of by far the greater part of the world's oil resources, with the statements of the political representatives of Great Britain that a small part only of the world's petroleum production is British, and that America holds a near-monopoly of the world's supply of oil. On casual consideration these contentions appear to be in radical conflict, but in reality they bear only the appearance of contradiction. Broadly speaking, both assertions are not far from the truth. One refers to oil for the future; the other to the oil now taken from the ground each year.

Britain Contends United States Controls 80 Per Cent of World's Petroleum

To the charge that Great Britain, through direct diplomatic action, through governmental co-operation, and even through partnership with her interlocking oil companies, has systematically and in some cases secretly been carrying out plans for the establishment of British dominance over the world's future oil supplies, the replies of the British spokesmen run along essentially identical lines. His Excellency the British Ambassador; Sir John Cadman, government Petroleum Administrator of Great Britain; Lord Curzon, and many British journalists and editors all dilate on the preponderant position of the United States in the world's petroleum production. They concentrate attention on the fact that the United States controls nearly 80 per cent of all the oil now taken from the ground, and on the surprisingly small amount, said not to be more than 4½ per cent, taken from British sources. They cite the vital need for assuring a supply for the British navy, for all time, under British control; and all this is said with the polite implication that the Americans are seeking to perpetuate a monopoly, and are unconsciously, of course, unsportsmanlike. These seductive statements have soothed the apprehensions of many American hearers, and have served as the foundation for many misleading American editorials. The real issue—the question of oil for America when our oil fields are exhausted—is so far as possible, skilfully dodged.

The direct statements kept prominently in view by the representatives of the British are essentially true. The United States in 1919 produced from her oil fields, or handled as commerce, about 82 per cent of the world's entire petroleum output, and owing to industrial and political conditions restricting the oil production of the European fields, our oil companies handled nearly 80 per cent of all the oil mined in 1920. It is most obvious that *at the present moment* the United States vastly predominates in the world's oil production.

Early Exhaustion of Domestic Fields Inevitable

Beyond this present picture of opulence in oil may already be seen, casting their shadows across the path of our prosperity, the rapidly approaching exhaustion of our own oil fields before most of the great oil reserves of the world are touched; our inevitable loss of world dominance in oil at a relatively early date; a waning exportation of oil products and its unfavorable effect on our trade balance; and the prospect that, even for a restricted consumption, we shall be compelled to shift to other countries for ever-increasing importations to meet our necessities, except in so far as help, possibly at high or commercially disadvantage cost, may come from oil shales. We must expect these things, face them manfully, and plan wisely, thoroughly, and promptly to meet them.

The losing of our dominance in oil has begun. The greatest menace, however, lies in the fact that American oil companies are excluded from over half of the prospective oil territory of the world outside of our own country; in the fact that much the greater part, probably three-quarters, of the foreign oil resources of the world, including concessions held mainly by companies under control of the British, the French, the Japanese, and the Dutch, are already inaccessible to us, the greatest portion by far having been gathered into the control of the British; and in the most important fact that to secure the oil for our great consumption requirements, for our industries, our commerce, our merchant marine, our navy, our air service, and our daily living, we may after a time be obliged to purchase largely from foreign companies under the control of a commercially competitive and conceivably unfriendly nation. In short, unless oil shale saves us at whatever economic handicap, the day is coming when our future in oil in no small part is likely to be at the mercy of a nation or combination of nations which at this moment are conniving not only to bring the oil fields of the Old World under their national control, but also, so far as practicable, to shut out our nationals from other regions, including the mandatory countries.

British Oil Companies Under Control of Government

The San Remo agreement is one document, once secret, but now in evidence of this fact. If there is known to be one such convention, may there not be other secret agreements inimical to our interests, not yet brought to light? Provision is made that stock holdings in the newer British oil companies, including those in which the British government is a partner, shall not pass from British hands. This bodes an evil day for the United States. If it is important to Britain that she assure herself of British control of adequate supplies of oil for her motors, her navy, and her merchant marine, as is absolutely logical and wise, is it not equally important that the oil on which the United States must depend be in the control of our nationals?

WASTEFULNESS AND OPEN DOOR POLICY IN PETROLEUM PROGRAM

The British spokesmen chide us for our waste of oil in the past, which some of them offer as an excuse for present British policies. That the United States has been wasteful is true. It has taken our people a long time to learn the lesson of the value of oil and of its importance in the advance of civilization—a lesson learned long ago by our mother country and put to profitable application even in the midst of hostilities. Our American fields were the first great oil fields of the world to be extensively developed. Widespread, accessible, and cheaply exploited, they have been drilled by an ever-increasing army of drillers, until for some years we have furnished the world with two-thirds of its annual supplies.

Meanwhile, in common with our copper, our iron, our coal, our silver, and other mineral deposits, oil territory in private ownership has from the first day been as open to development by the nationals of foreign countries as to our own citizens. Foreign owners of American companies and companies with American charters, but in the control of any other country, have until 1920[1] been as free as our own domestic corporations or nationals to buy, lease, and drill, even on the public lands of the United States, and to refine, transport, and market oil in this country or any other part of the world.

AMERICA'S RESOURCES DRAINED BY FOREIGN COMPANIES

The open-door policy is traditional in America. British, French, Dutch, German, Japanese, and Belgian capital has had a free hand in the development of our oil fields, and no inconsiderable part of our 1920 production, reported by G. B. Richardson, of the Geological Survey, to be approximately 443 million barrels of oil, was mined, transported, and sold over the world by British and British-Dutch companies. In fact, the amount of oil taken by foreign companies from our oil fields is nearly one-half as great as the total world's foreign production outside of Mexico.

British companies have organized and begun drilling operations in the Mid-Continent and Gulf oil regions since the San Remo agreement was secretly passed between the representatives of Great Britain and France, and American geologists in British employ were outlining oil territory in Palestine and other parts of Asia Minor probably while the Peace Conference was sitting in Paris.

One cannot exhaust his oil fields and expect them to fill up again any more than he can eat his cake and keep it too. So, after sixty years, during which the United States has contributed generously to the supply of the rest of the world, while developing an extravagant consumption capacity herself, we find that her oil fields can no longer be made to meet her requirements. A taking account of stock by the U. S. Geological Survey shows that although in 1920 we produced oil at the rate of nearly 450 million barrels, the requirements of the petroleum industry called for about 531 million barrels —i.e, for over half a billion barrels per annum. Unless curbed by industrial depression, the total requirements will be larger in 1921.

The oil remaining in the American ground and recoverable by present methods of mining was in 1919 estimated by the Geological Survey at about seven billion barrels—enough to meet the 1920 rate of requirements of the United States for thirteen years, if it could be mined and made available so rapidly for use, which of course is impossible. At the consumption rate of 1919, this would suffice for over eighteen years, but requirements increased more than 100 million barrels during the year. The estimates made by the Geological Survey, though formulated with great care and representing the combined views of a considerable number of oil geologists experienced in the study of the different regions of the country, are necessarily subject to revision by reason of the nature of the problem and the character of the available data. They are bound to differ from the final production, but it is unlikely that they will vary so much as two billions of barrels (enough to supply requirements for less than four years) from the truth; any difference is likely to be additional.

PROBABILITY OF QUANTITY OIL PRODUCTION IN CERTAIN AREAS INDEFINITE

Should Alaska far exceed our rough forecast, should the Permo-Carboniferous of Wyoming prove more widely productive than has been calculated, or should Utah and Colorado and western Washington disclose some surprises not compensated by corresponding disappointments in some of the other states, such an increase may be realized. Nine billions of barrels would satisfy our 1920 rate of consumption for less than seventeen years. However, the chance of discovering so much available oil in the ground must not be relied on. So large a recovery by present methods is possible, but to gamble on it is dangerously hazardous and unwarranted.

INCREASED PRODUCTION POSSIBLE BY BENEFICIATION

It will be noted that the Survey's estimates are based on present methods of recovery. If better methods of extraction of oil from the ground can be devised, and generally employed so as to increase recovery by so much, possibly, as 50 per cent, as is hoped by the U. S. Bureau of Mines, the supplies may approximate 10½ billion barrels, enough for twenty years, perhaps, according to the conservative estimates, or, on the basis of the possible 9 billion discussed above, 13½ billion barrels—enough, if available at once, to satisfy the wants of the United States for nearly twenty-five years, provided our use of oil is not increased after this year. Not to insure such an increase—and an enormous increase if oil is not too costly—would be sheer insanity. On the other hand, as I have pointed out, unless the evil day is held back by more complete extraction of oil from the ground, our domestic production will probably pass its peak in less than four years, and perhaps within two; after which our oil fields will fall off, slowly at first, then rapidly, and we will depend upon imported oil, use oil-shale oil, or resort to the other alternative and go without oil.

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[1] The leasing law of 1920 provides that companies in the control of nationals of a country excluding our companies from operating in territory in the control of that country may be excluded from [illegible] on the "public lands" of the United States. This is retaliatory and

IMPORTATIONS VS. EXPORTATION

For several years the United States has had to depend upon oil from other countries, principally from Mexico, to make up the deficit in our domestic production. In 1920, our importations doubled those of 1919, reaching 100 million barrels in excess of our exportations (estimated at 7½ million barrels) of crude petroleum, notwithstanding that, under the influence of oil shortage and consequent advancing prices, greater efforts than ever before were put forth during the first three-quarters of the year to increase production in this country.

Restriction of production near the close of 1920 resulted from over-supply, due to favorable production conditions, including open weather, abundant supplies, and ample railway and other transportation; to the usual winter curtailment of consumption; to special curtailment on account of industrial depression and high costs, and to over-importation. It is, however, to be borne in mind that up to the present (May, 1921) the results of curtailment of domestic production are at most less than the increase of the present importation over that of a year ago. Even during the winter period of slackened consumption our domestic production capacity has been found to be far short of that actually required for our need.

UNITED STATES INCREASINGLY DEPENDENT ON FOREIGN OIL

Larger production will soon be necessary if imports or prices are not further increased. In short, the United States is dependent upon foreign oil for nearly 20 per cent of its requirements, and this dependence must enormously increase in the near future. Barring, again, a marked improvement in the way of more complete extraction from the ground, it cannot be many years before our wells are able to supply less than half our normal requirements, even with more effective efforts to restrict the latter. Evidently our standards of living, our industries and our prosperity must depend upon our ability to get adequate supplies either from foreign sources or from our shales. The latter we have not yet been able to treat with commercial success, and it remains to be determined at what cost satisfactorily usable oil-shale products can be made at a profit, and when they will become available even in relatively small quantities.

NATIONAL OIL CONTROL ESSENTIAL

One thing is certain: If we are to have oil for our cars and our machinery, without paying more for it than some other nation has to pay; and if our ships, which with Diesel engines will have nearly three times the radius of ships burning oil under boilers, are to sail the Seven Seas and are to be sure of securing bunker oil at foreign ports as cheaply as ships of our trade competitors, that oil must from first to last be under the control of our own nationals. There is no room for possible doubt on that point. Only through American control of supplies sufficient to meet our needs can we expect to secure oil for our automobiles, tractors, or ships as cheaply as the country from whose nationals we will otherwise be obliged to buy it. In this way only can we be sure that oil will not be withheld from us in some time of greatest necessity. At whose mercy shall we be in time of war?

The American public does not yet fully realize the grave danger of our petroleum situation. The U. S. Geological Survey, which has taken the census of our oil reserves, and the U. S. Bureau of Mines, have for two years been warning the country to prepare for the day when our oil fields will begin to fail. In fact, the main task of arousing the public has been carried by these bureaus of the Government, and by Mark L. Requa, in charge of petroleum in the late Fuel Administration. The *Engineering and Mining Journal* also has carried on a consistent campaign of enlightenment as to the situation for the last year and a half. The leaders of the great oil companies cannot, in general, be expected to enter a publicity campaign to the effect that the oil resources behind the capital stock of many of their companies are likely at an early date to enter permanent decline. A relatively small number, including some of the largest of our companies, have secured promising if not actually productive concessions in foreign countries, mainly in Mexico; but even the largest companies seem careful to locate near the coast or inland transportation and timid of undertaking too much development. Few, if any, have ventured across the ocean.

As yet, American oil companies have made only a beginning in the acquisition of rights for the development of oil in foreign countries commensurate with our prospective needs, and, therefore, necessary for the safety of our country. Their managers seem incapable of visualizing the nearness of our peril or the extent of the concessions necessary to guarantee our future. It is time that our oil men abandoned the fatuously complacent belief that the United States contains all she needs and ever will want, a national conceit now threatening harm to several other American mining industries.

In a juncture like the present it is deplorable that the people of the United States are constitutionally jealous of investing the Government with power such as is needed to meet our rivals even-handed, and effectively to assist our nationals in the protection of our country.

PETROLEUM REQUIREMENTS OF UNITED STATES DOUBLE THOSE OF OTHER COUNTRIES

The total petroleum resources of the world recoverable by present mining methods are estimated by Eugene Stebinger, of the U. S. Geological Survey, and by myself at 60 billion barrels, about 8½ times those of the United States. On the other hand, the annual requirements of the United States are at present twice those of the rest of the world. The proportions of this disparity in consumption will probably decrease from 1921 on, by reason of rapid increase in the use of petroleum by other nations and the development of oil fields nearer to their hands. However, though our rate of increase must fall off, no permanent reduction in our total consumption is to be looked for in the near future, if oil, either imported or made from oil shale, is to be made obtainable within the purchasing power of the consumer.

The available contents of the discovered oil fields of the world, according to the estimates given in my paper on "The Oil Resources of the World" in the May, 1920, issue of the *Annals of the American Academy of Politi-*

cal and Social Science, are grouped as follows, the estimates being based on present methods of recovery:

OIL RESOURCES OF DISCOVERED OIL REGIONS OF THE WORLD

Country or Region	Millions of Barrels
United States and Alaska	7,000
Canada	995
Mexico	4,525
Northern South America, including Peru	5,730
Southern South America, including Bolivia	3,550
Algeria and Egypt	925
Persia and Mesopotamia	5,820
S. E. Russia, S. W. Siberia, and the region of the Caucasus	5,830
Rumania, Galicia and Western Europe	1,135
Northern Russia and Saghalien	925
Japan and Formosa	1,235
China	1,375
India	995
East Indies	3,015
Total	43,055
Total eastern hemisphere	21,255
Total western hemisphere	21,800
Total north of equator	36,400
Total south of equator	6,655

To the estimated oil resources (43 billion barrels) in the discovered oil regions are to be added 17 billion barrels, which, on geologic evidence, I have estimated to be present in areas where oil has not yet actually been discovered. The total, 60 billion barrels, is conservative and almost certain to be exceeded eventually —possibly by 15 billions of barrels. The most accurate calculation is that for the United States, for which the data are by far most nearly adequate. The estimate for our own country includes oil from undiscovered regions as well as that from known fields.

In my paper, mentioned above, also are briefly summarized the conditions of political control adversely affecting the privilege of American participation in the development of the oil resources of other countries, which give rise to the following conclusions:

> As the case now stands, our nationals are either distinctly or in effect shut out of the regions containing nearly one-half of the oil in sight in the rest of the world if the open-door policy is not assured in the mandatory countries. Further, if to the petroleum resources in the countries now held by Great Britain, France, and The Netherlands, there be added the concessions held by their nationals in producing or prospective oil regions of other countries, the total oil resources in the control of these nations will probably exceed three-fourths of the world's oil reserves outside of the United States. An open-door policy, in the mandatory countries, at least, is an economic necessity to the United States.

The legislative restrictive regulations and policies of these countries are more fully presented in a report by the Secretary of State, May 14, 1920, to the President, and published as Senate Document No. 272.

To the above quotation I may be excused for adding another paragraph:

> Behind the curtain of secret diplomacy, the rich oil reserves of the unappropriated mandatories of the Near East and of the Caucasus Transcaspian regions are stakes of a great game during which more than one political boundary is likely to be adjusted to meet the oil ambitions of a prospective protector, while in portions of Latin America the forces of commercial and political diplomacy are fully exerted to the disadvantage of our nationals. Even during the long war, oil geologists in the employ of the French, the British, and the organically allied Dutch Shell interests have been examining the most remote lands, including some of the neutral countries, and in certain regions have carried on their search at the very heels of the armies. According to recent British oil news, the division of the Mesopotamian oil regions between the French and British has been agreed upon, and an understanding formulated in accordance with which Great Britain and her European allies will control the oil resources of the Mediterranean region.

The statement quoted above was written in February, 1920, before the San Remo agreement dividing the rich petroleum resources of Mesopotamia and Syria—75 per cent British and 25 per cent French—with the joint arrangement for the aggressive acquisition, with government aid, of oil territory in Russia, Rumania, and other parts of Europe, was known in America, though probably long after it had actually been signed. There is no sign of an open-door policy in this; no reciprocity or equality of opportunity for the United States. As a Washington editor writes: "Moral obligations are soluble in oil." British fair play seems to have been lost sight of and British sportsmanship to have broken down.

PETROLEUM SITUATION IN THE FAR EAST

In this connection it is pertinent to recall the remarkable situation in the Far East. The German domains in Africa, and, for the most part, in the East Indies and Polynesia, having been scheduled by secret treaty for allocation to the British and French spheres of influence, there was little German territory outside the German islands of the Pacific north of the Equator left to give to the Japanese. Accordingly, the surrender by China to Japan of certain of her sovereign diplomatic, financial, and military rights under the terms of the "twenty-two (?) articles" forced on China by Japan in 1915, and Japan's aggressions on the territory of China, one of our allies, appear to have been tacitly sanctioned—league-alized, as it were—and Japan left to proceed according to her ambitions and her conscience in acquiring territory and resources belonging to the Chinese and the Russians. Digressing a moment, it may be remarked that the interests of two of the Allies, China, in an important way, and the United States, in a very subordinate way, seem to have been sacrificed to a third ally. No account is taken of Russia. Japan, whose oil reserves are quite limited, has since "occupied" Russian Saghalien (Sakhalin), with its stores of high-grade coal and its 200-mile belt of tempting oil, gas, and asphalt seeps, until a permanent government is established and the prospective interests of Japan, including other oil territory in eastern Siberia, are recognized and assured. Oil territory under Japanese control is not likely to be open to development by the oil companies of the United States.

Within the last year, representatives of British interrelated oil interests, some of which are in part directly underwritten by the British government, have been making examinations in Siberia, in Mexico, in Colombia, in Peru, in Bolivia, and in other countries in South America, and in the United States; have been gathering in German and other concessions in the Rumanian, Galician, and Russian fields; spreading their holdings of prospective oil territory in the East Indies, and, in general, proceeding with feverish energy with the British plans for a world domination in oil more complete and arbitrary than that which is now slipping away from the United States. In these plans the open door of opportunity seems to play no part such as it has played during the world domination by our country. It is rumored, also, that arrangements are now nearly if not quite completed whereby the British will secure an oil concession covering the entire Province of Kan-Su, which from the oil standpoint now appears to be second best, if not the best, prospective great oil region in China. The oil resources of Shensi are said to be in Japanese control, and the grasp of the

British is stronger in Szechuen, the remaining of the great prospective oil regions of China. If we are to have oil bunker stations for our merchant marine and our navy, along the avenues of world trade, from which oil may be obtained as cheaply for our ships as for the ships of any other nation, where is this oil to come from?

Referring to the Stebinger map, published in my above-cited paper to show the open and closed countries and the geographical distribution of the estimated oil reserves, it now would seem that to the countries closed to American oil companies, according to present policies of Great Britain, France, Japan, and The Netherlands, may be added the Dutch East Indies, Saghalien, and possibly Mesopotamia (British claim based on a concession never granted by the Turkish government), Syria, the northern strip of Persia, and Arabia; and it remains to be seen whether American companies will hold oil concessions of value in mandatory German territories in Africa or other regions of the world. The exclusive monopoly of oil development in mandatory New Guinea was promptly granted by Australia, which holds the mandate, to the Anglo-Persian Oil Co., in which the British government owns a controlling interest.

A concession, or perhaps several selections, from cull territory in Mesopotamia or some other country, eventually offered American oil companies, after the prospective oil regions have been examined and all the promising areas covered by the nationals of more favored nations, might technically figure as an open door, but such belated opening, at best without evenly competitive conditions of operation, will assure little oil for America.

It is common knowledge that our principal allies, now our commercial rivals and trade competitors, have, by secret agreements, by diplomatic camouflage, and by direct action, shown a purpose to close to us the open door of equal opportunity in the mandatory as well as in other countries under their influence, and to hasten the day when we may be dependent on them for oil. Neither in recent history, nor in the present outlook, is there any foundation warranting the United States in leaving her future as to oil not only to foreign supplies, as she surely must, except as she may perhaps be saved by oil shale, but also to oil mined, prepared, transported, and marketed by companies in the control of a nation not only competitive but commercially antagonistic.

Oil is essential to our work, to our daily living, and to our protection. In the day of our disadvantage and dependence can we expect fairer treatment than we are receiving now?

Petroleum in Bolivia*

By Arthur H. Redfield

Two districts of interest as possible producers of petroleum are recognizable in Bolivia: The Chaco or Yacuiba district, in the southeast of the country, comprises a strip 300 miles long and 50 miles wide along the eastern foothills of the Andes, between latitudes 22 deg. S. and 17 deg. 45 min. S. or between the towns of Yacuiba, on the Argentine frontier, and Santa Cruz de la Sierra. It includes portions of the departments of Tarija, Chuquisaca, and Santa Cruz. This is the district of greater promise. The other, of less interest, known as the Pacajes district, lies in the northwestern part of Bolivia, in the Department of La Paz, comprising chiefly a limited area (so far as reported) around Chulluncayani, in the southwest of that department, sixteen miles from the Arica-La Paz railroad.

The occurrence of oil both in the Chaco and the Pacajes districts of Bolivia is connected with the same petroliferous formation which supplies the oil indications of the Salta-Jujuy district of Argentina. This formation has been in recent years assigned to the Cretaceous, with its latest member extending perhaps into the Early Tertiary. The lack of fossils makes its correlation uncertain; earlier geologists have ascribed it to a variety of periods, from the Silurian to the Tertiary.

The petroliferous formation is folded along a north-south line, parallel with the Cordillera, into anticlines and synclines. Recognized anticlines are observed at the Quebrada de Peima, at the Quebrada de Cuarazuti, and at the Quebrada de Machareti.

Seeps of oil, often of high grade, are the outstanding evidence of the petroliferous character of southeastern Bolivia. Such seepages are found at the Loma de Ipaguazu, the Quebrada de Peima, Quebrada de Cuarazuti, Quebrada de Machareti, Quebrada de Itacua, and at numerous other points between Yacuiba and Santa Cruz. Oil seeps occur also at Chulluncayani, in the Pacajes district.

The Chaco oil fields have been known since 1868, and several observers visited the region prior to the World War. In 1913 a British engineer surveyed the region from Machareti to Buenavista for an English company. A well drilled by the company near Cuevo found oil at a shallow depth. The work stopped suddenly in 1914. In 1915 an American engineer prospected the Yacuiba district, and reported unfavorably on it in view of the difficulties of development and transportation.

The Sindicato Petrolifero del Oriente Boliviano was formed in 1916 by a group of German and Chilean nitrate producers who desired to solve the fuel problem for the nitrate refineries. The field was prospected; a railroad to Potosé was planned; and even a pipe line over the Cordillera to Antofagasta and Iquique was considered. No active development took place, however. In the Pacajes district, the company Montes y Zupan was reported in 1915 to be drilling on the Copacabana claim. No reports of the outcome of its venture have been made public.

There are no exclusive or monopolistic concessions in Bolivia covering large tracts of land. Prospecting on public land is free, the prospector being required merely to notify the authorities. Claims (called "concessions"), to the extent of thirty areas of 100 hectares each, may be taken out by any individual, citizen or alien, by complying with the necessary formalities. A large number of such claims have been taken out by individuals who are holding them for speculative purposes.

The mining laws make no distinction between the rights of citizens and of aliens to prospect or to acquire land for mining and development. A measure passed early in 1920 taxes the net earnings of mining companies. The purpose of this bill appears to be purely fiscal, to make up for the shortage of revenue.

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*U. S. Geological Survey, Section of Foreign Mineral Resources.

Book Reviews

Le Platine et les Gites Platiniferes de l'Oural et du Monde. By Louis Dupare, professor at the University of Geneva, and Marguerite N. Tikonowitch. Quarto, pp. 600, 99 plans, 90 stereotype plates, 11 plates in black and colors, atlas containing 5 geological colored maps, and 8 plates. Price, 150 fr. Geneva; S. A. des Editions Sonor, 46 Rue du Stand.

This is a monumental work on a subject but little studied heretofore, and is, therefore, classic. The subject of platinum is treated for the world in general, but the actual research has been done mainly in the world's greatest platinum field—that of the Ourals, in Russia. The monograph treats of the geology, mining and treatment methods, refining, industrial uses, and production statistics of this metal. After a preliminary geologic sketch of the Oural Mountains, five chapters are devoted to the description and petrography of the basic igneous intrusions which form the "mother rock" of platinum. The principal "mother rock" is dunite, an olivine rock containing chromite. This rock occurs generally in rudely elliptical outcrops, outside of which is a ring of pyroxenite, and still outside a ring of gabbro, all rough and interrupted. Platinum occurs to a less extent in the pyroxenites; only rarely in the gabbros.

The origin of the dunites and the concentration of platinum by magnetic differentiation is demonstrated. Dike rocks of many varieties, belonging to the same general type of magma, cut the major phases. A chapter is next given to the metamorphic schists into which the basic eruptions are intrusive; another treats in detail of the occurrence of platinum in the "mother rock." Chapter IX treats of the analyses of platinum and the other rare metals with which, in the Ourals, it is alloyed.

Chapter X treats of "placer" platinum, and Chapter XI of the different methods of working platinum from gravels, from the cradle to the dredge. Chapter XII describes in detail the different platinum mining districts of the Ourals in the dunites, and Chapter XIII the corresponding districts in the pyroxenites. In Chapter XIV thirty pages are given to sketching the occurrence of the platinum of the world outside of the Ourals. In a number of places, in various parts of the world, the "mother rock" is shown to be dunite, and in some cases, as in the Ourals, the dunite outcrop is surrounded by rings of less basic intrusions. Chapter XV treats of the metallurgy and refining of platinum, Chapter XVI of its uses, and Chapter XVII of the world statistics of its production.

Essentially, of course, this monograph is on Russian platinum. The inclusiveness of treatment is unusual, involving everything from drill rods and close-connected dredge buckets to general geology, so that the editorial blue-pencil would doubtless have given a more compact and as valuable a treatment containing whatever the writers have to offer that is new. Nevertheless, this is a most important contribution to the knowledge of platinum and its allied metals, particularly concerning their origin. J. E. S.

Preliminary Report on the Sand and Gravel Deposits of Georgia. By L. P. Teas. Geological Survey of Georgia, Bulletin No. 37. Cloth; 7 x 10; pp. 392; 20 plates, 13 figures, 1 map. Atlanta, 1921.

Sand and gravel are commodities of such common occurrence, and are so familiar, that few authors have thought it worth while to devote any attention to their properties or problems. Consequently, the literature on the subject is neither voluminous nor comprehensive. The Georgia bulletin is welcome, therefore, in that it supplies a real need, both in general and special information on a subject of wide interest. The first forty-four pages describe the origin, classification, physical properties, and methods of determination of physical properties of sand and gravel. Pages forty-four to ninety-five outline the various uses, such as for building, glass manufacture, foundry, sand-lime brick, roads, ballast, filter, engine, abrasive and other. The two following sections are devoted to methods of excavation, transportation, and preparation for market, and methods of prospecting and testing sand and gravel applicable to the three main types of deposits, stream, bank, and sandstone. Production figures, prices, and a list of producers of Georgia sand and gravel are supplied. A large part of the volume, comprising 221 pages, is devoted to a discussion of the three principal areas, the Coastal Plain, the Crystalline area, and the Paleozoic area, giving their extent, physiography, geology, and a detailed description of deposits by counties. The addition of an excellent bibliography on sand and gravel literature is noteworthy. The bulletin concludes with four appendices on special types of Georgia sands. O. B.

Zinc (1913-1919). Part of "The Mineral Industry of the British Empire and Foreign Countries." Paper; pp. 112. Published by His Majesty's Stationery Office, London. Price, 3s. 6d., net.

A paper similar to the ones published by the U. S. Geological Survey on domestic mineral resources, with particular reference to the position of the British Empire in the world's zinc industry. A mass of statistical information is presented, covering the production and trade in zinc, supplemented by descriptive accounts of developments in important zinc-producing and zinc-consuming countries. An excellent bibliography is appended. The paper should prove interesting to persons wishing a compact exposition of the British Empire's zinc trade.

Recent Patents

Allen Cone—No. 1,374,625. Charles Allen, El Paso, Tex. A baffle for deflecting the feed into an Allen cone so that conditions therein will be quieter and more favorable for proper settlement and efficient classification.

Automatic Sand Trap—No. 1,374,626. Charles Allen, El Paso, Tex. A tank supported over a cone classifier, so arranged that when a sufficient amount of sand collects, a spring will be released, thereby opening a valve through which the sand discharges into the cone beneath.

Ball Mill—No. 1,370,700. B. A. Mitchell and F. G. Janney, Garfield, Utah. A ball mill with a new design of liners and grate discharge.

Chloridizing Roasting—No. 1,375,002. Julius H. Hirt, El Paso, Tex., assignor to Alvarado Mining & Milling Co., New York. A method of heating ore for chloridizing, and introducing the chloridizing agent in gaseous or vapor form.

Combined Flotation Machine and Classifier—No. 1,375,211. David Cole, Morenci, Ariz., assignor to Minerals Separation North American Corporation, New York. A frothing classifier used in combination with a ball mill, by means of which minerals capable of being floated are removed and the oversize is returned to the mill for regrinding.

Concentrator—No. 1, 370,601. R. Luckenbach, Philadelphia, Pa., assignor to Luckenbach Processes, Inc., San Francisco, Cal. A method of gravity separation of the heavy particles in an ore, followed by recovery of the valuable minerals in the resultant tailings by forcing them through a porous medium to which the minerals will adhere.

Electrode—No. 1,373,273. Urlyn C. Tainton, Martinez, Cal. A permeable electrode for electrolytic precipitation of metals, which comprises a paper sheet in which is incorporated a powdered conducting material.

Differential Flotation—No. 1,375,087. Charles Faul, St. Kilda, and Henry Lavers, Surrey Hills, Victoria, Australia, assignors to Minerals Separation North American Corporation, New York. The use of a copper compound and a bichromate of an alkali metal to effect differential flotation of mixed sulphides.

Riffled Trommel—No. 1,374,472. William W. Richardson, London, England. An apparatus consisting of at least one trommel with riffle plates arranged longitudinally on the interior surface, designed for classifying and concentrating ore and also applicable to dredging operations.

Tube-Mill Liner—No. 1,371,929. M. R. O'Shaughnessy, Cobalt, Ont. A method of designing and securing sectional liners within a tube mill.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Vegetation May Indicate Geology

Soils Not Always Safe Guides to Parent Rocks—Much Research Needed

Speaking before a recent meeting of the Geological Society of Washington Edgar T. Wherry discussed the variations in soils derived from similar rocks and the fundamental soil characters important to plant growth. He summarized present knowledge and showed that many soil factors control surficial vegetation, and that much work is yet to be done before vegetation may be accepted as a sure guide to the mineralogic character of the underlying rocks. The title of the paper was "Our Present Knowledge of the Relation Between Vegetation and Geology." Mr. Wherry's remarks are summarized in the following:

The observation that there is some relation between the vegetation and the underlying soil or rock formation was made at least as early as 300 B.C., by Theophrastus. During the Middle Ages and the early part of modern times the subject was looked at in the same light as the divining rod, namely as an easy means of penetrating the mysteries of the earth's interior, and of finding hidden ore deposits. Hence there arose beliefs concerning the existence of silver plants, lead plants, zinc plants, and so on, the data on which were summarized in 1875 by the late Rossiter W. Raymond in the Transactions of the American Institute of Mining Engineers.

For many years ecologists have been collecting data concerning the kinds of rock preferred by individual species of plants, and have named certain species calcicolous and others silicolous on the basis of the results obtained. As the study of such relations progressed, however, numerous exceptions to the rules came to light, plants which were limited to limestone in one region being found to be indifferent or even limited to siliceous rocks elsewhere. Because of these exceptions, as well as from various theoretical conclusions (not always based on sound knowledge of chemistry and other sciences) there has come into vogue an opinion that the physical properties, specially the moisture content, of soils or rocks are the chief factors in determining where given plants will grow. Such physical factors unquestionably have considerable importance, but chemical factors have far too great significance to be overlooked. It is difficult to determine in any given case how much of the various chemical constituents of a rock or a soil are available to plants. Fortunately, however, we now have ready means for determining soil acidity and alkalinity, and as these have a marked influence on the availability of plant foods, such as calcium, nitrogen, and phosphorus, their study is of great importance in this connection.

The simplest method of determining the acidity or alkalinity of a soil is by some indicator, as litmus, but synthetic dyes developed in recent years indicate by their color changes different degrees of acidity and alkalinity. Many hundred soils and rocks have been tested in this way, with reference to the vegetation growing upon them. It has been found that many native plants are decidedly sensitive to the reaction of the soil. In particular most of the members of the Heath family prefer highly acid soils, while a number of rock ferns and some members of the Saxifrage family, especially the "grass of Parnassus," are quite intolerant of such soils and grow only where the reaction is neutral or alkaline.

As to rocks, the following observations have been made: limestone and other rocks containing calcium carbonate tend to yield alkaline or neutral soils. They are attacked by any acids which may form in the soil through the decomposition of organic matter, and neutralize these acids wherever the circulation of soil water permits. Only where a thick layer of humus matter or rain-leached clay accumulates over limestone ledges can acid soils develop. The more basic igneous rocks are also attacked by organic acids when these become strong enough, and may neutralize them at least in some degree, so that the resulting soils are low in acidity. The more siliceous rocks seem to be attacked so slowly by soil acids that little neutralization occurs and acid soils most frequently develop over them. It has also been noted that in some soils no acids are produced by decomposition of the organic matter. Instead the latter goes off as carbon dioxide and water, leaving the lime and potash of the original plant tissue behind, and thereby rendering the soil reaction neutral or even slightly alkaline without the underlying rock having any effect one way or another.

Because plants, on the whole, are affected more by the soil than by the underlying rock, and as the soil is not necessarily related to the rock on which it rests, it seems impracticable to use vegetation as a certain indication of the calcareous or non-calcareous nature of a rock in general. In regions where soil and rock are more definitely connected, as in mountainous country, high latitudes, or in special situations, as near a glacial moraine, a study of the vegetation may aid the geologist in preparing his maps. Much more work is needed, however, both on individual plant species and on associations of plants; and not only the acidity and alkalinity, but also other chemical features preferred by each, must be considered. In conclusion, it seems that either the geologist must have a fairly detailed knowledge of botany, or botanist and geologist must work in conjunction, to render the botanical method of practical value in geology.

Institution of Mining and Metallurgy Awards Two Gold Medals

The gold medal of the Institution of Mining and Metallurgy (London) has been awarded this year to Sir Thomas Kirke Rose "in recognition of his eminent services in the advancement of metallurgical science, with special reference to the metallurgy of gold."

At the same annual meeting of the Institution, on April 21, the "New Consolidated Goldfields of South Africa, Ltd., Gold Medal and Premium of Forty Guineas" was awarded to H. Livingstone Sulman for his paper of 1920, "A Contribution to the Study of Flotation." This paper won for Mr. Sulman the Institution's gold medal in 1920, and President Merricks expressed his desire to indorse the words used on the previous occasion by his predecessor.

Sir Thomas and Mr. Sulman are the first two members of the Institution of Mining and Metallurgy to receive both the gold medals mentioned.

British Committee on Rock Names Makes Report

The Geological Society and the Mineralogical Society appointed a joint committee in February of last year, which was to consider standardization of British petrographic nomenclature, and make such recommendations as seemed adapted to secure that end. Prof. W. W. Watts was appointed chairman, and the other members of the committee were J. V. Elsden, J. S. Flett, J. Teall, H. H. Thomas, G. W. Tyrrell from the Geological Society; and J. W. Evans, F. H. Hatch, Arthur Holmes, G. T. Prior, R. H. Rastall, and W. Campbell Smith, from the Mineralogical Society. This committee has now reported its recommendations. No names of general undisputed definition are discussed and only British ones appear. Forty-seven terms naming rock species or textures are given preferred definitions; twenty-seven terms are classed as obsolete or unnecessary, being used in more than one sense, and their further use is condemned. In this list one notes "diabase," "binary granite," and "melaphyre." A list of synonyms indicates the committee's preference for nineteen terms which have simplicity or priority in their favor. No new terms are recommended.

MEN YOU SHOULD KNOW ABOUT

H. F. Bain, director of the U. S. Bureau of Mines, was in New York City on May 26 and 27, on professional business.

Charles Hayden and **D. C. Jackling**, of the Mesabi Iron Co., inspected the company's new plant at Babbitt, Minn., last week.

E. F. Burchard, geologist, is visiting centers of pig iron, iron ore, and cement production in research for the U. S. Geological Survey.

D. B. Dowling, of the Department of Mines, Canadian Geological Survey, Ottawa, has received the degree of D. Sc. from McGill University.

L. W. Stephenson, who went to Mexico early in February on a private geologic commission, has resumed his work with the U. S. Geological Survey.

Daniel M. Drumheller, Jr., superintendent for the Tidewater Copper Co., Sidney Inlet, B. C., has gone to Spokane, Wash., for an indefinite stay.

W. F. Ferrier, mining geologist, of Toronto, Ont., has gone to Vancouver, B. C., on professional work, and will spend some time in British Columbia.

M. M. Duncan, vice-president and general manager of the Cleveland-Cliffs Iron Co., Ishpeming, Mich., is spending a few weeks at Asheville, N. C.

A. P. Low, geologist, is on his way to the Fort Norman oil fields, in charge of a party employed by the Mackenzie River Oil, Ltd., Co. to locate sites for three wells.

Edward R. Knowles, consulting engineer, is now associated with Murrie & Co., Inc., 74 Broadway, New York City, in charge of that company's fuel engineering work.

J. P. McFadden, general manager for the Rosebery-Surprise Mining Co., has returned to the Slocan district properties, from a visit to New York and other Eastern points.

Charles W. Potts, of the Northern Minnesota Ore Co., has returned from Washington, where he has spent several months in the interests of his company and of manganese mining legislation.

Carl J. Trauerman, formerly manager of Liverpool Silver Mines Co., Clancy, Mont., has resigned to accept a post with the oil stock department of the Lauzier-Wolcott Co., Butte, Mont.

J. S. Diller, of the U. S. Geological Survey, is en route to continue his study of the volcanic activity at Lassen Peak, Cal. He also will make geologic observations in the vicinity of Fallon Reservoir, Nev.

Charles P. Perin, consulting engineer, of the firm of Perin & Marshall, New York City, has returned from his recent trip to England. **S. M. Marshall**, of the same firm, sailed from India for the United States about June 1.

Pierre Pruvost, of Lille, France, a geologist who has made important contributions to our knowledge of the coal fields of northern France, has been awarded the Gosselet prize by the Geological Society of France.

W. L. Loveland has resigned as general manager of The Mine and Smelter Supply Co., Denver, Col. His successor will be **H. J. Gundlach**, who has been manager of the company's store in Denver for the last year.

Roy M. Wolvin, president of the British Empire Steel Corporation, has sailed for England in connection with the business of the corporation, involving the arrangement of some details with the English interests concerned.

Charles Butts, of the U. S. Geological Survey has been detailed to make an additional study of the geology of northwestern Alabama. **E. O. Ulrich** will make a similar study in middle Tennessee and in Kentucky, and **R. D. Mesler** in southern Illinois.

Robert J. Grant, mining engineer, of Denver, Col., has been selected as superintendent of the Denver Mint to succeed **Thomas Annear**. Mr. Grant began his mining career in Colorado in 1888 and has had mining interests in Mexico, California, Arizona, British Columbia, and Australia.

H. G. McClain, general superintendent for Liberty Bell Gold Mining Co., Telluride, Col., and **Webster P. Cary**, recently general manager for New Henrietta Mining Co., Globe, Ariz., announce the organization of McClain & Cary, mining and metallurgical engineers, 708 Harrison Ave., Leadville, Col.

O. C. Ralston, superintendent of the U. S. Bureau of Mines Experiment Station at Seattle, Wash., has been named assistant chief metallurgist of the Bureau, the appointment to become effective July 1. Mr. Ralston will have headquarters at Berkeley, Cal., where he also will have charge of the Berkeley station. He will direct all the work of the Bureau on non-ferrous metals.

J. Cavalier, rector of the University of Toulouse, and an authority on metallurgical chemistry, has been selected by the French faculties as their first representative in the international exchange of professors in engineering and applied science, arranged between seven United States institutions and that country. Prof. **A. E. Kennelly**, of Harvard University and Massachusetts Institute of Technology, is the American representative.

SOCIETY MEETINGS ANNOUNCED

American Society for Testing Materials holds its annual meeting at Asbury Park, N. J., on June 20 to 24, inclusive. Headquarters will be in the New Monterey Hotel. The secretary, C. L. Warwick, may be addressed at 1315 Spruce St., Philadelphia.

The Army Ordnance Association purposes forming a local branch in the metropolitan district of Greater New York to include all ordnance officers of the Officers' Reserve Corps. There will be a meeting for this purpose at Engineering Societies' Building on June 15, at 8 p.m. Guy E. Tripp will preside. All who served as officers in the Ordnance Department and all others interested in ordnance as a factor in preparedness are invited to attend.

OBITUARY

Louis Tauzin, vice-president of the Council Général des Mines, a former professor and director of the Saint-Etienne School of Mines, died at Chantegrillet, France, from overexertions attendant on the celebration of the Saint-Etienne centenary.

Frank D. Baker, mechanical engineer, for the last twenty years head of the mechanical staff of the Colorado department of the American Smelting & Refining Co., at Denver, Col., died there the last week in April. Mr. Baker, who was a graduate in mechanical engineering from the University of Illinois, had spent over thirty years in Denver, and had become closely associated with a number of mining enterprises. He was a member of the American Society of Mechanical Engineers.

John D. Gilchrist, mining engineer of Denver, Col., died at Kansas City, on May 8, of plural pneumonia. Mr. Gilchrist was born at Hancock, Mich., in 1864, but had lived in Denver for many years. He first engaged in mining for his own interests, but in 1901 he became general superintendent for all the iron mines belonging to the Colorado Fuel & Iron Co., and so continued to 1914 when he resigned to re-engage in private mining operations. The A. I. M. E. elected him to membership in 1896.

William Fernie, pioneer prospector, mine operator, and railway promoter, died in Victoria, B. C., on May 15 at the age of eighty-four years. The city of Fernie, B. C., was named after him, and he was the original discoverer of coal in that district. His first work as a mining man was done in the Bendigo and Perdue mines, in Australia. Coming to British Columbia in 1860, he was attracted to the Cariboo district, where he engaged in mining for many years. In 18[illegible] he was appointed Gold Commissioner for Canada, a position he held for four years. On resigning, he joined Colonel C. Baker and other western Canadians in their effort to obtain a charter for the British Columbian Southern Ry. In this he and his confreres were successful, and in 1887 Mr. Fernie located the coal fields of Crow's Nest Pass. With the opening of these fields there grew up in that locality the now flourishing community of Fernie, so named in honor of the man primarily responsible for its existence.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

Wisconsin Zinc-Lead District Quiet but Not Despondent

Mineral Point Zinc Co. Not To Leave District, as Reported—National Zinc Separating Co. Will Increase Acid Plant's Capacity

Platteville, Wis., May 28—No despondent gloom pervades the Wisconsin zinc district but, rather, as much optimism perhaps as in any sister mining field which is feeling the pinch of reaction, all reports to the contrary notwithstanding. It is not a fact, for instance, that the Mineral Point Zinc Co. has discharged all its engineering staff and is dismantling its mining plants and shipping its mining machinery to New Mexico. Though no official information is available as to the company's future plans, the only visible grounds for the current rumor that it contemplates leaving this district is the pulling of some of its mine pumps and the fact that a single air compressor was shipped from the Coker mine to New Mexico. Pulling of pumps is the common practice in this district when a mine is shut down, as the water problem is not difficult, and the mines are quickly unwatered when operations are resumed. This company is still operating the Penna Benton mine, at Benton, and is running the oxide plant at Mineral Point. Its other mines and also the roaster and acid plant are down, owing to the large excess amount of ore in storage and the general industrial depression.

Other mines still operating in the district are the Nightingale, Connecting Link, and two Vinegar Hill company's properties, the Yewdall and the North Unity. The National Zinc Separating Co. has continued to operate its separating and acid plants at Cuba City; these will be shut down in June for a month, but only for general repairs and to increase the acid plant capacity by 25 per cent.

The Federal Bureau of Mines staff has been conducting experimental work in zinc-slime separating for the last six months at the Platteville substation, and results obtained indicate table installations at the individual concentrating mills, and central plants to treat this enriched table product by flotation.

A new ray of hope for zinc is the fact that some cities are now adopting ordinances forbidding the further use of wooden shingles on all city buildings, to reduce fire hazard. Sheet zinc roofing and the kind of sheet zinc shingles just recently put on the market by the Illinois Zinc Co. are going to win favor and preference for economy, strength, weight, adaptability, and durability. The Methodist church in Platteville is now being roofed with zinc.

WEEKLY RÉSUMÉ

In the Lake Superior iron-ore district, operations have been curtailed by the Cleveland-Cliffs Iron Co. The Oliver Iron Mining Co. has abolished the twelve-hour shift and has made other readjustments along this line. On the Gogebic Range, the Colby and Ironton mines shut down on May 28, 500 men being laid off. C. A. Remington has been granted a new trial of his suit against John A. Savage & Co. In the zinc-lead district of Wisconsin conditions are quiet, but no more so than might be expected at present. The National Zinc Separating Co. is to increase its acid-manufacturing capacity by 25 per cent. In Utah, the Utah Consolidated Mining Co. has decided that it will appeal in the case involving apex rights at Bingham Canyon won by the Utah Apex company. At Tonopah, Nev., strike conditions are but little changed. In the Coeur d'Alenes, the Mudd-Wiseman interests have added the Great Eastern to the holdings under their control. The Hecla and the Bunker Hill & Sullivan companies are reported to have decided upon the joint purchase of the Star mine. Alaska Gastineau has shut down. Verne M. Bovie has resigned as superintendent of the New York Assay Office.

At Washington, the House Committee on Mines and Mining has reported favorably on the proposal to change the assessment work year to a fiscal basis. The report of the Ingalls committee on changes needed in the mining law has been received by the Director of the U. S. Bureau of Mines. Will H. Coghill will undertake a study of the zinc problems in the Joplin-Miami district.

Utah Consolidated To Appeal From Recent Apex Decision

The Utah Consolidated Mining Co., of Bingham Canyon, Utah, has announced that it will appeal to the Circuit Court of Appeals against the verdict of the United States District Court at Salt Lake City awarding damages to the Utah Apex Mining Co. for ore taken from beneath the surface of the latter by the Utah Consolidated, claiming the ores by apex rights.

Cleveland-Cliffs Iron Co. Reduces Operations

5,000,000 Tons of Ore in Stock at Mines and 1921 Orders Scarce—Aid for Those Out of Work

The Cleveland-Cliffs Iron Co. made a considerable reduction in its operations on June 1. The Angeline and Lake mines, at Ishpeming, Mich., and the Meadow, on the Mesabi Range, were abandoned, and mining operations will not be again conducted at these properties. The ore reserves are practically exhausted at these three mines, and it will not pay to operate them again. The Cliffs Shaft mine, at Ishpeming; the Spies, at Iron River, and the Wade-Helmar and Crosby, on the Mesabi Range, were closed down. The Holmes and the Morris-Lloyd, at Ishpeming; the Maas, at Negaunee; the Francis, Gwinn, Stephenson and Princeton, in the Gwinn district, are now being operated three days a week, as compared with the former practice of five days each week. The curtailment means a cut in production of 130,000 tons per month for this company.

In addition to the reduction in the mining department, the Pioneer furnace, at Marquette, was closed. All timber operations by the company were discontinued several weeks ago. The company has over 5,000,000 tons of ore in stock at its mines, and is experiencing difficulty in booking orders for 1921 delivery. Only three of the company's fleet of boats are engaged in the ore trade.

W. G. Mather, president of the company, stated in an interview at Ishpeming that everything possible would be done to aid the men out of employment. Those living in company houses and out of work would not be asked to pay rent, and those working but half-time would be charged but one-half the regular price. Medical attention will be given free to those out of work, and the same applies to members of their families. There are but two operating mines in Ishpeming today; the Holmes and Section 16, the latter being owned by the Oliver Iron Mining Co.

V. M. Bovie Quits Assay Office In New York

Isaac H. Smith has been nominated by President Harding to be superintendent of the U. S. Assay Office in New York, to succeed Verne M. Bovie. Mr. Bovie has accepted the presidency of a company operating a group of stores.

Northern Light Co. Organizes To Build Ontario Railroad

Proposes To Construct 100 Miles of Narrow-Gage To Outlying Camps

The proposed construction of a narrow-gage railway to the outlying mining districts of northern Ontario appears in a fair way of being realized soon. The Northern Light Railway Co., Ltd., has been organized, with Frank L. Culver, president of the Beaver and Kirkland Lake mines, as president, and several experienced business men as directors. It is proposed to build approximately 100 miles of railway, using 36-in. gage 56-lb. rails and 8-ton oil-burning locomotives. The company has been authorized to make a bond issue of $15,000 per mile, and the Ontario government is asked to supplement this amount by the purchase of bonds not yet authorized to the amount of $3,500 per mile. The provisional program is to build about 75 miles this year, connecting the West Shining Tree, Matachewan and Gowganda camps on the west with Swastika on the Timiskaming & Northern Ontario Ry., and then looping round to the east to Kirkland Lake, Larder Lake and Skead, returning to the T. & N. O. at Boston Creek.

Remington Granted New Trial in John A. Savage & Co. Suit

C. A. Remington's appeal to the Minnesota Supreme Court for a new trial in his suit against John A. Savage & Co. for $47,083 has been granted. The litigation, which is of two years' standing, grew out of the sale of a stockpile of iron ore by the plaintiff to the defendant. The plaintiff alleges that he entered into a contract with the defendant for the sale of 50,000 tons of 48-per cent iron ore at a price of $2.825 per ton and has received only half of the sale price. In the counter claim of the defendant it is stated that the iron content of the ore was considerably lower than represented and that the silica content was higher, so that the value of the ore was materially lowered.

In June, 1919, the defendant in a counter suit for $18,000 was awarded $2,374 for damages, but the appeal that has been granted will reopen the case for another trial.

Hecla and Bunker Hill Reported To Have Bought Star Mine

It has been announced from Milwaukee that the directors of the Hecla Mining Co., of Wallace, Idaho, have decided to side with the Bunker Hill & Sullivan Mining & Concentrating Co. in the purchase of the Star mine. The price paid for the property has not been divulged. The action of the directors in acquiring this interest marks a departure from the course they have hitherto pursued in confining their attention to the Hecla mine.

Perry H. Stewart has been named by the President to be Assayer in charge of the U. S. Assay Office at Deadwood, S. D.

Oliver Iron Mining Co. Abolishes Twelve-Hour Shift

The U. S. Steel Corporation has issued orders abolishing the twelve-hour shift which affect the employees of the Oliver Iron Mining Co. in the Lake Superior district. All working shifts of twelve hours a day have been discontinued. Wherever it is feasible in certain departments, relative to office work, the working day constitutes eight hours. Locomotive firemen and stationary engineers and firemen have been placed on a basis of eight hours per day. The steam-shovel engineers and all pit men are still on the ten-hour basis. This order is in line and follows the suggestion made at the last annual meeting by Elbert H. Gary, chairman of the board of the U. S. Steel Corporation.

Compensation Awarded for Death Caused by Insane Employee

A recent decision of the Utah State Industrial Commission, awarding compensation for injury by a fellow employee, later adjudged insane, is of interest. The case in point is that of Frank Como, who on June 11, 1917, was killed in one of the shafts of the Spring Cañon Coal Co. at Storrs, in Carbon County, by a blow on the head delivered by John Avostino, who was later committed to the state mental hospital as insane. A dissenting opinion on the part of one of the commission holds that only if Como had been killed by Avostino because of his employment could compensation be allowed under the law, and that there was no evidence that the decedent had been killed because of his employment. The Spring Cañon Coal Co. is ordered by the commission to pay the widow compensation in the sum of $9.52 per week for a period not to exceed 312 weeks, and $150 for funeral expenses.

More Iron Mines Close Down

The Colby and Ironton iron mines, both of which are on the Gogebic Range, Michigan, closed down completely May 28. Five hundred men were laid off.

Madagascar Embargoes Unfabricated Gold

The French Minister for the Colonies has taken a step long awaited by Madagascar. Because of speculation in the precious metals, notably gold, produced in great quantity by "la Grande Ile" (as the French call Madagascar), and by reason of the large-scale frauds practiced, particularly by the Hindus, who are at liberty to send the metal abroad as "fabricated gold," M. Saurraut has signed a decree prohibiting the export of jewelry that has not been increased in value, through expended labor, by at least one-quarter of that of the metal. "This very opportune measure will certainly end the intolerable abuses which are pouring abroad considerable quantities of the metal France has such pressing present need of," says a recent issue of *Le Bulletin du Commerce de la Nouvelle Caledonie*.

Mudd-Wiseman Interests Secure Option on Great Eastern Control

Will Aid in Developing Flynn Group Property in Coeur d'Alenes

The Senator Mining Co., in the Coeur d'Alene district, Idaho, has secured an option on the control of the Great Eastern Mining Co. on a basis of 10c. per share, and an easement for the use of the Great Eastern tunnel for developing the Senator. The privilege of using Great Eastern ground for practically all mining purposes is also included.

The Coeur d'Alene Syndicate, of which Colonel Seeley W. Mudd and Phillip Wiseman, of Los Angeles, are the trustees, and Rush J. White, of Wallace, is local manager, has an option on the control of the Senator company, and these deals with Great Eastern will enable the Syndicate to proceed with the development of the former. The Coeur d'Alene Syndicate also has an option on the control of the Flynn Group Mining Co., which with the Senator owns the large block of ground between the Frisco and Black Bear on the west and the Morning and Star on the east.

Old Tombstone Camp More Active Than in Recent Years

Tombstone, Ariz.—The new Co-operative mill, on the Fisher mill-site, is in successful operation. Led by V. G. Mellgren, eight mine owners erected the plant, and each will operate it while it is handling his own ores. Water is secured from a well on the ground. Another milling project is that of George Kitt and others, of Tucson, who will erect a concentration and cyaniding plant for handling ores and dump material from the State of Maine and other mines on which they have leases. H. O. Hammond will be in charge. The mill of the National Metals Recovery Co. is handling sixty tons a day in two shifts, turning out concentrates. The plant is in charge of J. W. Stockham, who erected the Shattuck mill, in Bisbee. A small mill is being operated by Bert Holland and associates at the foot of Emerald gulch, with high percentage of recovery and with ore available for two years working. In addition, a contract has been entered into for the shipment by the Bunker Hill company of 1000 tons of manganese-silver ore to the El Paso smelter. It is remarkable that in a time of general mining depression the old bonanza silver camp of Tombstone is showing greater prosperity than for years.

E. J. Longyear Co. Secures Contract for Sinking Shaft

The E. J. Longyear Company has secured a contract from the American Lime & Stone Co., of Tyrone, Pa., to sink a 9 by 24 ft. 45-deg. inclined shaft, and drive four 8 to 24 ft. crosscuts at the latter's No. 4 Bellfonte limestone quarry. At the completion of this work, underground mining will replace the present quarry work.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Proposed Change of Assessment Work Year to Fiscal Basis Reported Favorably

Opponents Claim This Will Interfere With Agricultural Pursuits

The House of Representatives is urged by its Committee of Mines and Mining, in a report submitted May 27, to change the period for doing assessment work on unpatented mineral claims from a calendar to a fiscal year basis. This action was taken after a full discussion of the matter by the committee. A tentative decision had been reached to allow the matter to go over until the whole subject of the revision of the mining law could be taken up. At the committee meeting, however, it was pointed out that the general revision would give rise to many controverted points, which necessarily would require considerable time for their discussion. The fact that the 1920 assessment work period had been extended to July 1 made the time particularly opportune for putting into effect promptly the new arrangement.

The Secretary of the Interior advised the committee that he had no objection to the measure, but pointed out that the tendency would be to put off the assessment work until the spring and early summer, when it would conflict with agricultural pursuits. In reporting the bill, Representative Rhodes, the chairman of the Committee on Mines and Mining, said that it is the usual and natural tendency of all persons to postpone until near the close of the period anything that must be done in a limited time. This has resulted in most of the assessment work's being done in November and December, when climatic conditions frequently interfere with the work. The measure has the support of practically every member of Congress who is personally familiar with the activities surrounding assessment work. The Legislature of Nevada, a body particularly familiar with mining matters, by a unanimous vote memorialized Congress urging that the change to a fiscal year basis be made. The Secretary of the Interior, however, doubts if the demand for this change is sufficiently widespread to justify the alteration in such a well-known and long-established provision of the mining law.

Mr. Rhodes meets the objection as to the conflict with farming by stating that the harvest season in the greater part of the West does not begin until after July 1, so that there is ample time for the labor engaged in assessment work to go down into the irrigated valleys and assist in gathering the crops.

The delegate from Alaska, who is also a member of the committee, objected to the legislation on the ground that assessment work in Alaska can be done best when the snow is on the ground and travel is relatively easier. Other members of the committee pointed out, however, that it still would be possible to perform the assessment work during the winter period. It also developed that there is division of opinion on the matter even in Alaska. Delegate Sutherland, from that territory, is communicating with the industry in Alaska. In case it should be found universally desirable for Alaska to continue on the calendar year basis, he probably will be able to secure an amendment to that effect when the bill is considered in the House.

Bureau Gets Report on Changes Needed in Mining Law

The final report of the Ingalls committee on changes needed in the mining law has been received by the Director of the Bureau of Mines. Before submitting the report to the Congressional committees, it may be necessary to return it to New York, but it is regarded as certain that the final report will be in the hands of the committees within a short time.

Patent Amendment Proposed

In the interest of the national defense and to prevent unwarranted advantages to foreign inventors, Senator Stanley, of Kentucky, has proposed an amendment to the revised statutes providing that any patents issued to foreigners must be put in operation and production in reasonable quantities begun within the continental limits of the United States within two years. Failure to comply with that provision entitles the United States to issue a license which will permit use of the patent by the recipient.

Ferromanganese Case Dismissed

The Federal Trade Commission has dismissed its complaint against Rogers, Brown & Co., of New York, in which unfair competition against a number of importers of ferromanganese was alleged.

Coghill To Study Joplin-Miami District's Zinc Problems

After having rendered notable assistance to the operators in the Wisconsin zinc field, W. H. Coghill of the metallurgical staff of the Bureau of Mines, will take up the metallurgical problems of the zinc industry in the tri-state district.

Longworth Resolution on Tariff Bill Causes Discussion

Few pieces of legislation have given rise to as much discussion as has followed the reporting out of Representative Longworth's resolution to give immediate effect to the permanent tariff bill directly after its being completed by the Committee on Ways and Means. The object of the resolution is to prevent large losses of revenue to the Government during the time the revenue bill is under discussion. When the proposed higher rates of duty become known, importers bring in large quantities of goods in anticipation of the higher rates. The large loss of revenue always has been regretted, but Congress never has been willing heretofore to give immediate effect to legislation previous to its having gone through the usual course. There is evidence that there will be no departure from this precedent, but, nevertheless, there is certain to be a determined effort to secure such legislation.

Great Britain, France, Italy, Canada, Australia, and other governments follow such a procedure. It requires from five to nine months for tariff legislation to take its regular course through Congress. Representative Longworth, in reporting his resolution, declared that between the dates of reporting a revenue bill to the House and of its final enactment into law, the loss of revenue resulting from the artificially stimulated imports will run into hundreds of millions of dollars "at a time when the Government is in need of revenue as never before, and when the resulting damage to American industries would be incalculable."

The suggestion for this legislation came originally from Secretary Hoover. In a letter to the Committee on Ways and Means, he said in part:

"It seems to me desirable that the new tariff should be made legally effective upon the introduction of the bill. This is the custom in many countries. It prevents a large amount of speculation. Of even more importance, however, is the fact that during the period of discussion there is always a flood of goods in anticipation of the tariff. This decreases the revenue and renders the position of our commercial community extremely difficult. The presence of these goods and their subsequent realization handicaps the effect of the tariff for many months, or even years, after its passage. The objection to the tariff being made effective upon its introduction is that the subsequent changes may necessitate refunds to importers in case of a reduction from the initial rate."

NEWS BY MINING DISTRICTS

Special London Letter

Nigerian Tin Companies To Merge—Gold Discovery Rumored at Naraguta Tin Mines—Gold Shares Quiet as Sterling Exchange Improves

By W. A. Doman

London, May 17—Because the price of tin shows an upward tendency, some of the Nigerian tin mining companies are beginning to give evidences of life again. Not so much from the point of view of production as from that of finance. Few of the undertakings can be said to be in sound condition, so the present dull period is being utilized to devise schemes of amalgamation. Even if it were possible to produce tin profitably, which it is not, and will not be until another £80 or £90 a ton is added to the market price, there are still large accumulations to be marketed. No country apparently seems able to stimulate consumption.

A big scheme is being carried through, and it remains to be seen whether the best is being made of the opportunity. In August, 1919, the New Lafon Tin Fields, Ltd., disposed of its Nigerian properties to the Associated Nigerian Tin Mines, Ltd., for shares. The latter company is now to be absorbed by the Keffi Consolidated Tin Co., Ltd., the Associated company to receive one fully paid 5/- Keffi share for each of its own 5/- shares. Both are quoted in the market at 1/9⅜. The capital of the purchasing company will be increased by £275,000. Taking all circumstances into consideration, it might have been better to write down the capital and raise additional funds, as it will prove none too easy to distribute substantial dividends on the enlarged capital of £775,000. It may perhaps be asserted that the mining companies in general are in a bad way financially, and it is frequently a mistake not to be drastic at the outset when amalgamation is decided upon.

For some time rumors have circulated of the discovery of an auriferous deposit in Nigeria on one of the properties of the Naraguta Tin Mines. I have made inquiries, and all that I can gather is that "to be skeptical would be wrong"! A trial crushing of five tons giving 4 oz. to 5 oz. to the ton had taken place; but trial crushings are [illegible] delusive.

With the improvement in the sterling-dollar exchange investors in gold-mining shares are beginning to look rather glum. Last year they benefited enormously by the so-called premium, and now they not only see profits and dividends declining, but in some cases absolute disaster seems ahead unless the expense of winning the metal can be lessened. The Transvaal, Rhodesia, and Australasia are all in the same predicament, and there is no life in the share market. Australian mining companies are hit doubly hard. Recently I quoted the Ivanhoe. Now the Golden Horseshoe comes along with a similar tale of misfortune. On Dec. 31 last the ore reserves were estimated at 637,330 tons of an average value of 8.75 dwt. The cost of treating a ton of ore at the mine was 36/1. The total net value of bullion for the year from 125,340 tons was £324,461; yet the profit was only about £95,000, and £87,223 of it was on account of sales of gold over the standard price. Over the whole year the excess averaged 32/3 per fine ounce, which will not be the case during the current period. Wage increases and reduced hours have created a serious condition of affairs, and the directors are throwing out hints.

In West Africa the Fanti Consolidated Mines owns an extensive manganese property. For a considerable time the company was prevented from dealing with it on account of the demands that would have been made for excess profits duty. To obviate the difficulty, the company issued reserve shares at a premium. It is intended to equip the property to produce and ship 200,000 tons of ore per annum at an estimated cost of £250,000. One contract has been entered into for the sale of 500,000 tons of ore at a guaranteed minimum profit of 7/6 per ton. Another and similar contract could have been made, but the directors are of opinion that they can make better terms later.

CANADA

Ontario

Gold Draws Prospectors Into Brice Township

Porcupine—McIntyre plans to carry operations down to 3,000 ft., but it will probably be two years before this objective is reached.

Last year diamond drilling was undertaken by English interests on the sand plains near the Hollinger, where the overburden is 200 to 300 ft. deep. Work was discontinued during the winter and has not since been resumed. Some of these claims have been taken under option by Americans, who are preparing to explore them.

A small force of men is at work on the Big Dyke property four miles south of the Dome Mines.

Cobalt—The Mining Corporation of Canada has resumed operations at full capacity on its Cobalt properties, taking on a working force of upward of [illegible] men. The enlargement of the mill is expected to lower the operating costs to a point which will enable the company to realize a profit on silver at 60c. per oz.

An option held by the National Mining Co. on that part of the Silver Cliff mine lying below a depth of 500 ft. was dropped some time ago. The Northern Customs which held an option on the upper section of the mine has also allowed it to lapse.

Matachewan—Fifteen men under the direction of William Judge are engaged in mining asbestos in Bannockburn Township. Thirty tons will be mined and shipped as a preliminary test.

Brice Township—A rush of prospectors has set in to this locality on the Elk Lake branch of the T. & N. O. Ry., stated to be fifteen miles south of any previously known gold occurrence in northern Ontario. Some claims were staked last fall, and good gold showings are reported to have been found this spring. About 200 claims have been staked.

British Columbia

Operations Resumed at Providence Mine

Greenwood—After some delay due to high water operations at the Providence mine are again well under way, with a crew of about twenty-five men. Stoping is progressing on the 400 and 500 levels, and it is planned to open up the 600 level. The property has been profitably operated for some years by lessees.

Penticton—D. C. Coleman, vice-president of the Canadian Pacific Ry., while on an official visit here the latter part of May, stated that he did not anticipate that the Canada Copper Co.'s property at Copper Mountain would be reopened for a long period. Mr. Coleman stated the Canadian Pacific had no further interest in the Canada Copper Corporation beyond contracts for ore transportation and was not entertaining any proposition with a view to acquiring the property or its control.

Trail—Application is being made to the provincial government for incorporation of the municipality of Tadanac, the area immediately surrounding the Trail smelter of Consolidated Mining & Smelting Co. of Canada, Ltd.

Ore received at the Consolidated smelter during the week ended May 22 totaled 9,587 tons, of which 9,586 tons come from company mines and 1 ton from the Krao at Ainsworth.

Hedley—If some further reduction in operating costs and mining supplies is manifested by July 1, of this year, Hedley Gold Mining Co., operating the Nickel Plate mine, is prepared to proceed with the expenditure of $35,000 on additional development, with a likelihood of resumption of productive operations in 1922.

Alice Arm—There is more activity in the Illiance River valley than in any other section of the district at present. Some development work is being done on the Bellevue group and the Silver Star. A number of claims also are being opened up by A. J. Bowen, former smelter superintendent at Anyox. In the Kitsault Valley there is no work in progress at present, the Dolly Varden being idle, with no information as to what the plans are for the forthcoming season. A. J. T. Taylor, who has returned from abroad, has not yet made a statement on this point.

Quebec

Report of Discovery of Gold at Kazubazua Doubted

Kazubazua — An investigation into the reported gold discoveries in the Gatineau district has been made by Theo. O. Denis, superintendent of mines for Quebec, who reports that eleven prospect pits and strippings were examined and sampled. None of the samples showed any trace of gold or silver. The geological conditions noted at all points appeared unfavorable to mineralization on a large scale.

BURMA

Bawdwin Mines Continue To Produce Steadily

Namtu—The lead production of the Bawdwin Mines for April was 3,526 tons gross; refined lead production was 2,369 tons; refined silver production was approximately 231,934 oz.

NEW CALEDONIA

Chrome Exports Expected To Drop in 1921

The Kopéto mine, operated for many years by the Béchade company, has been closed down and all the personnel have been released. A few laborers have been retained to dismantle the twenty kilometers of railway tracks.

The Edison mine, yielding auriferous copper, is under active development. A power pump was received in March and will facilitate prospecting at depth.

Thio—La Société le Nickel is offering contractors, in its cobalt mines only, as high as 230 fr. per tonne of ore running 4 per cent. Most of the cobalt miners (lessees) claim that this price does not pay them, because of the high costs of mining supplies, such as sacking, tools, and the like. Moreover, the contracts are aleatory and without guaranty for the future. However these things may be, there certainly is a demand for cobalt, which seems to presage important developments for the future.

Tiébaghi — Chrome ore exports in 1921 will not reach the high figures of 1920. American freighters "Nishmaha" and "Chepadoha" have loaded about 18,000 tonnes, cleaning all ore that had been brought down to the docks. Future loadings must wait the mining of new ore, and everything indicates that there will be but two or three more cargoes this year.

ALASKA

Alaska Gastineau and Perseverance Close Down

Juneau—The Alaska Gastineau and the Perseverance mine at Thane are reported to have closed on May 31, in accordance with an announcement previously made.

MEXICO

Coahuila

Government May Return Rolling Stock to Peñoles Company

Sierra Mojada—Walter B. Gates, representing the Cia. Minera Asarco, has filed on an extensive area of mining territory embracing in all a group of sixty-seven claims to be titled under the name of El Panama. This property is on the north side of the Sierra Mojada Mountain in the vicinity of the American, El Capitan, and Orientales mines, in the Sierra Mojada district. Development work will soon be started on these claims, which are to be explored for silver, lead, and copper. Max F. Quinn, engineer, has been appointed to make the official survey and plans.

A large number of the miners of the Sierra Mojada camp have left for the oil fields in search of employment, having been thrown out of work by the closing of the principal mines of the district.

The train over the branch line from Escalon to Sierra Mojada now makes only one trip each week, as very little ore is being shipped out and only a small amount of supplies is coming in.

The few miners that remain are finding employment in development work at the big mines or prospecting on some of the new claims recently taken up.

Torreon—During the recent railroad strike on the National Lines of Mexico the mines of the Peñoles Mining Co. at Mapimi were closed down and their rolling stock and railroad employees were turned over to the government to relieve the situation. The government is now receiving a large number of new engines and cars, the striking employees are returning to work, and it is proposed to return to the Peñoles company the borrowed equipment, to enable it to resume operations. The smelter at Mapimi will not be blown in for the present, but it is said that employment will be given to about two thousand miners in the mines. The ores will be shipped to the company's plant at Torreon and Monterrey.

Durango

Durango—Alexander O. Stevenson, possessor of a large number of mines in the San Dimas camp, is doing considerable development work at his properties and is also acquiring new claims. He has made two recent filings before the mining agent at Durango, one for a group of eleven pertenencias embracing the bid Tecolotes and Santa Rita mines and the other a relocation of abandoned mines in the Tecolotes mountains.

Federal District

Import Duties Removed on Mining Supplies and Equipment

Mexico City—A recent mining decree exempting mining supplies and equipment from import duties is intended to encourage idle mines to resume operations. An improvement in railroad traffic also is hoped for by the end of May.

ARIZONA

State To Appeal From Recent Decision That Industrial Commission Law Is Unconstitutional

Clifton—Smelter and mines of the Arizona Copper Co., Ltd., closed May 31, affecting about 125 men at Clifton and about 800 in the mines at Morenci and other points. Most of the employees were Mexican, many of them long employed. The power plant at the smelter will be kept in operation, to supply electricity to the town of Clifton, and the company stores will be kept open. Passenger service on the Arizona company's seventy-two mile railroad to Lordsburg will be maintained by motor car, with occasional freight trains. A large proportion of the Mexican workmen had already been sent back to Mexico through El Paso.

Globe—James J. Jeffries, former heavyweight champion, is said to be one of a company of five associates that has acquired possession of eight asbestos claims in the Sierra Ancha Mountains, north of Globe. Jeffries recently visited the mines.

Miami—Inspiration is to lay a 7,000-ft. stretch of railway over a part of the newly acquired porphyry ground to connect the main shaft with the Live Oak, to facilitate carriage of Live Oak ores to the big mill.

Jerome—The orebody in the Verde Central has not yet been fully crosscut. It has been found that the supposed footwall, giving a width of 30 ft., was merely a streak of hard quartz-porphyry and all that is known is that the footwall lies somewhere further to the west. The lower drift is being pushed ahead and is expected to be under the original ore showing within another week.

The Verde Central showing has renewed interest in the old Venture Hill property nearby. The mine was sold by the sheriff six months ago and was bid in by John Robinson and Edward Shumate, of Prescott, and Boaz Duncan, of Los Angeles. The stockholders are trying to organize a new corporation to redeem the property.

Phoenix—Amethyst is being mined near Roosevelt by W. S. McDaniels, who is shipping to Loss Angeles. Pink onyx, capable of high polish, has been found on the west slope of the Whetstone Mountains, near the Mexican border, the deposit having been located by Dr. L. W. Klene of Nogales.

Notice of appeal has been given by the Attorney General from Superior Judge Stanford's decision that the Arizona Industrial Commission law is unconstitutional. Arguments are to be heard June 15, and a decision is not expected before fall.

Kingman—At a recent meeting of the Nancy Lee Mining Co., operating a gold-silver property in Secret Pass, Mohave County, it was decided to change headquarters of the company from Bisbee to Kingman, to facilitate the dispatch of business. Kingman is the railroad point for the mine, being twenty-three miles distant. The new officers elected are John Olson, president and general manager; Fred T. Bragonier, vice-president, and Robert B. Manson, secretary and treasurer, who with Senator Henry Lovin, Dr. Robert Ferguson and H. J. Hierl compose the directorate.

Bisbee—A meeting of the directors of the Apache Powder Co., held at the company's office in Bisbee, Ariz., was attended by the following: T. H. O'Brien, general manager of the Inspiration Consolidated Copper Co.; Thomas H. Collins, director of the Calumet & Arizona Mining Co.; F. W. Maclennan, general manager of the Miami Copper Co.; Norman Carmichael, general manager of the Arizona Copper Co., Ltd.; and J. E. Curry, secretary of the Arizona Chapter of the American Mining Congress.

The plant of the Apache company is on the San Pedro River, a short distance from the town of Benson, in Cochise County, and is in the final stages of construction. The moving spirit of the enterprise is Charles E. Mills, president of the company and formerly general manager of the Inspiration company. The plant has been under construction for the last ten months. W. W. Edwards, assisted by D. E. Fogg, has been in direct charge of construction.

Douglas—The office of the general manager of the Phelps Dodge Corporation at Douglas has been closed since May 15 and will remain so during the period of depression in the copper market.

NEW MEXICO

Work To Be Resumed on American Mine at Old Hachita

Lordsburg—Exploration work by the new owners on the Last Chance property is showing up well. A parallel vein on the 275 level has been opened, showing 12 in. of high grade. Two samples gave an assay of 172 oz. and 278 oz. silver, respectively, with 7 per cent copper. John H. White is in charge.

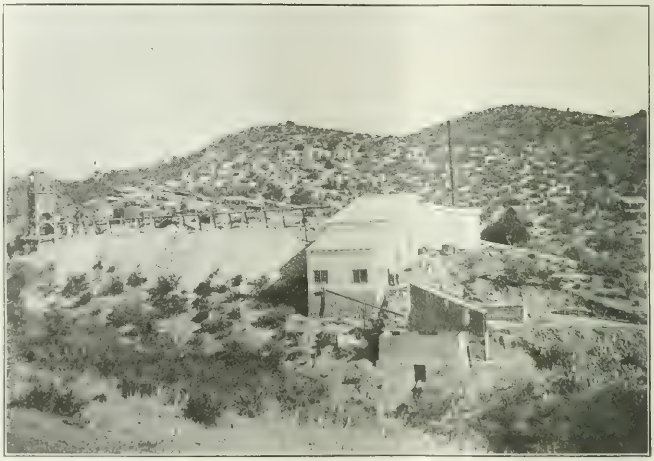
The Co-operative Mining Co. held a special stockholder's meeting on May 14. The capital stock was increased from 250,000 shares to 500,000 shares, 215,663 shares voting. The board of directors was given greater authority. The enlarged mill was started May 9. A recovery of 91.50 per cent is claimed. Concentrates are reported to run $169.50 per ton. Shipments will be made to the El Paso smelter. It is planned to do 200 ft of sinking. C. H. Walters is manager.

A rich strike of specimen gold ore has been made at Gold Hill by Frank C. Cline. Mr. Cline has operated a two-stamp mill successfully for a number of years in this district, doing all the work of mining and milling himself.

Steins Pass—C. W. Mitchell and associates have taken an option upon the old Volcano mine and sixteen adjoining claims. A small force is working. A 16-ft. vein carrying considerable argentite and chlorides has been opened on the 100 level. A car of sorted ore is being hauled for shipment.

Hachita—The American Metals Mining Co. report that work will be resumed soon upon the old American mine at Old Hachita, in the Eureka district. A 100-ton concentrator is to be installed; also a new compressor and a complete equipment of air drills. A 15-ft. orebody is reported upon the 200 level that assays about 60 oz. silver and 60 per cent lead. The property consists of eight claims. Charles Fowles, is manager.

Albuquerque—The Mont de Lion Mining Co. has filed application for 10 second-feet of water from Peralta Cañon Creek in the Bland district. The water to be used for a hydro-electric power plant to operate a 30-hp. stamp mill. It is expected to impound 500 acre-feet in the reservoir.


CO-OPERATIVE MINE, LORDSBURG, N. M., SHOWING ORE DUMP AND FLOTATION PLANT

Santa Fe—The Mineral Mining & Milling Co., a New York corporation has filed a foreign corporation statement. The authorized capital stock is $50,000, with $10,000 subscribed. The principal office is in New Mexico at Santa Fé. J. O. Seth is the statutory agent.

COLORADO

Ouray Union Co. Begins Work at Wanakah Mine—Chipeta Company Completes Air and Power Line

Ouray—The Ouray Union M. & M. Co has begun work at the old Wanakah mine, close to Ouray. The mine is being re-furnished with a mining plant and the mill is being overhauled and equipped with oil flotation apparatus as well as closed-circuit ball-mill machinery. The mine has produced a large quantity of pyritic ore carrying high gold values, with copper. Development of the unexplored parts of the property is planned.

The Gold Crown mill at Ouray is being overhauled by Frank E. Henn, owner, and was put into operation on June 1, to treat custom ores and ore from the Two Kids mine, the property for which the mill was built. Prospectors and small mine operators are beginning to prospect the old mines and small properties on East and West Gold Hill in the vicinity of this mill, as considerable milling ore can be won and easily transported to the mill.

The Chipeta Mining, Milling & Reduction Co. has completed the electric-power line and the compressed-air line for its new plant, and is now erecting mine buildings and a compressor plant.

This company has opened a good showing of milling ore in a wide vein on the H. A. C. property in the Amphitheatre, and plans to push development when the new plant is complete.

The Mountain Top Mining Co. has completed the sinking of an additional 150 ft. of its shaft disclosing excellent ore at the new level, and is now drifting on the vein at this level. The mill is operating steadily. Shipments of high-grade silver ore are also made regularly.

Carey Bros. & Summerville have begun operations under lease and option on the old Plutus & Sampler property just north of Ouray, and have opened some good high-grade gold ore accompanied with a good grade of milling ore.

John Sylstra has resumed work at the Little Maudie under lease. A shipment of good silver ore was made from this property last year, but work was suspended for the winter.

The Eurade Mining Co., with a small crew, continues development of the shoot of silver copper ore encountered last winter.

The weather has been continuously bad, and the roads and mines at high altitudes are still heavily snowed under.

UTAH

M. J. Dailey Elected Director of Silver King Coalition—Zuma Shaft, at Eureka, To Be Deepened

Park City—M. J. Dailey, mine manager of the Silver King Coalition, has been elected director to succeed William S. McCornick, recently deceased. F. D. Wescott, for some time secretary, will succeed Mr. McCornick as treasurer. Remaining members of the directorate are: David Keith, president; Thomas Kearns, vice-president; W. Mont Ferry, managing director.

Eureka—The Zuma has contracted to have its shaft, now down 500 ft., continued to 1,200 ft. It is reported that part of the payment for the work will be made with treasury stock. The Eureka Bullion has shipped thirty-five tons of silver-lead ore carrying gold from the 900 level, where ore cut higher up appears to have been picked up again. The ore has come in bunches, thus far.

Moab—The Buena Vista Copper Co. is reported to have given up its lease on the property and mill of the Big Indian Copper Co. The Buena Vista company has been working the mill and property for about two years and a half, and making experiments on the low-grade copper ores of the mine. A sample of uranium ore weighing about 15 lb. from the claims of H. W. Baisley in the Brown's Hole country has been on exhibition in Moab. About forty sacks of ore similar to the sample has been taken from a petrified tree which was largely replaced by the high-grade carnotite ore.

IDAHO

Coeur d'Alene District

Highland-Surprise Resumes Work—Polaris Leased to Ferguson and Associates—Sunset Drift 100 ft. in West Sunset Ground and Still in Ore

Kellogg—After a prolonged suspension the Highland-Surprise company is again active. According to official announcement, the first work to receive attention will be to extend the raise, which is now up about 50 ft., from the No. 3 to the No. 2 level. The completion of this raise, the statement says, "will make available enough ore to run the mill for a long time and with a favorable market condition, should be a source of much profit." The company has a mill of 125 tons' capacity. The property is on Pine Creek.

Wallace—John F. Ferguson and associates have secured a lease on the Polaris, situated in the Big Creek silver belt. The property was located many years ago by the late Senator Heyburn, who shipped gray copper ore having a high silver value and did considerable development work. Following his death, the Polaris was sold by his widow for $20,000 to a group of Wallace and Spokane men. These owners were unable to carry out their development plans, and the lessees have now stepped in and are in line to make a good profit, as indicated by the present showing of ore and the high price of silver.

The Kennan Mining Co., operating in Pony Gulch, is developing a remarkably fine tungsten vein, which where exposed by stripping and sinking a few feet in the bed of the creek appears to be about 15 ft. wide and has streaks of clean scheelite varying from 1 to 8 in. thick. A drift is now being run which is expected to develop a large body of ore.

A report from the West Sunset, which appears to be reliable, says that the drift from the 1,000 level of the Sunset has been extended over 100 ft. into the West Sunset ground; that there was from 10 in. to 3 ft. of ore for a distance of about 200 ft. in the Sunset ground, and that since passing into the West Sunset the ore showing remained practically the same for about 80 ft., and from that point the amount has steadily increased until there is now 5 ft. of shipping ore, mostly lead-silver, in the face. The West Sunset is controlled by the Days.

Bonners Ferry—Construction of a two-bucket aërial tram, connecting mine and mill of the Cyanide Gold company, in the northeast corner of Boundary County, is about to be completed, work having been delayed because of a late spring and deep snow.

Sandpoint—A car of high-grade ore is being taken out on the Marguerite property, on Trestle Creek. Arrangements have been made to resume development of the Chilco group, just north of Hayden Lake, and it is planned to add a two-drill compressor to the equipment during the summer.

Porthill—An accumulation of about 3,000 tons of concentrates left over from last year's operations of the Idaho-Continental mine and mill will be shipped this summer to the Bunker Hill & Sullivan smelter at Kellogg.

MONTANA

Cascade Silver Stockholders to Meet in Butte June 7

Butte—An orebody with a width from 5 to 6 ft. of bornite and running 16 per cent copper is one of the latest developments of importance at the Davis-Daly's Colorado mine. This shoot is found on the 2,300 level, serving further to emphasize the enrichment found in the so-called "northwest" veins at depth.

The hanging wall fissure of the Spread Delight vein on the 1,600 level of the Main Range mine of the Tuolumne company is expected to be reached within three weeks. This fissure was well mineralized on the 1,200 level with about a foot or two of ore, a marked improvement over the showing on the 1,000 level.

Drifting operations on the recently uncovered copper-bearing vein on the 2,050 level of the Black Rock mine of the Butte & Superior company constitute the chief feature of the development work under way at this property. Ore reserves were increased at the end of the first quarter by 39,250 tons over those of the preceding quarter. The total reserve tonnage on that date was 461,350.

Drifting on a 7-ft. orebody found on the 400 level in the Norwich vein, together with crosscutting for the foot wall of this vein where another ore shoot is looked for, constitute the development work at the Butte & Plutus. Plans are taking form for a resumption of operations at the Mapleton shaft of this company, about 1,200 ft. away.

Lessees operating through the shaft of the Butte-New England on the Hesperus vein of the Davis-Daly have a 7-ft. body of commercial ore from which shipments are being made.

Neihart—The annual meeting of the stockholders of the Cascade Silver Mines & Mining Co. will be held in Butte on June 7, at which time it is expected that the question of rebuilding the concentrator recently destroyed by fire at Neihart will be taken up.

OREGON

Several Stamp Mills Being Remodeled in Southwestern Part of State

Gold Hill—Construction work under way at present in southwestern Oregon is indicated as follows: The Gold Ridge company, of Medford; the Pittsburgh-Oregon company, of Gold Hill; the Millionaire mine, C. A. Knight, manager, Central Point; and the Boswell mining company, of Holland, are all remodeling small stamp mills, of which there is one of five stamps on each property. All these are gold mining companies. The War Eagle mining company (quicksilver), of Medford, is remodeling a 25-ton Scott furnace to save byproducts. The principal byproducts are arsenic, zinc, gold, silver, and cobalt.

Sumpter—The Mammoth gold quartz property is reported to have been sold by J. J. Heilner to W. H. W. Hamilton, of Baker, Ore. There is a 300-ft. shaft on the property.

CALIFORNIA

Calaveras Copper Co. Improving Copper Smelter—Finnegan Mining Co. Completes New Stamp Mill

Copperopolis—The Calaveras Copper Co. is sinking its south shaft, which is vertical and has two compartments and a manway and has reached a depth of 225 ft. At the copper smelter, a new dust flue and 75-ft. stack is being constructed and a converter will be added. The blast furnace is also to be altered, and many improvements are under way to increase labor efficiency in the smelter. At the flotation mill, minor changes in crusher and conveyor arrangements are being made. No production is being made, but work will be speedily resumed when the copper market improves.

Angels—At the Angels Deep, ore development on the 200 and 500 levels has been such that the continuous operation of a new twenty-stamp mill in the near future is assured. The property has been brought to its present efficiency by J. C. Benson. Alfred Hunt is superintendent.

The Toll Gate Mining Co., near Altaville, is opening up a promising prospect called the Port Arthur, and has sunk a shaft to the 100 level and constructed a small testing mill.

The Triple Lode Gold Mines has purchased the Hardenburg mill, and construction of a twenty-stamp mill is expected to be completed within ninety days.

At Vallecito, A. H. Mackenzie and Don Steffa have been prospecting for eleven months for the continuation of the Vallecito channel and have driven over 1,000 ft. of workings in an effort to find the channel. Lately the discovery of coarse gold has encouraged them in the belief that the channel has been found.

Melones—The Carson Hill Gold Mining Co. is pushing development and mining over 500 tons of gold ore per day. There is a shortage of highly skilled miners. The thirty-stamp amalgamation and concentration mill is handling over 500 tons per day. The tailings are pumped and laundered over to a sand and slime cyanide plant near the old Melones mill.

The Finnigan Mining Co. has completed the erection of a ten-stamp mill and is operating it on part time.

Jamestown—Operations at the Belmont Shawmut at Shawmut are restricted to shaft repairs and plant betterment.

The Rawhide mine has resumed operation to a limited extent, and the Patterson has started up.

Amador City—The mill of the Treasure mine has been temporarily shut down pending placing a new hoist.

Merced—The Original Mining & Milling Co. has applied to the Federal Power Commission for permission to build a conduit 3,100 ft. long from the present diversion dam in the Merced River, in Sec. 22, T. 3 S., R. 19 E., M. D. M., to a power house developing 500 hp. This plant will supersede a small existing plant.

NEVADA

Little Change in Strike Situation at Tonopah—Orebody 18 ft. Wide Discovered at Gibraltar Mine

Tonopah—There are no new developments in the strike situation in this district. The larger companies, including the Tonopah Extension, Tonopah Belmont, and Tonopah Mining, are making housing preparations to accommodate men being brought in from the outside. It is believed that sufficient men can be brought in to enable these properties to resume operations at an early date. The Tonopah Extension is operating with about sixty-five men, out of a normal crew of 250. The strikers are "sitting tight," relying on the poor quality and inefficiency of the imported labor to bring the operators to terms. Many men are reported as ready to return to work at the new scale, but are held in line by the strike leaders, most of whom are craft men.

The West End on May 18 shipped 1,500 oz. of bullion valued at approximately $53,000. This represents the result of operations for the two weeks ended May 15. During the week ended May 24, 200 ft. of development was done and 1,500 tons of ore hoisted.

Divide—The south crosscut on the 900 level of the Kernick shaft has recently cut several small stringers carrying high values in gold and silver. One picked sample assayed 128 oz. of gold and 146 oz. of silver. The crosscut has advanced 700 ft. from the shaft and is making excellent headway. Most of the small properties in the district are operating under the old scale of wages, but the Tonopah Divide mine is closed down, wages having been cut 75c. per shift at this mine.

Gibraltar—It is reported that a tunnel being driven on the Gibraltar property, situated in Jett Canyon 65 miles north of Tonopah, has proved the existence of an orebody about 18 ft. wide which contains values from $10 to as much as $500 in picked samples in gold and silver. Some work was done on this property in 1919, but no commercial ore was discovered then. It now appears that the ore recently discovered lies at right angles to what was originally supposed to be the strike of the outcrop. A crosscut tunnel is to be run under the ore showing which will give approximately 150 ft. of backs.

MICHIGAN

Marquette Range

Laughlin Ore Co. Surveying Lands Bought From Breitung

Palmer—The M. A. Hanna Co. has resumed operations at the Richmond mine, an open pit property. Shipments were begun on June 1. The Maitland is preparing to start shipments at an early date.

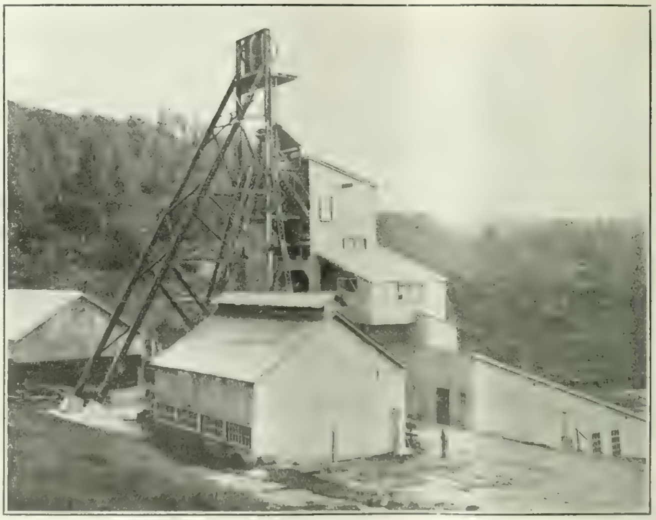
Negaunee—Engineers in the employ of the Laughlin Ore Co. are making a complete survey of the lands recently acquired by the company from the Breitung interests. The lands comprise twenty-seven forties, and include the Breitung Hematite mine. The mine is idle at present, but will be operated when the ore market improves. Every operating mine in the Negaunee field is now on a three-day-a-week basis.

MINNESOTA

Mesabi Range

Dunwoody Open Pit, Biwabik Pit and York Mine To Be Reopened

Buhl—The Oliver company has started shipments from four other properties since the first orders were issued this season. The Wanless and Shiras mines are now shipping steadily, also the Pool mine, at Hibbing, and the Leonidas mine, at Eveleth.



SURFACE PLANT AND MILL, TREASURE MINING CO., NEAR AMADOR CITY, CALIF. THIS MILL HAS JUST SHUT DOWN TEMPORARILY

Chisholm—The Tod-Stambaugh is making all preparations to reopen its Dunwoody open-pit mine. It is planned to ship daily.

Biwabik—Preparations have been made to reopen the Biwabik open pit. Four shovels will be used, three on ore and one on stripping.

Nashwauk—The York mine, operated by Coates & Tweed, will reopen soon. Equipment is being overhauled.

Marble—The Hill-Trumbull mine, operated by the Mesaba Cliffs company, is running only one shift, as the new plant of the Trumbull Cliffs Furnace Co. is not yet ready.

The Interstate Iron Co. has ceased all ore operations at its Hill-Annex open pit. The property had only been shipping for a month. This does not effect the stripping work being done by A. Guthrie Co.

THE MARKET REPORT

Daily Prices of Metals

May	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
26	13 @13.25	31.25	32.25	4.75@4.875	4.75	4.70@4.75
27	13 @13.125	30.75	32.00	4.75@4.875	4.70@4.75	4.70@4.75
28	13 @13.125	31.00	32.00	4.75@4.875	4.65@4.75	4.70@4.75
30	....	......	......	....	....	....
31	13 @13.125	30.50	31.50	4.75@4.875	4.60@4.75	4.70
June 1	13 @13.125	30.25	31.25	4.75@4.875	4.60@4.75	4.70

*These prices correspond to the following quotations for copper, "delivered": 13.25 @ 13.50c. for May 26; 13.25 @ 13.375c. May 27 to June 1.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

May	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
26	74½	74½	76	180¾	181⅝	23⅝	23⅝	28	28⅜
27	73⅞	73⅞	76	177¾	178½	23	23	28	28¼
28	...	....	...	....	....	...	...	..	...
30	73	73¼	76	173½	174¼	22½	22½	27½	27¾
31	72½	72¾	76	174	175	22¼	22¼	27¼	27½
June 1	73	73¼	76	173	173¾	22¾	22¾	27	27¾

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

May	Sterling Exchange	Silver New York, Domestic Origin	Silver New York, Foreign Origin	Silver London	May	Sterling Exchange	Silver New York, Domestic Origin	Silver New York, Foreign Origin	Silver London
26	392	99¼	58	33½	30	...	...	...	34⅛
27	389	99¼	58	33⅞	31	387	99¼	57½	33¾
28	389¼	99¼	58⅝	34	June 1	389	99¼	57¾	33½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Monthly Average Prices for May

Copper:	
New York Electrolytic	12.742
London Standard............	73.196
London Electrolytic	74.298
Lead:	
New York	4.952
St. Louis	4.784
London	23.399
Silver:	
New York, foreign	59.810
New York, domestic.........	99.250
London	34.165
Sterling Exchange	396.580
Zinc:	
St. Louis	4.848
London	26.923
Tin:	
99 per cent	31.431
Straits	32.500
London	177.411
Antimony	5.250
Quicksilver	47.000
Platinum	73.740

Metal Markets

New York, June 1, 1921

Consumers continue to take no interest in the metal mraket, and the speculative element is also lacking. Monday was a holiday, but it is probable that no one would have suffered had the market remained closed for the entire week. In view of this inactive condition, nothing but gradually decreasing prices could be expected. Our monthly averages show that the prices for copper, tin, lead, and zinc all exhibited increases for May over the corresponding figures for April, which were in turn higher than those for March, when the turning point occurred. June starts none too well, however; particularly in the case of zinc, which is now lower than any monthly average price since March, 1909, when 4.607c. was recorded.

Copper

Export demand, which has been the sole support of the market for the last few weeks, almost completely died out during the last week, owing to the fall of sterling exchange and the increased prices quoted by the Copper Export Association. Large producers continue optimistic because of the greatly curtailed production. As will be seen from reference to page 971, copper production dropped from ninety million pounds in April to forty-six million in May, practically 50 per cent, and a further reduction may be expected in June, when the curtailments will be more complete. The larger producers are asking 13.50c. delivered for June copper, and threaten to raise this price as soon as business of any magnitude sets in. There seems little immediate cause for them to consider this matter, however. Large quantities of June copper can be obtained for 13.25c., delivered, today; 13.375c. being quoted for July-August by those willing to sell at these prices.

Lead

The A. S. & R. official contract price continues at 5c., New York and St. Louis.

One lot of several hundred tons of lead was sold at our average prices yesterday, but business in general has been deadly dull. At least one interest has been anxious to sell New York lead for 4.75c. all week, but has found practically no demand even at this marked concession over previous figures. At present lead could be imported probably for slightly less than 4.75c., but there is some hesitation about doing this, even if the demand were sufficient to warrant it, because of the possibility of the passage of the Longworth Bill.

The St. Louis market is also weaker, particularly for soft Missouri lead. Large producers of the more popular brands are quoting 4.75@4.85c. St. Louis and Chicago, but it is reported that some lead can be obtained at 4.60c.

Zinc

The zinc market is exceptionally quiet and galvanizers are buying practically nothing. The metal is freely offered by the few willing to sell at 4.70c. The market for forward zinc is non-existent. High-grade is quoted at 6.25c. delivered in the East.

Tin

Tin continues to be neglected, and there is practically no market in this country. Futures are nominally the same price as spot.

Arrivals of tin, in long tons: May 25th, China, 10; 28th, China, 5; 31st, Liverpool, 25; Straits, 500.

Gold

Gold in London: May 26th, 104s. 8d.; 27th, 105s. 1d.; 30th, 106s. 1d.; 31st, 106s. 4d.; June 1st, 105s. 9d.

Foreign Exchange

The break in sterling which began last week has progressed further, and quotations are now back to what they were several weeks ago. German reparations payments and many buying orders for dollars in foreign markets are assigned as the reason. On Tuesday, May 31, francs were 8.37c.; lire, 5.245c.; and marks, 1.59c. New York funds in Montreal, 12$\frac{3}{16}$ per cent premium.

Silver

The outstanding feature in the silver market the last week has been the weakness and violent fluctuations in sterling exchange, which seriously affected the export price for silver. The London price has been fairly steady between 33½ and 34¼d., with small demand from India buyers, and closing dull at 33½d. China demand still continues lifeless, with no indication of a decrease in stocks of silver on hand. The demand for silver in the domestic market continues quiet and below normal for this time of the year. Further shipment of about 50,000 ounces was received in New York this week from Germany. The tendency of the market is uncertain, with no marked movement, and the price for shipment is dependent on developments in the sterling-exchange situation.

Mexican Dollars — May 26th, 44½; 27th, 44½; 28th, 45; 31st, 44¼; June 1st, 44½.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 22@23c. per lb.; 22½c. for imports, duty paid. Metal being imported in anticipation of a higher tariff.

Antimony — Chinese and Japanese brands, 5¼c.; market dull. W.C.C. brand, 5¾@6¼c. per lb. Cookson's "C" grade, spot, 9⅝c. Chinese needle antimony, lump, nominal at [illegible] per lb. Standard powdered needle antimony (200 mesh) nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, [illegible]

Bismuth—[illegible] per lb., 500 lb. lots.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, [illegible] per lb.; black oxide, $3@$3.10 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, [illegible]@$300 per oz.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz.

Palladium—$70 per oz.

Platinum—$75 per oz.

Quicksilver—Nominally, $46@$48 per 75-lb. flask. San Francisco wires $48.50.

[1]**Rhodium**—$150 per troy oz.

[1]**Selenium—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.**

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal—Wire, $35@$60 per kilogram, according to purity and gage.**

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 45@55c. per long ton unit, f.o.b. Atlantic ports.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $7.45; Mesabi bessemer, 55 per cent iron, $7.20; Old Range non-bessemer, 51½ per cent iron, $6.70; Mesabi non-bessemer, 51½ per cent iron, $6.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5.80; old bed concentrates, 63 per cent, $6.70; Harmony, cobbed, 63 per cent, $6.70; new bed low phosphorus, 65 per cent, $9.50.

Manganese Ore — 25c. per unit, seaport; chemical ore (MnO_2) $55@$60 per gross ton, lump; $70@$75 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¾@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$80 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., May 28—Zinc blende, per ton, high, $28.55; basis 60 per cent zinc, premium, $25; Prime Western, $23.50@$22.50; fines and slimes, $20@$27.50; average settling price, all grades of zinc, $23.44.

Lead, high, $65.20; basis 80 per cent lead, $55; average settling price, all grades of lead, $55.91 per ton.

Shipments for the week: Blende, 4,761; lead, 942 tons. Value, all ores the week, $164,290. Shipment for five months: Blende, 116,478; calamine, 80; lead, 23,212 tons. Value, all ores five months, $4,084,420.

Lead was unchanged from last week, but spirited demand for a limited tonnage of premium ore resulted in $25 basis for 200 tons. Around 300 tons was bought early in the week on $24 basis, the balance of 3,800 tons purchased sold on $23.50@$22.50 basis. Production is estimated to be around 4,300 to 4,500 tons per week, and decreasing.

Platteville, Wis., May 28—Blende, no sales or shipments. Lead ore, basis 80 per cent lead, $58 per ton. Shipments for the week: Lead ore, 80 tons. Shipments for the year: Blende, 11,460; lead ore, 910 tons. Shipped during the week to separating plants, 441 tons.

Non-Metallic Minerals

Asbestos — Crude, No. 1, **$2,000@$3,000**; No. 2, $1,400@**$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock**, $110@$150; **paper stock, $60@**$75; cement stock, **$17.50@$30; floats,** $8.50@$15, **all per short ton, f.o.b.** Thetford, Broughton, and **Black Lake** mines, Quebec, Canada; 5 **per cent to** be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7 per long ton, f.o.b. Cartersville, Ga. Small lots sell for as low as $5.

Bauxite—High-grade French bauxite, $8@$10 per ton, Atlantic ports. American quotations the same. Consumers generally well supplied. Prices vary according to grade. Crude, unground, $16.50 per ton; ground, $22; calcined, ground $35; unground, $45, f.o.b. plant.

Chalk—English, extra light, 5@5½c. Domestic light, 4½@5c.; heavy, 4@4½c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$10; washed, [illegible]@$12; powdered, $15@$20; bags extra, per net ton, f.o.b. mines, Georgia; [illegible] powdered clay, $15@$20, f.o.b. Virginia points. Domestic lump, $10@[illegible], powdered, $25@$30; imported lump, $15@$25, f.o.b. American ports, powdered, $35@$45, f.o.b. New York.

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c. f.o.b. New England points.

Feldspar—Crude, $7@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$25 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $15, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $32, New Mexico. Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 7@7½c. per lb.; chip, 5½@6c.; dust, 3¼@4c. No. 1 flake, 6½c.; amorphous crude, ¾c.@2¼c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$2 per net ton; 1½ in., $1.50@$2. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead - Burned — $38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica. slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $6.75; 68 per cent, $6.25; 68@66 per cent, $6.

Pumice Stone—Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 14c., c.i.f. Atlantic seaport; furnace size, 14c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 12 @ 14c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$40, talcum powder grade. Southern talc, powdered, carload lots, $10@$14 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic — White arsenic, 7½c. per lb. in carload lots.

Sodium Nitrate—$2.85@$3 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $18@$20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; $33@$35 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.50@$1.75 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 15c. per lb. of chromium contained; 4 to 6 per cent carbon, 16@17c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $80@$82, f.o.b. furnace; resale, $90, delivered; English, $80, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $30@$32, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $50@$55; 50 per cent, $80@$85; 75 per cent, $145@$150.

Ferrotungsten—Domestic, 70 to 80 per cent W, 50@55c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$5@$6 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 21.50c. per lb.; wire, 15c.

Lead Sheets—Full lead sheets, 8.25c.; cut lead sheets, 8½c. in quantity, mill lots.

Nickel Silver — 31½c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets 17¾c.; sheathing, 16¾c.; rods, ⅝ to 3 in., 14¾c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina, $35@$50 per ton, f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $75 per net ton, shipping point; arches, keys, wedges, $80; splits, soaps, $90.

Fire Brick—First quality, 9-in. shapes, $40@$50 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $35@$40.

Magnesite Brick—9-in. straights, $90@$95 per net ton; 9-in. arches, wedges and keys, $100; soaps and splits, $110.

Silica Brick—9-in., per 1,000: $45@$55 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, May 31, 1921

The last week has easily been the dullest the iron and steel trade has experienced since the latter part of 1914, if not for a longer period. The period is regarded as the regular midsummer dullness, coming simply about a month head of the usual time. Predictions are made more commonly, and with more confidence, that there will be a substantial improvement in demand in August. No one looks for definite improvement before that time.

Steel prices are steady at the levels reached about the middle of April, but that means little as to inherent strength, as buyers' requirements are in such small tonnages that it is hardly worth while to seek competitive prices and mills have no incentive to cut prices.

Steel production is now at under 30 per cent of capacity, and a 25 per cent rate or less seems probable before the middle of June, so that predictions that there will be some kind of improvement by August seem natural. Buyers expect steel prices to decline farther before then; producers are non-committal.

Pig Iron—Bessemer iron, being only occasionally inquired for in carload lots, remains quotable at $24, Valley. On two 1,000-ton lots basic has declined 25c. to $21.75, Valley, and there is a rumor of $21.50 having been done. On light transactions foundry has declined 50c. to $23, Valley.

Coke

Connellsville—Furnace, $3.25@$3.75; foundry, $4.50@$5.

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[1] Foote Mineral Co., Philadelphia, Pa.

COMPANY REPORTS

Chile Copper Co.

A report of operations of Chile Copper Co. for 1920 states that the net surplus realized was $151,994, compared with a loss of $2,290,658 in 1919. Copper production amounted to 55,565 short tons, compared with 38,359 tons in 1919. A combined statement of the income and surplus accounts of Chile Copper and Chile Exploration companies follows:

	1920		1919	
Operating revenue				
Copper sold and delivered —96,498,116 lb. @ 18.354c	....	$17,711,021		$10,350,167
Operating cost:				
Cost f.o.b. plant yards	$8,490,962		$7,643,991	
Freight, insurance, and delivery expense	1,538,435		1,085,965	
Selling expense	176,368	10,205,765		8,729,956
Operating profit		$7,505,256		$1,620,211
Other income:				
Dividends—Chile Steamship Co.	$250,000		$500,000	
Interest and discount received	824,903		343,784	
Miscellaneous	94,964	1,169,867	25,094	868,878
Total income		$8,675,123		$2,489,089
Charges against income:				
Taxes and miscellaneous charges	$433,211		$395,557	
Interest on bonds of Chile Copper Co.	3,157,069	3,590,280	2,823,043	3,218,600
Balance of income carried to surplus account		$5,084,843		(a)$729,511
Charges against surplus:				
Depreciation of plant and equipment	$2,754,749		....	
Plant and equipment superseded or abandoned	133,690		65,639	
Depletion of ore reserves	1,904,411		1,355,508	
Amortization of discount on bonds	140,000	4,932,851	140,000	1,561,147
Net surplus from operations		$151,992		(a)$2,290,658
Surplus from operations previous to 1920				
Debit Dec. 31, as stated	$287,795		$2,787,882	
Add:				
Adjustment of plant and equipment accounts, depreciation and obsolescence	1,794,797			
Miscellaneous adjustments	111,270		785,019	
	$2,193,861			
Less: Adjustment of depletion reserve	1,692,149			
Net debit—Dec. 31 as adjusted		501,711		(b)2,002,863
Net debit—Dec. 31		$349,719		(c)$287,795

(a) Loss. (b) Dec. 31, 1918. (c) Dec. 31, 1919.

The actual cash cost of producing copper was 10.7c. per lb., exclusive of depreciation and depletion, compared with 13.01c. per lb. in 1919. The president states that operations have now passed the development stage; the metallurgical predictions of engineers have been met; the company has an extremely efficient staff of expert and loyal employees.

Capitalization: 3,800,000 shares outstanding of $25 par; funded debt: $15,000,000 7 per cent bonds, ten-year convertible; $34,916,250 6 per cent bonds, ten-year convertible.

Mexican Corporation

A report of operation of the Mexican Corporation, Ltd., ([illegible]) for the period Nov. 1, 1919, to June, 30, 1920, states that the surface orebody of the Fresnillo unit produced [illegible] dry tons of ore, having a value of $[illegible], or [illegible] oz. of gold and [illegible] oz. of silver, and accumulated tailings yielded [illegible] oz. of gold and [illegible] oz. of silver, a gross value of $507,139. The Teziutlan unit produced [illegible] lb. of copper, [illegible] oz. of silver, and [illegible] oz. of gold from [illegible] dry tons of ore, having a value of $[illegible],326.57.

Profit-and-loss account indicates a loss of $[illegible]. No dividends were paid.

Judge Mining & Smelting Balance Decreases

A report of operations of the Judge Mining & Smelting Co. for 1920 states that 7,877,121 lb. of lead, 2,664,005 lb. of zinc, 359,186 lb. of copper, 650 oz. of gold, and 483,890 oz. of silver were produced and sold for $969,122.87. Operating account follows:

Balance on hand Jan. 1, 1920		$148,385.43
Receipts		
Ore sales	$675,677.19	....
Zinc plant	293,445.68	969,122.87
Interest and sundry receipts		15,801.57
		$1,133,309.87
Expenditures		
Mine account	$309,587.13	
Mill operation	66,621.80	
Ore expense	36,583.07	
Prospecting and dead work	70,296.50	
Zinc reduction plant	287,619.22	
General expense	9,402.21	
Taxes, fire and liability insurance	40,511.78	
Engineering and surveying	2,541.61	
Drainage	12,000.00	
Emergency hospital	1,590.04	
Property purchase	55,250.00	
	$892,003.36	
Dividends Nos. 36, 37, 38	180,000.00	
	$1,072,003.36	
Balance available Jan. 1, 1921	61,306.51	
		$1,133,309.8

Issued capitalization, 480,000 shares of $10 par.

Daly West Dividends $225,000 in 1920

A report of operations of the Daly West Mining Co. for 1920 states that 3,364,606 lb. of lead, 505,506 oz. of silver, 341,465 lb. of copper, and 241 oz. of gold were produced, and sold for $615,464.45. Operating statement follows:

Balance on hand Jan. 1, 1920		$141,978.99
RECEIPTS		
Ore sales	$615,464.45	
Interest and sundry receipts	6,809.77	$622,274.22
		$764,253.21
EXPENDITURES		
Mine account	$158,408.33	
Prospecting, exploratory and dead work	134,894.14	
Ore expense	22,647.49	
General expense		
Office, salaries, rent, legal, etc.	8,167.73	
Engineering and surveying	1,083.12	
Tunnel rent and drainage	9,000.00	
Taxes, fire and liability insurance	9,061.78	
Emergency hospital	482.35	
Property purchase	55,250.00	
Dividends Nos. 62, 63, 64, 65	225,000.00	
	$623,994.94	
Balance on hand Jan. 1, 1921	140,258.27	$764,253.21

Mining Dividends for May, 1921

The following dividends were paid by American mining and metallurgical companies during May, 1921.

Companies in the United States	Situation	Per Share	Totals
Bunker Hill & Sullivan	Idaho	$0.25M	$81,750.00
Chief Consolidated, s.l.	Utah	.05	44,201.60
Homestake Mining, g	S.D.	.25	62,790.00
Internat. Nickel, pfd.	U.S.-Can.	1.50Q	133,689.00
Miami Copper, c	Ariz	.50Q	373,557.00
New Jersey Zinc, z	N.J.	2.00Q	840,000.00
Silver King Coalition, s	Nev	.15K	187,500.00
United Verde Exten., c	Ariz	.25Q	262,500.00
Companies in Canada and Mexico			
Amparo Mining, g	Mex	$0.02½	$50,000.00
Coniagas Mines, Ltd., s	Ont	.12½ Q	100,000.00
Hollinger Porcupine, g	Ont	.05	182,014.00

Coniagas Mines, Ltd. and Homestake Mining re-enter the ranks of dividend payers, the latter not having paid since Sept. 25, 1919 when it made a monthly disbursement of 50c. per share. New Jersey Zinc Co. disburses a part of its surplus.

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1920	1921	1920	1921	1920	1921
January	132 827	65.950	79 846	39.985	367.082	372.650
February	131.295	59.233	85 005	34 745	337.466	385.932
March	125.551	56.023	74.194	32.479	370.870	38).806
April	119.779	59.337	68.848	34.250	392.438	391.784
May	102.585	59 810	60 010	34 165	383 360	396 580
June	90.957		51.096	......	393.663	......
July	91.971	..	53.736	......	385.538	......
August	96.168	......	59.875	.	360.404	......
September	93.675	.	59 476		350.370	......
October	83.480	.	54.197	......	346.460	......
November	77.734	....	50.952	......	342.333	......
December	64.774	....	41.845	......	348.101	......
Year	100.900	......	61 590	......	364 840	......

New York quotations cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York Electrolytic		London Standard		London Electrolytic	
	1920	1921	1920	1921	1920	1921
January	18.918	12.597	118.095	70.964	123.238	79.119
February	18.569	12.556	120.188	70.925	126.950	75.925
March	18 331	11 976	109.533	67.565	118 348	71.190
April	18.660	12.438	103.025	69 381	111.500	71.786
May	18.484	12 742	96.750	73 196	109 200	74.298
June	18.065	.....	87.864	.	101.909	......
July	18.576	......	90.148	. .	106.455	......
August	18.346	......	93.935	..	111 143	......
September	18.144	.....	96 381		111.905	. . .
October	15.934	.....	93.327	. .	104.905	. .
November	14.257	......	84.807	.	94.614	. ...
December	13.188	......	75.702		85.905	.. ..
Year	17.456	......	97.480	.. ...	108 839	......

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London	
	1920	1921	1920	1921	1920	1921
January	8.561	4.821	8.300	4 747	47.095	23.387
February	8.814	4.373	8.601	4.228	50.256	20.650
March	9.145	4 084	8.894	4.000	46.054	18 911
April	8.902	4.356	8.618	4.272	39.225	20.589
May	8.576	4.952	8.352	4.784	38.488	23.399
June	8.323	......	8.169	......	34.330	......
July	8.338	......	8.283	......	34 960	......
August	8.687	......	8.725	......	36.304	......
September	8.177	......	8.160	......	35.452	......
October	7.070	......	7.018	.....	35 238	......
November	6.159	......	6.127	......	32.489	......
December	4.727	......	4.717	.. ...	24 089	......
Year	7.957	......	7.830	......	37 832	......

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton.

Tin

	New York 99%		New York Straits		London	
	1920	1921	1920	1921	1920	1921
January	61.596	36.000	......	36.000	376.512	190.464
February	58.466	28.534	59.932	32.142	395.750	166.250
March	61.037	27.296	61.926	28.806	369.489	156.024
April	61.120	28.990	62.115	30.404	345.450	163.905
May	53.230	31.431	55.100	32.500	294.813	177.411
June	46.125	......	48.327	......	250.614	....
July	45.798	......	49.154	......	261.886	....
August	43.856	......	47.620	......	274.048	....
September	41.940	......	44.465	... ..	270.120	....
October	39.310	......	40.555	...	258.190	....
November	35.667	......	36.854	......	241.080	....
December	31.135	......	34.058	......	212.440	....
Year	48 273	......	49 101	......	295.866	....

New York quotations, cents per lb. London, pounds sterling per long ton.

Zinc

	St. Louis		London	
	1920	1921	1920	1921
January	9.133	5.413	58.643	25.262
February	8.708	4.928	61.338	24.850
March	8.531	4.737	53.467	25 077
April	8.184	4.747	47.388	25.530
May	7.588	4.848	45.088	26.923
June	7.465	....	41.193	......
July	7.720	.....	41.886	......
August	7 835	...	41.220	......
September	7.661	.....	39.690	......
October	7.150	....	39.756	......
November	6 247	.. .	35.028	......
December	5 824	....	27.762	......
Year	7.671	. ..	44 372	......

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1920	1921	1920	1921	1920	1921
January	10 577	5.258	90.192	48 440	154.23	73.400
February	11.588	5 250	84 432	49 545	151.59	70.227
March	11 056	5 282	92 611	46 796	138.56	72.463
April	10.500	5 137	102 192	45 423	127.04	73.404
May	9.655	5 250	89 560	47 000	97.50	73 740
June	8.289	...	90.154	......	85 19	.....
July	7.500	.. .	90 333	.....	83 94	.. ..
August	7.177	....	83 806	......	111 44	.....
September	7.113	.....	75 000	......	115 20	.....
October	6.723	.....	67.200	......	101 70	.....
November	6.109	......	58 417	......	84.75	.....
December	5.534	......	49.577	......	79.62	.....
Year	8.485	......	81.123	......	110.90	.....

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1920	1921	1920	1921	1920	1921
January	$40.47	33.96	$39.88	31.96	$39.86	33 88
February	42.95	28.96	42.61	26.96	43.40	30.25
March	43.40	28.16	42.90	26.46	43.40	27.85
April	43.72	26.96	44.22	24.46	43.90	26 77
May	44.00	.....	44.88	.....	45.36	......
June	44.89	....	45.41	.....	46.40	......
July	47.21	.....	47.42	.....	46.56	......
August	48.90	....	49.88	.....	49.35	......
September	50.46	....	50.46	.....	51.96	......
October	49.21	....	44.38	.....	48.58	......
November	41.26	.....	39.20	.....	42.61	......
December	36.96	.....	34.90	.....	37.73	......
Year	44.45	.....	43.85	.....	44.93	......

In dollars per long ton.

Monthly Crude Copper Production

	1921 January	1921 February	1921 March	1921 April
Alaska shipments	5,241,634	5,482,962	4,985,259	5,615,500
Arizona Copper	2,300,000	2,000,000	2,000,000	2,000,000
Calumet & Arizona	2,438,000	3,330,000	3,455,672	2,204,000
Cons. Ariz. Smelting	(a)	(a)	(a)	(a)
Inspiration	5,000,000	4,500,000	5,000,000	1,100,000
Magma	600,000	600,000	650,000	378,900
Miami	4,439,000	4,200,101	4,572,000	4,262,625
New Cornelia	2,170,000	1,975,918	2,220,186	1,864,772
Old Dominion	2,822,000	1,882,000	2,199,000	984,000
Phelps Dodge	6,339,000	5,712,000	6,959,000	1,461,000
Shattuck Arizona	(a)	(a)	(a)	(a)
Ray	2,983,000	2,976,000	2,940,000	(a)
United Verde	3,500,000	3,450,000	4,115,000	2,600,000
United Verde Extension	3,219,912	3,349,942	2,951,390	3,092,746
Calumet & Hecla	7,234,300	7,395,084	9,147,000	(a)
Other Lake Superior	6,000,000	5,000,000	5,000,000	5,000,000
Anaconda	9,700,000	9,000,000	11,600,000	2,935,840
East Butte	1,600,000	1,500,000	1,000,000	1,047,140
Nevada Cons	3,000,000	3,000,000	3,100,000	(a)
Chino	2,999,751	2,978,934	3,051,838	(a)
Utah Copper	7,500,000	7,500,000	7,500,000	(a)
Eastern Smelters	1,500,000	1,500,000	1,500,000	1,500,000
Others, estimated	10,000,000	9,300,000	7,100,000	10,900,000
Total United States	90,586,597	86,632,941	91,046,345	46,946,523
Imports: Ore and concentrates, matte, etc	8,634,206	10,580,611	9,865,917	....
Imports of blister, unrefined, etc	21,456,013	19,424,907	12,448,823	.
Imports of refined, etc	9,679,973	10,631,161	359,572	
Grand total	130,356,789	b127,269,620	113,720,657	.... . .
British Columbia:				
Granby Cons	2.530 038	2,274,530	2,617,702	2,459,250
Mexico				
Boleo	969,920	813,650	618,222	728,000
Cananea	2 530,038	(a)	(a)	(a)
Phelps Dodge Mexican properties	2,362,000	1,870,000	2,285,000	407,000
Other foreign:				
Cerro de Pasco	4,086,000	4,174,000	4,200,000	5,344,000
Chile	6,732,000	5,278,000	6,000,000	3,993,802
Katanga	2,912,805	3,283,960	5,360,128	4,862,025
Backus & Johnston	1,760,000	1,306,000	1,642,000	1,400,000

(a) No copper produced during this month. (b) Corrected.

Comparative Annual Copper Production

	1919	1920	1921
January	135,733,511	121,903,744	90,586 597
February	111,649,512	117,450,000	86 632,941
March	102,040,460	120,309,316	91,046,345
April	98,808,998	116,078,871	46,946,523
May	92,652,975	114,964,207	. . ..
June	95,856,570	116,107,856	. .
July	100,369,247	109,729,510	...
August	107,994,040	116,460,654	. . .
September	108,703,075	(a) 104,919,262	.
October	115,143,143	(a) 105,231,571	.. ..
November	117,289,735	106,700,178	.. . . ..
December	102,997,633	95,709,009	.. .. .

(a) Revised

MINING STOCKS

Week Ended May 28, 1921

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Adventure	Boston	....	....	*50		
Ahmeek	Boston	52	52	52	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	7/16	⅜	7/16		
Allouez	Boston	23	21	21	Mar. '19	1.00
Anaconda	New York	42¼	40½	40½	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2⅝	2½	2⅝		
Ariz. Com'l	Boston	9¼	9	9	Oct. '18,	.50
Big Ledge	N. Y. Curb	5/16	¼	5/16		
Bingham Mines	Boston	10	10	10	Sept. '19, Q	.25
Calumet & Arizona	Boston	51¾	50	50	Mar. '21, Q	.50
Calumet & Hecla	Boston	254	252	252½	June '20, Q	5.00
Canada Copper	N. Y. Curb	....	....	*13		
Centennial	Boston	10	7	7¾	Dec. '18, SA	1.00
Cerro de Pasco	New York	29	28½	28½	Mar. '21, Q	.50
Chile Copper	New York	12⅝	11½	11¾		
Chino	New York	26⅛	24½	24⅝	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*27½	*26½	*26½		
Con. Arizona	N. Y. Curb	....	....	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	1⅜	1¼	1¼		
Copper Range	Boston	36⅞	34½	34⅞	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*30	*26	*30		
Davis-Daly	Boston	7	6	6¾	Mar. '20, Q	.25
East Butte	Boston	9¼	9	9¼	Dec. '19, A	.50
First National	Boston Curb	*75	*65	*65	Feb. '19, SA	.15
Franklin	Boston	....	....	2⅛		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol.	New York	22¾	22½	22½	May '19, Q	1.25
Greene-Cananea	New York	....	....	23¼	Nov. '20, Q	.50
Hancock	Boston	3¼	3¼	3¼		
Howe Sound	N. Y. Curb	....	....	2¼	Jan. '21, Q	.05
Inspiration Consol.	New York	36⅝	35	35	Oct. '20, Q	1.00
Iron Cap	Boston Curb	..	..	6¼	Sept. '20, K	.25
Isle Royale	Boston	21¼	21	21	Sept. '19, SA	.50
Kennecott	New York	21¼	20¼	20⅝	Dec. '20, Q	.50
Keweenaw	Boston	....	....	1⅝		
Lake Copper	Boston	3¼	2¾	3		
La Salle	Boston	2	2	2		
Magma Chief	N. Y. Curb	..	..	*21		
Magma Copper	N. Y. Curb	21½	20½	20½	Jan. '19, Q	.50
Majestic	Boston Curb	*11	*09	*09		
Mason Valley	Boston	...	...	1¾		
Mass Consolidated	Boston	2⅜	2¼	2¼	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	4¼	4	4		
Miami Copper	New York	23½	22½	22½	May '21, Q	.50
Michigan	Boston	2	2	2		
Mohawk	Boston	53½	52½	52¾	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5⅝	5½	5½		
Nevada Consol.	New York	12⅛	11⅝	11⅞	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	15¾	15½	15½	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....	....	*5		
North Butte	Boston	10¾	10½	10½	Oct. '18, Q	.25
North Lake	Boston	[illegible]	[illegible]	[illegible]		
Ohio Copper	N. Y. Curb	....	....	[illegible]		
Old Dominion	Boston	22½	21	22	Dec. '18, Q	1.00
Osceola	Boston	32	30	30	June '20, Q	.50
Phelps Dodge	Open Mar.	†160	†150	....	Apr. '21, Q	1.00
Quincy	Boston	40	39	39½	Mar. '20, Q	1.00
Ray Consolidated	New York	14¾	14	14	Dec. '20, Q	.25
Ray Hercules	Boston Curb	..	..	*35		
St. Mary's Min. Ld.	Boston	39	38	38	June '20, K	2.00
Seneca Copper	Boston	16¼	16¼	16¼		
Shannon	Boston	0.80	0.80	0.80	Nov. '17, Q	.25
Shattuck Arizona	New York	7	7	7	Jan. '20, Q	.25
South Lake	Boston	.	.	1½		
Superior Copper	Boston	.	.	4	Apr. '17,	1.00
Superior & Boston	Boston	1⅛	1½	1[illegible]		
Tenn. C. & C. ctfs.	New York	9[illegible]	8¾	8¾	May '18, I	1.00
Tuolumne	Boston	*63	*60	*62	May '13,	.10
United Verde Ex.	Boston Curb	2[illegible]	25½	25½	May '21, Q	.25
Utah Consol.	Boston	4	3[illegible]	3¾	Sept. '18,	.25
Utah Copper	New York	5[illegible]	54	55	Mar. '21, Q	1.00
Utah Metal & T.	Boston	1[illegible]	1½	1⅝	Dec. '17,	.30
Victoria	Boston	1[illegible]	1	1[illegible]		
Winona	Boston	*45	*40	*40		
Wolverine	Boston	11	11	11		
NICKEL-COPPER						
Internat. Nickel	New York	15[illegible]	15[illegible]	15[illegible]	Mar. '19,	.50
Internat. Nickel, pf.	New York	82[illegible]	[illegible]	[illegible]	May '21, Q	1.50
LEAD						
National Lead	New York	77	77	77	Mar. '21, Q	1.50
National Lead, pfd.	New York	104	101	101	Mar. '21, Q	1.75
St. Joseph Lead	New York	12	12	12	Mar. '21, Q	.25
Stewart Mining	Boston Curb			*[illegible]	Dec. '15,	.05
ZINC						
Am. Z. L. & S.	New York	9¼	[illegible]	[illegible]	May '20,	1.00
Am. Z. L. & S., pfd.	New York			28	Nov. '20, Q	1.50
Butte C. & Z.	New York	5¼	4	4	June '18,	.50
Butte & Superior	New York	14	13½	13	Sept. '20,	1.25
Callahan Zn-Ld.	New York	5[illegible]	4[illegible]	[illegible]	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb	120	120	120	May '21, Q	2.00
Success	N. Y. Curb	*3	*2	*[illegible]	[illegible] '16,	.03
Yellow Pine	Los Angeles	‡		*[illegible]	Sept. '20, Q	.03

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

Stock	Exch.	High	Low	Last	Last Div.	
GOLD						
Alaska Gold	New York	¾	⅝	⅝		
Alaska Juneau	New York	1½	1¼	1¼		
Carson Hill	N. Y. Curb.	14¼	14	14		
Cresson Consol. G.	N. Y. Curb	1 15/16	1½	1⅞	June '20, Q	$0.10
Dome Extension	Toronto	....	....	*75		
Dome Mines	New York	19½	18½	18¾	Apr. '21, Q	.25
Golden Cycle	Colo. Sprgs.	*74	*72	*74	Dec. '20, Q	.02
Goldfield Consol.	N. Y. Curb	*8	*7	*8	Dec. '19,	.05
Hollinger Consol.	Toronto	7.40	7.25	7.25	Feb. '21, M	.05
Homestake Mining	New York	56¾	56½	56¾	Sept. '19,	.50
Kirkland Lake	Toronto	*49	*49	*49		
Lake Shore	Toronto	1.32	1.31	1.31	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	2.00	1.97	1.97	Jan. '21, K	.05
Porcupine Crown	Toronto	*20½	*20½	*20½	July '17,	.03
Portland	Colo. Sprgs.	*60	*59¼	*59¼	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*4	*2½	*3	May '19,	.05
Silver Pick	N. Y. Curb	*6	*3	*5		
Teck Hughes	Toronto	*16	*16	*16		
Tom Reed	Los Angeles	....	....	*80	Dec. '19,	.02
United Eastern	N. Y. Curb	2 9/16	2 7/16	2½	Apr. '21, Q	.15
Vindicator Consol.	Colo. Sprgs.	*34½	*34½	*34½	Jan. '20 Q	.01
West Dome Consol.	Toronto	*8½	*8¼	*8½		
White Caps Mining	N. Y. Curb	*7½	*4	*7		
Yukon Gold	N.Y. Curb	1	1	1	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*28	*25	*28	Apr. '20, M	.03
Batopilas Mining	New York	¾	¾	¾	Dec '07, I	.12½
Beaver Consol.	Toronto	*34	*33	*33	May '20, K	.03
Coniagas	Toronto	....	...	1.70	May '21, Q	.12½
Crown Reserve	Toronto	....	....	*13	Jan. '17,	.05
Kerr Lake	Boston	3½	3½	3½	Apr. '21, Q	.12½
La Rose	Toronto	*21	*18¾	*19	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	....	...	*19	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	....	...	1.08	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4½	4¼	4½	Apr. '21, Q	.15
Ontario Silver	New York	....	....	5	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	....	....	2	Jan. '12,	.10
Peterson Lake	Toronto	....	....	*6½	Jan. '17,	.01½
Temiskaming	Toronto	....	....	*18	Jan. '20, K	.04
Trethewey	Toronto	*16¼	*16	*16	Jan. '19,	.05
GOLD AND SILVER						
Atlanta	N. Y. Curb	*1	*½	*1		
Barnes-King	Butte	‡....	....	1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*65	*58	*65		
Cashboy	N. Y. Curb	*6½	*5	*6		
El Salvador	N. Y. Curb	¼	3/16	¼		
Jim Butler	N. Y. Curb	*10	*8	*9	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*7	*5	*6½	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	¼		
MacNamara M.& M.	N. Y. Curb	*18	*14	*15	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1⅜	1¼	1 5/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1¼	1[illegible]	1⅛		
Tonopah-Extension	N. Y. Curb	1½	1⅜	1½	Apr. '21, Q	.05
Tonopah Mining	N. Y. Curb	1½	1½	1⅝	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	1	⅞	15/16	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N.Y. Curb	*11	*9½	*10	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	1.10	1.10	1.10	Dec. '20,	.15
Chief Consolidated	Boston Curb	2½	2½	2½	May '21, Q	.05
Consol. M. & S.	Montreal	16½	16	16	Oct. '20, Q	.62½
Daly Mining	Salt Lake	1.50	1.50	1.50	July '20, Q	.10
Daly-West	Boston	...	...	3	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	...	...	2¼	Apr. '21, K	.05
Electric Point	Spokane	*7½	*7½	*7½	May '20, SA	.03
Federal M. & S.	New York	7	6	6½	Jan. '09,	1.50
Federal M. & S., pfd.	New York	27½	26½	26½	Mar. '21, Q	1.00
Florence Silver	Spokane			*12½	Apr. '19,	.01½
Grand Central	Salt Lake			*07½	June '20, K	.03
Hecla Mining	N. Y. Curb	4⅛	3⅞	4	Mar. '21, Q	.15
Iron Blossom	N. Y. Curb			*20	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake			3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*7½	*[illegible]	*7		
Prince Consol.	N. Y. Curb	3/16	⅛	3/16	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*5½	*5	*5½	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*11	*[illegible]	*10		
South Hecla	Salt Lake	*53	*[illegible]	*53	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	3/16	⅛	3/16	Oct. '17,	.05
Tamarack-Custer	Spokane	1.90	[illegible]	1.90	Jan. '21, K	.04
Tintic Standard	Salt Lake	2.42½	2.40	2.40	June '20, Q	.10
Utah Apex	Boston	2⅜	2¼	2¼	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*4	[illegible]	*3½	Nov. '17,	.01
QUICKSILVER						
New Idria	Boston	†*50		*50	Jan. '19,	.25
VANADIUM						
Vanadium Corp.	New York	33	[illegible]	31	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal			58	Apr. '21, Q	1.50
Asbestos Corp., pfd.	Montreal			80	Apr. '21, Q	1.75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	4[illegible]	[illegible]	4[illegible]	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf.	New York	78	[illegible]	77[illegible]	Mar. '21, Q	1.75
Am. Sm. pf. A	New York	72	[illegible]	72	Apr. '21, Q	1.50
U. S. Sm. R. & M.	New York	34[illegible]	[illegible]	33½	Jan. '21, Q	.50
U. S. Sm. R. & M. pf.	Boston	41	41	41	Apr. '21, Q	.87½

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The Case for a Department of Mines

THE ARGUMENTS why the mining industry should now move as a body in support of a Department of Mines have been ably editorially summarized by *Coal Age* in the issue of May 26, apropos of the Frelinghuysen Bill, which is designed to establish what are vital statistical facts regarding the coal industry. The original draft of the bill placed the carrying out of its provisions in the hands of the Director of the Geological Survey, but as it now stands it is intrusted to the Secretary of Commerce and the Director of the Bureau of Mines. The bill is obscure as to how the work shall be divided; but the prevailing theory is that the statistical work and the reporting thereon shall be taken over by the Commerce Department and the technical investigations shall be conducted by the Bureau of Mines.

Technical investigations on coal have always been one of the chief features of the Bureau of Mines, so that this new commission will hardly disturb it from its routine; but the proposed duties of the Department of Commerce will mean lifting the coal statistical work from the Geological Survey and transferring it to the Commerce Department. For this we see no logical warrant whatever; it is not, we believe, in the line of constructive reorganization, but more in the way of light-hearted and wanton monkeying. Mining is not commerce, and no casuistry can make it so. The Geological Survey has developed the investigations and statistics of coal production for many years with great success and accuracy; and during the war their data furnished satisfactorily the facts for the Fuel Administration.

On the other hand, the mineral statistics of the last census (the census is the chief statistical organization of the Commerce Department) were notably bad; so that when the present census began there were conferences between the Census Bureau, the Geological Survey, and the Bureau of Mines, with a view toward getting more reliable statistics than in the past. *It was granted that these could only be intelligently collected and properly interpreted for presentation by men familiar with the mineral industry;* and, therefore, the Interior Department bureaus, at the request of the Census Bureau, selected Mr. Frank J. Katz, of the Geological Survey, to take charge of mineral statistics for the census and to arrange for a fusion of the endeavors of the Census Bureau and those of the Interior Department in such manner as to avoid duplication. Therefore, the only way that the Department of Commerce will be able to gather and present mineral statistics reliably in the future, if it relieves the Geological Survey and the Bureau of Mines of their mineral statistics, will be to hire a new corps of men familiar with the industry; and in the long run it is more likely that the work will slip back into the hands of routine statisticians.

The trouble is that we have no single Government branch to which Congress can look as representing mining. Instead, we have two bureaus in the same department, jealous of each other's extension of activities, and, therefore, not disposed to fight back to back, under a Secretary of the Interior who usually is apologetic and half-hearted when a powerful cruiser in the uncharted seas of Washington's executive departments bears down with the intention of relieving the department from some of the mining duties.

The industrial side of mining is only fragmentarily represented at best. Most has been done by the Geological Survey, where it was least in place. The metallurgists and experiment-station experimenters who are doing most valuable work in their line for the Bureau of Mines have little idea what the business of mining may be, or why the Bureau of Mines should be interested in it. We need reorganization right there. Transfer the Bureau of Mines and the Geological Survey bodily into the Commerce Department, if you will: they do not belong there, but they would probably be more actively reorganized under Hoover than any one else. But Hoover is only a transitory phase in Washington; new Secretaries of Commerce will come, and certainly they will not be mining men, and not even engineers; they will be merchants or manufacturers, as in the past. The Government machine, on the other hand, will, we expect, go on forever; so that the all-important thing is to have any change a change for the better per se.

If we take the Geological Survey and divest it of its economic work which it has undertaken, to its great credit and to the great good of the country; if we take the Bureau of Mines and rechristen it for what it really is, a Bureau of Mineral Technology; if we create a new Bureau of Mineral Economics; and put all under a Secretary of Mines—then we shall have an adequate organization without much more expense and personnel than we have at present.

The mining industry, which embraces metals, nonmetals, coal and oil, is an enormous one; it is not commerce, but a producer of the raw materials for manufacturing and commerce. It is as fundamental as agriculture, and not to be casually grouped with the boot-and-shoe industry or the ladies' millinery business. It is one of the principal industries of the greatest mining country in the world, which mines the framework of commerce and industry for many countries besides our own; and yet when Congress wants something done with regard to the industry, it does not know where to turn.

During the war, the Interior Department bureaus were passed by and the economics of the metal mining industries were intrusted to the War Industries Board; of coal and oil, to the Fuel Administration. And now the colossal Frelinghuysen Bill, designed to throw light on the coal industry, puts hesitatingly one foot each on two ships sailing in different directions.

The Engineer and the Business of Mining

"IS ENGINEERING A PROFESSION or a business?" is a question which has been consistently discussed of late, in connection with the fight in New York State over the engineer's licensing law. For the mining engineer, however, his chief interest is not in engineering, but in mining. We think that we shall receive general agreement to this preliminary definition. And, therefore, the question which we would like to propound to him is whether mining is a profession or a business? And we think we shall receive the great majority of votes to the effect that mining is a business. It is an industry.

The engineering of mines is not to be compared closely to the law, medicine, or the clerical occupations. The doctor, the lawyer, or the clergyman prescribes for the body, for civil strife, and for the soul, from his knowledge of the laws of physiology, or codified law, or of the moral and divine law respectively. They are compensated therefor by fees, flat charges, or salaries. But they do not sell any material commodity; and in this we see the wide difference between the practice of these professions and the engineering of mining.

The engineering of mining is the business guiding of one of the greatest extractive industries; and the engineer of mines, in the true sense that it has come to be generally accepted, studies, comprehends, and guides the whole transaction. It is not a simple operation, but a series of problems in steps: A. Find the ore, develop it, expose it and measure it. B. Remove it from the ground. C. Reduce the metal out of the ore. D. Market your metal. These operations have developed specialists: for A, the geological engineer; for B, the mechanical-electrical engineer; for C, the metallurgical engineer; for D, the managing and financial engineer. Who, then, is the engineer of mining? Any one of the above, or any combination of more than one.

A generation ago, the engineer of mining was all of the above combined: a *multum in parvo*, an *e pluribus unum;* and there were some able specimens thus developed. Nowadays knowledge has gone too far: the jack of all trades in mining is master of none: there is no profit in attempting the stretch.

But the whole thing is a business. The primary object of the operation is to produce and sell material commodities *at a profit*. The four kinds of engineering which control the business all are carried on with the main object of a profit.

These things are open to no dispute. Nobody will disagree with us. But we believe that the engineers of mining would do well to follow out the logical deductions and courses. Much has been written and said within the last two years about the duty of the engineer as a citizen; that the engineer was best fitted to handle the public business; that the engineer of mines should devote his abilities to guiding the economic affairs of the country. But there is a hiatus here. The progress of organization in the mining industry has been such that the fact is that the mining engineer does not, as a class, take an intelligent interest in his own business. The background of impression that he is a professional man—that he is a kind of scientist—hampers him.

There is an academic timidity about the high-class engineer, when it comes to discussing anything but technology—a shrinking away from contemplation or discussion of the fundamental economic conditions governing his industry—that almost reminds one of the recent European professional caste feeling of superiority to "trade." Your engineer can locate and estimate the ore; can remove it skilfully from the ground; extract the metal with marvelous skill. This is engineering, he will tell you. But, what about the tariff on minerals, on tungsten, chrome, and bauxite? "A forbidden subject, my dear sir," says the high-class engineer, in effect: "do not mention it in my presence again." Yet this may determine whether you will mine or not.

How about the McFadden Bill, to subsidize the gold miner? "Mercy, how coarsely the man talks—we shall be ranked next with the promoter class!" What about the Pittman Act, without which your mines would be now closed? Is it sound or not—what do you think about it? "The subject, my persistent sir, is not in place in an assemblage of professional men." What about the mineral policy of England and of France? "Hadn't we better leave that to the State Department?" What do you think of the way the Bureau of Mines and the Geological Survey are being run? "Isn't that the business of the Directors? They might not like it if we expressed an opinion." What about the Minerals Separation grip on flotation? "That is a subject that I could easily get myself in trouble with—if I don't think about it, I shall retain my professional detachment." What do you think about these apex controversies: are they silly or are they constructive? "Oh, say now; I have a friend who is a geologist." What do you think about licensing mining engineers? "Are they licensing mining engineers—oh, yes; I remember. Engineering Council has attended to that. I haven't the slightest idea what it is all about, but it has all been arranged for us."

The engineers of mining should realize that they are engaged in a business transaction, if they are engaged at all. They should cease to be afraid of the great controlling factors in their own business. Until then, we are forced to admit, we should not hold ourselves superiorly fitted for handling other kinds of business, including public business.

Farmers' and Miners' Combinations

THE ANNOUNCEMENT of the formation of the Farmers' Finance Corporation, a "co-operative financial institution" with a capital stock of $100,000,000, is of intense interest, not only to farmers and food consumers but to the mining industry. Like the agricultural industry, mining is a great basic industry, engaged in the production of raw materials for general use; and the problems of these two great fields of endeavor are in many ways similar. There has been a notable hiatus between the farmer and the consumer, a wide split between the prices the grower gets for his produce, which often does not permit him to go on producing, and the price the housewife pays for the family's food, which often bears little relation, in its altitude, to the cost or volume of production. The reason is, in general, poor marketing systems, waste, ruinous competition in distributive methods, and petty or larger combinations of middlemen at various stages to keep prices at a certain profitable level.

The answer to this problem has been found in certain sections by combinations of producers into a marketing organization—like the California Citrus Growers' Association, in which growers hold stock and which is a purely co-operative body, marketing the citrus fruits scientifically and economically. No one has protested against these regional organizations. They have been good things. They have eliminated waste. They have closed up the price gap between producer and consumer to the advantage of both—or at least to that of the producer. They have reduced to a minimum the rake-off of the non-productive middlemen. There ought to be more of them for our country's health as an agricultural nation; and agriculture is the backbone of a country, economically and as a guarantee of stability and democratic institutions. These associations are also, however, combinations in restraint of trade. They involve private price-fixing agreements. There is no getting away from it.

And now a national association or combination of farmers on this basis is proposed. The new organization is a subsidiary of the United States Grain Growers, Inc., recently organized at Chicago, which will organize the marketing of grain and "stabilize and perhaps reduce the price of flour." Besides grain, it is planned to embrace, along similar lines, livestock, fruit, vegetables, poultry, eggs, tobacco, and other products. The immediate steps will be the establishment of terminal sales agencies, warehousing facilities at terminal markets, an export corporation, and a marketing news service.

The parent corporation, the United States Grain Growers, Inc., is reported to comprise in its membership most of the grain growers of the country; and the new subsidiary will doubtless have as its stockholders eventually most of the other big farmers, as individuals or groups. A campaign will be launched to distribute its stock among farmers at $100 a share. The general counsel for the organization is Clifford Thorne, of Chicago; and it is announced that Bernard M. Baruch will serve in an advisory capacity for the corporation.

We must approve of the principle of these co-operative organizations. At the same time, we feel rather aghast at the results to which logic and business common sense have led. Here is a farmers' combination, prospectively more powerful than any business or industrial combination the world has ever seen. Standard Oil and the United States Steel Corporation will be relegated to inferior rank. Those who have hitherto freely indicted labor organization as the greatest trade-restraining combination in the country, and criticised the anti-trust law for not being applied to them, will find food for thought in this new type of combination, most inclusive and powerful of all. It has been found difficult to attack the trade-restraining activities of the labor unions, because they have not been incorporated; but these new farmers' combinations are incorporated and fearless. Mr. Thorne, the counsel, stated, "We are asking no favors of the Government. Nor are we asking for anything that we are not willing to accord to every other line of industry. We are going to operate on a business basis."

This last setting forth of position makes plain the permissible application of the plan to the mining industry. We are forced to approve of it, on logical grounds, for the farming industry, although, as we stated above, we cannot quite foresee the further results of this most profoundly significant development and experiment in socialistic organization. Who, for example, is going to represent the consumers' interests, and will not this necessity eventually compel government supervision of prices? But we have much the same evils or defects of organization in the mining industry that the farmers have to suffer under: the same faulty marketing and distributing methods, the same unreasonable split between thirteen-cent copper to the producer, large or small, and dollar copper to the home builder, with the difference mainly absorbed by an army of middlemen. On this problem we know our copper producers have been working. Will they perhaps intrepidly follow the course of the farmer and organize the Miners' Finance Corporation, to "stabilize" the price of metals, as the United States Grain Growers, Inc., purposes doing in the case of flour; to study the problems of marketing and the elimination of middlemen's profits, and provide the consumer with his sheet and wire copper at a less price, while the miner gets a better price?

There is a difference, to be sure, between the agricultural and the mining industries, in that large groups control more in the latter. But these large groups have not combined, and, therefore, have been inactive in supporting their industry: great size has made them timid and sensitive against possible attack. The farmers have had no such timidity, any more than the labor unions had; and their numbers make them formidable and effective. And there are a host of miners outside of the largest companies who would have no more hesitation in any plan that would promise better support and organization to their industry than the farmers have had.

Reform in the Patent Office

A GENIUS FOR INVENTION is something which not all of us possess, but it is nevertheless a fairly common attribute of the American engineering mind, and the efficient co-operation of the U. S. Patent Office in recording and protecting our ideas is necessary. The year 1920 was by far the busiest year in the history of that Government bureau; the lull in business seems to have given inventors an opportunity to develop their thoughts and to dream of new things. As a result, over 40,000 applications for patents are now awaiting examination and response on the part of the Patent Office. This means that the average new application is not reached for seven months after it is received. True, the inventor sometimes wishes to delay the granting of a patent as long as possible, in order to have protection extend over a longer time; but in many cases the applicant is anxious to have the status of his invention determined at the earliest possible date, so that he may make plans accordingly. To him a delay of seven months before anyone even looks at his application is most undesirable, and the condition is not a healthy one.

The American Engineering Council has joined with several other associations in a broad movement to bring about sweeping reforms in the Patent Office. In addition to the condition just outlined, the Nolan bill awaits action by Congress, and the passage of this act is to be pushed by the Council. It provides for the promotion of the international rights of inventors, which are often of more importance than domestic rights. We trust that all of those interested will give their maximum support toward a betterment of conditions. Some inventors, of course, are freaks, but most of them are not, and to them we owe a large share of our industrial progress.

WHAT OTHERS THINK

Further Comments on the Naica Case

The observations of "Lay Student" in *Engineering and Mining Journal* of May 14 regarding the Naica case will, I am afraid, leave a wrong impression in the minds of your readers regarding the essential features of the recent decision of the Supreme Court of Mexico in this litigation. I must leave to others the discussion of the subtleties of civil law, but having gone into the case pretty thoroughly in behalf of one of the principal stockholders, I may venture to give your readers—whether they may be students of law or plain business men—a brief statement of the central features of the case.

The decision of the Supreme Court of Mexico in January, 1921, ordered the return of the principal mine of the Naica company to the heirs of Stoppelli on the following grounds (the parts of the summary given below in parentheses constituting my comments):

1. That Stoppelli, one of the original organizers of the company, had contributed the mine to the corporation at the time of its organization in 1897 (although he had to contribute merely the right to denounce the mine, which right, moreover, he sold to the company).

2. That the Naica company had not been legally organized, because of certain omissions in its original articles of incorporation (although these omissions had later been legally repaired).

3. That the company, by reason of these omissions, was non-existent, and, therefore, the property held by it belonged to its associate members, and on dissolution each associate was to receive back what he had originally brought to the company at its organization.

4. That, though the right to petition the court for the dissolution of the company under the law is confined to associates in the company, namely stockholders, and although Stoppelli had forfeited his shares for failure to meet the last five of a series of fourteen assessments against them for an increase in capital, this forfeiture was illegal, and thus the plaintiffs were absolved from their legal responsibility to prove their status as associates as a condition to the prosecution of their case.

5. That if it were true that Stoppelli had forfeited certain shares for failure to pay assessments against them, these were not all of the shares he possessed, because he must have received other and non-assessable shares (the court argued) in return for the alleged contribution of the mine to the company (although no record of these shares had at any time been made by the company, and their existence was unknown to any person, nor had any claim at any time been made regarding them in behalf of any person. Moreover, all of the existing shares of the company were plainly described as assessable in the original articles of incorporation).

6. That a settlement between the company and the heirs of Stoppelli made in 1905, on the termination of the previous litigation between them, was [illegible] because it had not been ratified by the Stoppelli heirs (although the money paid by the company in the settlement was retained by the estate, and its return or tender under Mexican law being a necessary precedent requirement to any action attempting to set it aside).

7. That the right of action of Stoppelli was not outlawed by the statute of limitations, although more than twenty years had elapsed from the date of the organization of the company at the time the action was brought, because under the Civil Code no illegal organization is made legal by the passage of time. (This position was taken by the court, although the Civil Code in no way applied to the Naica case, it having to do with a mercantile transaction and thus falling within the scope of the Commercial Code, as indeed the court itself held with respect to every other point in the case).

8. That there was to be no legal effect given to the amendment by the original parties of the original defective charter of the company which they thought they accomplished when they adopted their by-laws in the year following the organization of the company, and included therein all the necessary legal observances omitted from the original papers (this being held, although nothing in the law prohibits such amendment of articles of incorporation).

There are a number of other interesting and pertinent points in the decision of the court, but the foregoing are the most material. Indeed, none of them is of relative consequence compared with the single one in which the court ingeniously contrived to give legal status to the plaintiffs through the creation of the fictitious *non-assessable* shares which it assumed that Stoppelli had at one time possessed (unconsciously, it must have been), and in some mysterious way had transmitted to his heirs.

The entire structure of the decision, with all the legal argumentation, would crumble if the fiction of "non-assessable shares" were removed. This fantastic conception has nothing to do with law, whether civil or Anglo-Saxon, but is the illegitimate offspring of outraged Fact by Wanton Judicial Casuistry.

Nothing in the facts of the case afforded an escape from the embarrassment under which the court suffered in attempting to give countenance to the plaintiff's demands. Other difficulties could be overcome by argumentation, or at least obscured; but no amount of verbiage could conceal the plaintiff's lack of right to be in court at all. Consequently, the missing fact had to be contrived.

"Lay Student" suggests that to Americans the Naica case is difficult because they are accustomed to Anglo-Saxon jurisprudence, whereas the Naica case was governed by civil law. This, however, in my view, does not explain the difficulty which right-minded Americans find in accepting this extraordinary decision of the chief court of Mexico. The Naica decision was not arrived at as a result of the vagaries of the civil law. The civil law, which applies in Mexico, applies also in French jurisprudence. Indeed, French authors are the main sources of interpretative authority in Mexican jurisprudence. But a decision such as the Naica decision could not conceivably be rendered by the courts of France, because there logic and legal learning are used by the courts to discover and clarify justice; whereas in the Naica case they were used to obscure it.

The civil law is different from English law, but its aims are identical with it, in making justice acknowledge fact.

HENRY BRUERE.

New York

The Tariff on Minerals

A Novel View in Opposition to the Policy of Tariff Protection For Minerals, Based on the Present Status of Our Mineral Industries and the Effect of a Tariff on Their Development

BY MARC PAWL

Written for *Engineering and Mining Journal* and *Chemical and Metallurgical Engineering* jointly

THE Ways and Means Committee of the House of Representatives has an exceedingly difficult job in trying to fix just rates in the new tariff bill that is to be introduced during the present session of Congress, for no man can know the conditions surrounding all the multifarious industries of this country, and no man can visualize the ramifying effects of a tariff. The difficulties are increased by the testimony and the briefs brought before the committee, for they are almost invariably highly colored by the desires of financially interested pleaders. In some of the briefs not a single fact is given without distortion, though a very few give fair and even scholarly presentations of their cases from the pleaders' standpoints.

In most pleas, especially by monopolistic concerns, costs, which ought to be the very foundation on which a tariff is erected, are carefully concealed, or excessively high costs covering the less defensible part of the industry are given, and the public is asked to grant a tariff to bolster prices, the justice of which is not shown.

In going over the reports of hearings before the Ways and Means Committee of the House, the unanimity of the emphasis placed on certain points is striking. Nearly all bills declare that they are "to provide revenue for the Government and for other purposes." One is to provide for the national security and defense, but I have seen one only that frankly states that it is merely to fix a duty on a mineral. One fears the Greeks who come bearing gifts.

Many of the pleas are for a tariff of 100 per cent or more of the price of the mineral or metal before the war, though some are less, and many have not yet reached the form of bills. Most of them ask for duties that will hold prices at or near the level reached during the Great War, but all show that the industry will not be overly enriched, and that the ultimate consumer will never know that his pocketbook has been touched.

Congress, in order that it might have less biased information than that introduced by special pleaders, provided for a Tariff Commission to investigate conditions governing the various industries, one of the most forward steps taken in tariff legislation in this country. This commission has done serious, hard work, but being composed of mortals, even as you and I, will require years to cover the huge and ever changing industrial world before it.

EFFECTS OF A MINERAL TARIFF

Perhaps no industry offers simpler conditions for weighing the application of a tariff than the mineral industry, and no industry except farming is more vital to our well-being.

General Hancock was, of course, wrong when he said that the tariff was a local issue. None but the immediate beneficiary has a local habitation. The payor is every purchaser from Cape Prince of Wales to Key West, and the effect of a mineral tariff may be much more serious than the immediate effect it has in increasing the industry or raising prices.

Ore deposits are diminishing assets. They are like cisterns—they hold a fixed quantity, but unlike cisterns they cannot be filled again. The first production—that from the outcrop—is the cheapest, and as the deposits are worked to greater depth, or the richer ores are worked out, the costs become greater. The first deposits worked are usually the richest and nearest to transportation routes, and there is only one crop of ore.

On these truths, so axiomatic that they are almost trite, is built the mining industry, yet every appeal for a tariff is based on the assumption that these factors do not apply to the particular item under consideration. The plea is almost invariably made that if proper "protection" and "encouragement" are given, the industry will prosper, though the lack of prosperity may be due to lean deposits, inefficient operation and poor location, for ore deposits are where you find them and may be in very inconvenient places.

Never before has there been so good an opportunity for a proper estimation of the country's mineral resources as the present. During the Great War, the prices for minerals and metals reached heights unheard of. Prospecting took on new life, and men went over the country with a fine-toothed comb. Every possible outcrop was carefully examined and known deposits were worked to the limit. At the same time, governmental agencies gathered together all possible data thus made available.

OUR MINERAL RESOURCES AND PROPOSED TARIFFS

Although the United States is the richest mining country in the world, there are certain metals and minerals in which it is very poor, of which the principal are nitrates, the platinum metals, tin, nickel, soluble potash salts and diamonds. We have some of all of them, but by no possibility can we get enough for our needs from known deposits. If we think of our mineral resources as represented by a pyramid, these mineral products may be taken as forming the apex, thus approaching zero. If we imagine the lower part of the pyramid as curving so that at the bottom the sides become nearly horizontal, the base may be taken to represent our illimitable supplies of such minerals as salt.

Using such an idea, the minerals and metals on which duties are now being asked have been grouped in the accompanying table. The list is divided into two main groups: I. Minerals of limited quantity; II. Minerals in large quantity. Under the first group three divisions may be made: *A*. Minerals insufficient for domestic needs; *B*. Minerals insufficient for domestic needs except at artificial prices; *C*. Minerals sufficient for the immediate future. It is probable that few if any of the producers will agree with the grouping, but the divisions are as indicated by the statistics of the United States Geological Survey.

MINERALS ON WHICH DUTIES ARE ASKED

	Proposed Tariff	Price in 1913
I. Minerals of limited known quantity:		
A. Minerals insufficient for domestic needs:		
1. Antimony ores.......	10c. per lb. contained Sb in ores, matte and antimonial lead.............	Best grade, 8.53c. per lb.
2. Cobalt oxide.........	75c. per lb.........	50c. or more per lb.
3. Tin ore.............	10c. per lb. Sn and 4c. on Sn in ore.	44.2c. per lb. Sn.
4. Graphite (lump and amorphous)........	Lump 3-6c., amorphous 2c. per lb..	Ceylon lump 6.5-11c. per lb.; amorphous 1-1½c. per lb.
5. Diamonds	10% (incl. borts)	.....
6. Iodine (resublimed)..	33⅓% ad val.	
7. Nickel..............	10c. per lb.........	38c. per lb.
B. Minerals insufficient for domestic needs, except at artificial prices:		
1. Aluminum (bauxite)..	Al 7c. per lb., bauxite, not determined	.....
2. Chromite........	60c. per unit	50% Cr₂O₃, $10-12 per long ton.
3. Manganese ores......	40c. per unit........	$7-$12 per ton.
4. Monazite	15c. per lb	None produced.
5. Tungsten ores........	$10 per unit (20 lb.) WO₃.	$7.50 per unit WO₃.
6. Pyrites.............	10c. per unit S......	8.4c. per unit S (Virginia).
7. Mercury............	50c. per lb..........	52.7c. per lb.
8. Graphite (flake)......	6c. per lb...........	6-8c. per lb.
9. Mica...............	Unrefd. 25c. per lb. and 20% ad val...	37c. per lb.
10. Potash..............	50c. per unit K₂O...	66c. per unit.
11. Vanadium.	$1 per lb. (in ore?)	..
12. Magnesite	Crude $15 per short ton. Calcined $25 per short ton......	Crude $7. Austrian calcined $16.20 per short ton.
C. Minerals sufficient for the immediate future:		
1. Arsenic (white).......	5c. per lb...........	4.4c. per lb.
2. Barytes	$15 per short ton....	$1.71 per short ton.
3. Bromine............	7c. per lb. plus 30% ad val...........	20.1c. per lb.
4. Fluorspar...........	$5 per long ton.....	$6.37 per ton.
5. Fuller's earth........	75c. and $1.50 per short ton.........	$9.58 per short ton.
6. Lead ores............	¾c. per lb. Pb cont...	4.4c. per lb. Pb.
7. Molybdenum ores....	50c. per lb. on MoS_2 and concentrates.	80% conc. 42½c. per lb MoS_2 cont.
8. Zinc ores............	2c. per lb. Zn in ore.	5.6c. per lb. Zn.
9. Feldspar............	Not determined.....	$3.31 per ton.
10. Sulphur............	0.75c. per lb........	0.8c. per lb.
D. [illegible]		
1. Lime...............	$1 per bbl..........	75.3c. per bbl.
2. Building and monumental stone	$1 per cu. ft.	.....
3. China clay..........	$6 per ton..........	$6.76 per ton.
4. [illegible]	50c. per ton.	$1.51 per ton
5. Magnesium chloride..	$15 per ton.........	Fused, $8 per ton.
6. [illegible]	10c. per lb. plus 15% ad val.	$1.65 per lb
7. [illegible]	Not determined	....
8. Pumice.............	$20 per ton.........	$2.26 per ton.
9. Talc	$10 per ton.	$11.90 per ton.
10. [illegible]	$5 per ton and duty on container......	$2.72 per ton.
11. Coal................	75c. per ton........	$1.33 per ton at mine.
12. [illegible]	17c. [illegible]	

A. MINERALS INSUFFICIENT FOR DOMESTIC NEEDS

All of the minerals of the first group are necessary in our commercial economy and will be imported no matter what tariff is placed on them. Tin ore, diamonds, and graphite in lump form are three mineral products that the United States lacks almost entirely.

We do have some amorphous graphite, to which reference will be made again. Flake graphite is put in the second group.

ANTIMONY ORE

Our experience during the war showed that sufficient antimony to supply the needs of the United States cannot be produced from our known deposits at five times the price of 1913, the last normal year, or seven times the present price of 5.5c. per lb. Even at a price of 14c. a lb., which the proposed tariff would probably put on the metal, it is likely that not over 500 of the 7,500 tons normally used in this country could be produced. Ten cents per lb. above the normal market price for 7,500 tons would be $1,500,000, that someone would have to pay as a tax, although the revenue that the Government would receive would be $100,000 less. Besides the deposits in our own country, Americans own considerable antimony deposits in Mexico.

COBALT OXIDE

Cobalt oxide is produced in only one mine, that at Fredericktown, Mo. Queerly, it is controlled by Canadian capital, and Americans produce much more cobalt ore in Canada.

TIN

We produce not more than 200 tons of tin concentrate per year, say 135 tons of tin, and we cannot enlarge this notably. The war put a price of 75c. to $1 a pound on tin for a considerable period, but production did not increase. Great Britain, through her assiduous and long-continued collection of unprotected territories, has acquired about 50 per cent of the world's tin deposits, not including Siam's, which she also virtually controls, but the United States, a non-producer, uses about 80,000 short tons (1918 figures) out of a world's production of 131,000 tons, or more than 60 per cent, and it seems possible to control commercially only a part of the ore necessary. The largest independent miner of tin ore is Bolivia, which produces 28,000 tons of tin in ore that is shipped to other countries for smelting, equivalent to more than one-third of our requirements, and it is possible that more ore may be mined under the initiative of outside capital.

Years ago the spectacle of American tankers carrying kerosene to Asia and coming back empty moved some American capitalists to build a tin smelter at Bayonne, N. J., with the idea of smelting tin concentrate to be brought back by the tankers from the Malay Peninsula, but a British company had a smelter at Singapore and the government promptly placed a 33⅓ per cent export tax on the ores and the smelter at Singapore continued a strict monopoly. The Bayonne smelter was put out of business, but five others have grown up, and all the Bolivian ore can now be handled here, though much of it goes to Europe and Singapore. Excellent electrolytic tin, apparently fit for all purposes, is now made here. A tariff on ores will give revenue, but cannot build a tin mining industry.

It must be remembered, however, that the United States cannot buy ore sufficient for her needs, for she uses 60 per cent of the world's output, and, including Siam's output, Great Britain controls nearly 60 per cent.

A duty of 10c. per lb. on tin would make an extra cost of $3 a ton on tin plate, and unless a rebate were allowed on export material, this might readily kill the export trade. Americans, however, would have to pay the increased cost.

Americans have several million dollars invested in tin mines in Bolivia and other millions invested in tin mines in the Federated Malay States and China.

GRAPHITE

This country has no deposits of lump graphite, from which the best crucibles are made, but imports its supplies from Ceylon, the one great producer, and Americans are interested financially in Singalese deposits. Our American deposits of amorphous graphite are not to be compared with the deposits in Sonora owned and operated by Americans. These deposits formerly furnished and probably yet furnish the graphite for the best lead pencils of both domestic and foreign make. The heavy duty proposed, about 100 per cent on flake graphite, is probably aimed at the Madagascar flake, which really competes with the American product, but the tariff on amorphous graphite is from 167 to 200 per cent of the 1913 prices.

DIAMONDS

The problem of the diamond is only a phase of the "woman question." The diamond millionaires of Great Britain, forming one of the most rapacious and complete monopolies known, were created and are kept growing by the American bride-to-be. Her solitaire is usually far more expensive than the young man can properly afford, and the price is maintained and kept up to all the traffic will bear. The mass of diamonds are indefensible luxuries for which prices beyond all reason are charged and paid to satisfy mere whims, so that no objection can be made to a tariff of any sum. A smaller part of the diamonds imported are for serious use. (It is not, however, intended to suggest that being a bride-to-be is not a serious matter!) They are the bort or imperfect stones and the carbons or amorphous diamonds, and are used in diamond drilling, glass cutting, etc., and a duty on them is a tax on necessities and especially on mining. The prices for these stones reflect the prices on gem stones and are out of all reason, even without a duty.

IODINE

Iodine has so far been produced only experimentally in this country. It comes from Chile, where it is obtained as a byproduct from the nitrate deposits in which American firms have millions of dollars invested, and can be produced in quantities far beyond the world's needs.

NICKEL

The suggestion that a tariff be placed on nickel is probably not to be taken very seriously. The richest nickel deposits in the world, those of Sudbury, Canada, are largely held by the International Nickel Co., an American company, and this company also supplies the larger part of the world's manufactured nickel. The investments of the company in Canada are valued at many millions. Under no imaginable circumstances could the United States supply its needs of the metal.

On none of the minerals of the first group, except diamonds for gems, does a tariff seem justifiable.

B. MINERALS INSUFFICIENT FOR DOMESTIC NEEDS EXCEPT AT ARTIFICIAL PRICES

In the group of minerals insufficient for domestic needs except at artificial prices are several minerals of which it is conceivable that if the price were high enough the entire needs of the United States might for a short time be supplied from domestic mines. During ordinary times, however, it has been found expedient to import a considerable part of our supplies, the proportion varying from almost the total quantity of potash to a comparatively small part of our flake graphite and mercury.

With the exception of monazite, this group of minerals was of enormous use in carrying on the Great War. Except for aluminum, graphite, mica and pyrites, these minerals were almost or quite irreplaceable by substitutes. We have not yet joined the League of Nations and there is as yet no insurance against war. Few thought the Great War possible; another may be nearer than we think.

Using for our nation the same sort of thoughtful care that we do for our families, what must be our attitude toward these deposits, the depletion of which, comparative or total, is apparently only a handful of years away?

BAUXITE

An important item that must be stressed when considering the cost of minerals is the matter of purity. Thus American bauxite ordinarily carries from 8 to 9 per cent SiO_2, against 2 to 3 per cent SiO_2 in good foreign material, and only 55 per cent Al_2O_3, against 62 per cent Al_2O_3 in the foreign ore. These differences are equivalent to an added cost of several cents a pound to the manufacturer if he must use the lower grade mineral. The same reasoning applies to chromite and manganese ores, to monazite and pyrite. The mass of domestic ores are of lower grade than the imported ores, and if the American metallurgist is compelled to use them either he must bear the added expense of reduction, or he must pass the cost along with the duty to the utlimate consumer—to you and to me, and to William Jones and John Brown, who are so lost in the crowd that, like the grains of sand on the beach, we blend in blurred obscurity unless someone stoops to look at us.

CHROMITE

Under the desperate needs of the Great War we produced 82,350 long tons of chromite averaging 50 per cent or less Cr_2O_3 at $48 per ton, but at the same time we imported more than 100,000 long tons averaging 50 per cent or more Cr_2O_3 at $28.88 per ton. That is, we produced four-ninths of our needs at a cost one-third higher than that of the five-ninths imported. Not only were the actual costs higher during the war, but an indirect cost was added of which little account was taken. That was the excess of cost in working lean concentrates, of which I have just spoken. At a time when every pound of coal and every bit of electrical energy was so greatly needed, we had to waste a great deal of it in slagging off useless rock. This was a tax as burdensome as the higher prices, but invisible to any but the metallurgist.

MANGANESE ORES

Almost the same conditions applied to manganese ores. Our own deposits were mostly small and mostly poor. Some high-grade deposits were developed and some are now known, but they are very much smaller than our needs, and must have high prices to work successfully. The manganese deposits associated with the copper ores at Butte (rhodochrosite) and Phillipsburg, Mont., are large, and water power is conveniently developed, but mining is expensive and the ore is not the cheapest to reduce. But even under war conditions, we cannot produce the ores we need, and under peace-time conditions higher grade ores at much lower prices can be readily obtained from India, Brazil and Russia.

Americans own large manganese deposits in Brazil, and other deposits are owned in Mexico and India, involving investments of probably $5,000,000.

MONAZITE

The proposed tariff on monazite is another case of a proposal to compel the use of American material of lower grade and higher price. The marketable monazite from the Carolinas carries only 4.5 to 5.5 per cent ThO_2, against about 6.5 per cent in the Brazilian monazite, and 8 to 9 per cent in that from Travancore. If the bill passes, either the waste of chemicals and the extra freight and labor costs required to use the American material or trebled cost for foreign "sand" must be faced. It is worth mentioning that John Gordon, an American, is the principal Brazilian monazite producer.

Tungsten Ores

Tungsten ore is another particularly bad subject for a tariff. In 1917, under prices at least three times the normal and which had existed for two years, we were able to produce a little more than one-half of our needs. In 1918, under similar prices, we produced one-third of our needs. Under a price of $17 per unit, two and one-half times the normal price before the war and the price which it is hoped will be reached under the proposed tariff of $10 per unit, it does not seem probable that the United States can produce more than 3,000 tons per year for three years from the deposits now known. Indeed this seems a rather optimistic estimate. Remembering the intensive prospecting of the war period, we have no reason to expect the discovery of deposits that will greatly alter the situation.

Americans own tungsten deposits in Bolivia, Mexico, Portugal, Argentina, Korea and Siam, worth probably a million dollars. The imposition of a tariff will, of course, prevent their shipping their ores to this country.

Pyrites

Before the Great War most of our sulphuric acid plants were fitted to use pyrites only, and great cargoes were brought from Rio Tinto, Spain, to supplement domestic supplies. Huge quantities of acid are made from waste gases from smelters, and sulphur is now being burned in large quantities for acid making. The usefulness of sulphuric acid depends largely on its cheapness, and a high degree of civilization demands cheap sulphuric acid, but tariffs on pyrites and sulphur mean dearer acid. In their need for pyrites, Americans were forced to buy pyrites mines in Canada and have considerable money invested in them. Their output will be affected by the tariff like any foreigner's product.

Mercury

Of mercury the United States mines about half of the world's supply, but according to testimony before the Ways and Means Committee our ores carry only about 8 lb. to the ton and our cost is 95c. to $1 a lb. According to the same testimony, Spanish quicksilver is produced at a cost of 30c. per lb. During the Great War, the price of mercury reached $125.89 per flask of 75 lb. If the figures for costs of production are accurate, American mercury cannot compete with foreign mercury even under the proposed tariff, for it certainly cannot be put on the market at less than 20 per cent gross profit. This added to the cost of $70 to $75 per flask will make a price of $84 to $90 per flask. The Spanish producers, if their costs are given correctly, should at the same rate of profit be able to lay their mercury down in this country at slightly less. Either the figures are wrong or the tariff proposed by the miners will be futile. For years American mercury has been sold for export at $5 per flask under the domestic price.

Flake Graphite and Mica

Of flake graphite the deposits of the United States are comparatively large, and Americans are known to be interested in flake graphite deposits in Canada. The Madagascar flake is better than the American, and will probably be imported in spite of a tariff, the duty merely adding to the user's troubles.

Mica is mined from pegmatite dikes and like all pegmatitic minerals is proverbially in uncertain quantity. The mining of mica in this country has always been so precarious that large users have invested in Canadian deposits in order that they might be sure of their supply. No one can foresee or foretell what the future supply will be. It is peculiarly an industry adapted to countries like India, where labor is cheap. Prices for mica have always been very high, and with the advent of the great electrical industry they have become higher. It is at present a small industry employing very few persons.

Potash

So far very few deposits of soluble potash salts have been found in the United States. They are confined to the small brine lakes of northwestern Nebraska, the salt fields in Great Salt Lake Desert, and Borax Lake in the Mohave Desert, California. There is no likelihood of our being able to supply our needs from these sources. More laboriously, potash is being obtained from kelp along the Pacific Coast, from the dusts of cement mills, from wood ashes, from alunite and from green sand marls of the Coastal Plain. Experiments without number have been made on the production of potash from the feldspars and other silicates, but to date these have not met with commercial success, though the use of glauconite is promising. We are still, and probably will be for a good while, dependent on the German and French deposits for a large part of our potash. The proposed tariff will add 75 per cent to the cost of potash, and may encourage continued experiments on the extraction of potash from the silicates. Potash is used mostly in fertilizers that are used in farming, the most poorly paid of the basic industries, and by the farmer must the cost of the experiments be paid. The passing along of the tax is in his case a grim pleasantry, for he does not and cannot fix the price of his products.

Vanadium

The proposed vanadium tariff is probably not to be taken too seriously. More than half of the world's vanadium comes from the unique deposits at Minasragra, Peru. The deposits are American owned and operated, and recently changed hands at a price of $3,000,000.

Our own vanadium deposits are mostly in southwestern Colorado and southeastern Utah. A large part of the output is made as a byproduct from radium ores.

It is likely that at recent prices we can supply most of our needs for five years or more from the known deposits.

Magnesite

Under normal open market conditions, magnesite has been a comparatively cheap mineral, but it is heavy and bulky. The American mines are located in California and Washington, but the principal users, the steel mills, are located from Chicago eastward to Buffalo. The California deposits are comparatively small, and for many years were worked with the tacit acknowledgment that without an unreasonable tariff they could not well compete with the Austrian magnesite on account of the much greater size of the Austrian deposits and the high freight rates from California to the Eastern steel mills. Before the Great War it was not always easy to get supplies of magnesite as they were needed, and one of the large American magnesite brick manufacturers bought an Austrian deposit and invested altogether $1,000,000 in the project. Other Americans bought and operated magnesite deposits in Venezuela, Lower California and Canada.

In 1915, the year following the outbreak of the war, when all imports were cut off, Austrian calcined magnesite was selling for from $25 to $26 a ton in New York, and brought as high as $60. The deposits near Chewelah, Wash., were rediscovered, and the high prices and shortage of magnesite offered an excellent opportunity for their exploitation. One company made an investment of nearly a million dollars and another company made an investment of half a million. At the prevailing prices and shortage of the material even the California deposits were enabled to ship to the East, and large developments were made. But the war came to a close and left the large Washington investments unamortized. With the cessation of hostilities in Europe, the usual sources of magnesite again became more or less available, and railroad freight rates had meanwhile increased largely, so that neither the Washington nor the California operators would have been able to ship magnesite in competition with the European producers, even had the demand not collapsed with the steel business. It is now proposed that a duty of $25 per short ton of calcined magnesite, equivalent to more than 150 per cent ad valorem, be levied, making the price to the Eastern consumer at least $41 per short ton of calcined magnesite, and probably nearly as high to the Western buyer.

On the crude magnesite a duty of $15, or more than 200 per cent, is proposed, making the cost at least $22 per ton. Should the consumption be equal to that of 1913, it would be equivalent to 172,591 tons of calcined and 161,967 tons of crude, on which would be levied a total tax of $6,740,000. It is explained that the cost is distributed over so many tons of steel that it will be unnoticeable. It will, however, put out of business the Americans who have invested in mines in foreign countries.

The proposed tariffs are so high that, if put into effect, they may defeat their objects, for at these prices it seems possible to make profitably an artificial magnesite and thus leave the Western mines without their market.

BAUXITE AND ALUMINUM INDUSTRY

It is impracticable to consider the tariff in relation to all the minerals as such and without regard to the manufactures from them; thus bauxite must be considered with aluminum. In the United States the aluminum industry is centered in a single company. It owns most of the American bauxite deposits and controls most of those in the Guianas—the best and largest known. This company, the Aluminum Company of America, has a monopoly of aluminum production both in the United States and Canada, and in 1919 its capacity in the United States was 90,000 short tons of the world's plant capacity (exclusive of Canada) of 270,000 tons, and including its Canadian plant, possibly 210,000 tons, or about 70 per cent of a total of 310,000 tons. It has kept free from competition probably as closely as any other American company.

It has net assets of more than $110,000,000, apparently mostly derived from earnings.[1] Inquiry along this line at the tariff hearings was not allowed to proceed. The representative of the company admitted that it had had, through its Canadian branch, a selling agreement in Canada and Europe which on account of the law did not apply to the United States. The cost of manufacture is supposed to be from 12c. to 13c. a lb. The selling price is from 28c. to 30c. a lb. In the committee hearings no data were brought out or asked for on this point. In its brief the company speaks of using only Arkansas bauxite of low grade, although in British Guiana the company owns the finest known bauxite deposits, and has brought in large quantities of the ore.

A tariff on bauxite means a burden on any company that might have the temerity to try to compete with the Aluminum Company of America, and further profit to the present monopoly. Aside from raising revenue, it can do no good. The company manufactures aluminum products and a tariff on the metal means more profit to the company, added cost to competitors in the manufacture of aluminum articles, and added cost to the consumer.

IMPORTANCE OF SOME ORES IN MODERN WARFARE

Manganese, chromite, mercury and tungsten are indispensable in modern warfare. Without manganese the making of steel is immensely more difficult; without chromite armor plate is useless and tool steels sink to a level little higher than carbon steels; mercury makes our best percussion caps, and without tungsten high-speed steels we would have been unable to equip enough factories to turn out our munitions in the Great War.

It is possible that very high artificial prices may cut part of the metals off from some of their most useful though as yet unproved applications. This may be shown by chromium. Stainless steel, an alloy of 13 to 17 per cent chromium with iron, is remarkably resistant to rust and seems to offer great possibilities of usefulness. As an example, concrete sea walls now destroyed by the rusting of the steel reinforcement would probably stand indefinitely were stainless steel bars used for reinforcement. The extra cost for such material would be much less than the cost of replacing the walls.

In many oil wells the pipes are destroyed by corrosion long before the well is exhausted. In certain favored wells it seems possible that a stainless steel casing could be used. The present cost of the chromium in a ton of such steel would be from $40 to $50 per ton, and must be near if not above the limit of cost. The heavy duties asked may well be the deciding factor for such possible uses.

In proposing heavy duties on these minerals, the plea has been that there is great need of home development so that the Government might have the necessary quantity of the minerals in case of another war, and that the mines should be kept in a state of development so that the ores could be quickly obtained and that if the mines were allowed to close they would be flooded and ruined.

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[1] Hearings on general tariff revision before the Committee on Ways and Means, House of Representatives, Pt. 2, pp. 894-921.

This is merely plausible sophistry, for no man will develop orebodies to let them stand for the Government's convenience. Development means depletion, and a tariff on the ores means a premium on early depletion. Flooded and caved mines are bad, but exhausted mines are useless. If the Government held in stock supplies of these ores large enough to carry us through a considerable period of another great war, such a situation could be faced with more equanimity.

MINERALS SUFFICIENT FOR THE IMMEDIATE FUTURE

In the group of minerals the deposits of which seem to be sufficiently large to furnish our needs for an indefinite time are two of the principal industrial metals —lead and zinc; two elements usually recovered only as byproducts—white arsenic and bromine; molybdenum, a metal apparently just finding its use; and a number of non-metallic minerals, particularly sulphur. Of lead and zinc the United States is the largest producer. The only difference between the minerals of Group C and Group B is that our supply is larger, but the end is just as definite and as certain to be reached.

If I understand the pleas for a tariff on zinc aright, however, it is not that we cannot produce in competition with the world, but that many of our poorer mines cannot compete. So far as I know, no figures of costs are given for the Franklin Furnace mines nor for the best of the northeastern Oklahoma mines. For many poor mines undoubtedly the costs are higher than the market price, but that would be true if the price were a dollar a pound. The principle advocated seems to be that when once a camp is started the tariff should follow rising costs in order that the operators may continue to make money until the zinc ore is all mined. If for poor zinc mines, why not for every non-paying industry?

Much the same arguments apply to lead. It is, however, a remarkable and disconcerting fact that if we except the continuance of the Joplin field into Oklahoma, the Bawdwin deposit in Burma is the only really large new deposit of lead that is known to have been found anywhere in the world in the past ten years. This shows how much nearer the end of the mines may be than we have thought.

Bromine is saved as a byproduct from salt wells and will be saved only if the price and demand justify. Arsenic is caught in the fumes at the great copper and precious metal smelters and practically must be saved to prevent its being a nuisance. Though some is now being made from arsenopyrite, no direct production is needed if the fumes are saved. Before the great increase in freight rates it could be marketed very cheaply. The duty asked, [illegible], is probably more than a 100 per cent tariff on cost f.o.b. New York.

Our supplies of sulphur are comparatively large and cheaply produced from the domes of Louisiana and Texas. It is difficult to see how anyone can compete with them more than temporarily. If prices on both pyrites and sulphur are revised upward by high tariffs, the price of sulphuric acid, fertilizers and other materials must rise accordingly, or be kept from approaching pre-war levels.

MINERALS IN LARGE QUANTITY

The minerals in large quantity are mostly those generally referred to as non-metallic, by which we mean that the compounds are more useful than the contained metals are after isolation. They are mostly bulky materials and the supply approaches infinity so far as human industry is concerned. Thus the ocean is a huge salt bed in solution and an inexhaustible supply of magnesium ore.

In these bulky products, position, freight and labor, rather than foreign competition, may cut the largest figures, and unless carefully drawn laws are made one locality may be placed at the mercy of a particular company.

This may be illustrated by a story told some years ago by a gentleman connected with a cement company. The company owned cement plants near the boundary in both this country and Canada. When a former tariff law was being framed in this country, he went before the Ways and Means Committee and asked for a specific duty of $1 a bbl. on cement to keep out the "pauper-made" cement of Canada and other countries, explaining that an earlier tariff of 20 per cent was equal to about $1 a bbl. He did not explain that, at the earlier date, the price of cement was $5 a bbl., but that at the time of his plea cement was being made profitably as low as 70c. a bbl. Then he went to Canada and petitioned for a tariff of 20 per cent against the American cement, as he wished to put up a mill in western Canada, where an extensive region was being supplied by a recently erected American plant. After both tariffs were granted, a new plant was built to supply the field in western Canada, and both an American and a Canadian community were compelled to pay tribute to the company.

Before the war anhydrous magnesium chloride used as a source of magnesium and as a component of oxychloride cements came from Germany, where it was made as a byproduct of potash refining. Probably it has not been very successfully made anywhere in this country, though the hydrous chloride is easily made.

Phosphorus is made in the electric furnace from lime phosphates. The other items are so familiar that little explanation is needed except as to coal.

M. R. Campbell estimates that at the present rate of use we have coal enough for 4,000 years, but the best steaming coal is being used rapidly and may not last more than fifty years, so that this might well be separated and put under Class C. Of the lignites and other poor coals the supply is huge, but on the other hand our uses are increasing at a rapid rate. As the United States is the largest exporter of coal, a tariff could have the effect only of raising the already high price in some poorly supplied locality like the Pacific Coast.

The fixing of a tariff on this group of minerals may well follow the same considerations as are applied to the fixing of tariffs on manufactured articles or farm products.

GENERAL CONSIDERATIONS

Some repetition in an effort to emphasize some of the points raised in this paper may be pardonable.

Of certain necessary minerals and metals we have practically none. Of certain other minerals, the bulky and common class, our supplies are very large, and of a few like salt, magnesium and lime, the supplies are, so far as human industry is concerned, unlimited. Between these two groups of minerals are two other groups. Of one we have a known quantity sufficient for our needs for a short time only and at highly artificial prices. Of the other we have a supply that is sufficient for our needs for some time to come. To all of the deposits of these two groups there is a definite end. Using them is precisely like drawing the water from a cistern, except that an ore deposit is filled only once, and when once mined, it is gone. There is no second crop. They are wasting assets.

Of the first group, that which we lack entirely, diamonds for gems are luxuries sold at absurdly extravagant prices, and no valid objection can be made to a duty of an amount comparable to the price. On the other substances, except bort and carbons, tariffs may be levied according to the theories of the party in power without directly affecting the mining industry of this country. To the last group tariffs may be applied much as to manufactures.

The minerals of the two middle groups, except bromine and arsenic, deserve entirely different consideration. Bromine and arsenic may also fairly be treated as manufactured products, for bromine will be saved from brines only if it pays, and arsenic can be supplied to fill all our needs as a byproduct from the smelters. We have the others in limited quantity. To place a tariff on them is to place a premium on depletion and to hasten the day when they too will be among the minerals of which we cannot supply our own needs. To bring that day more quickly than necessary is economic crime.

The civilization that we enjoy and that we are attempting to intensify is making more and more use of mineral products. To our grandfathers nickel was a curiosity; to our fathers aluminum was an unseen metal; tungsten, vanadium and chromium were heard of only among the abstruse things of chemistry. To us they are all necessities, and perhaps the Great War was won so soon because Germany lacked tungsten.

The mineral products are becoming more and more indispensable to us and depletion of deposits more and more of a menace. A hundred years ago iron furnaces were operated on chunks of iron ore picked up between Washington and Baltimore; now a single blast furnace will turn out as much pig iron in a day as one of those furnaces would in months, and it must have a large and assured ore supply to guarantee operation. When our great Lake Superior iron deposits were discovered they were heralded as inexhaustible—but our iron and steel industry has grown so that already we have had to commence beneficiation of the lean Lake Superior ores, and American firms are exploiting iron deposits in Cuba and Chile. It is probable that in 100 years the owners of the Brazilian iron fields will control the world's steel trade.

We have been the world's greatest copper producers, but our energetic mining firms have found it expedient to take over the great copper deposits of South America.

Besides these great investments by the most powerful of our mining interests, many smaller investments have been made in foreign mines—made at a time when our every endeavor has seemed to be to obtain foreign trade. These men have retained their American citizenship, and their ties with the United States are very real. Uncle Sam never forgets them when their income tax is due and they pay precisely the same rates as those of us who live at home where we have some advantage from the tax. These men have been, and are, the advance guard of American exports. They buy American machinery, foods and clothing; and in very many places they import American timbers for their mines and American lumber with which to build their mills. They are probably our best field agents for American exports. Do we believe in American exports, or is it mere cant?

Some of the American owned foreign mines are so close that the minerals are brought into the United States by aërial tramways; others are in the snowy heights of the Andes and in torrid India.

Probably the total American investment in foreign mines amounts to between $600,000,000 and $1,000,000,000, and if our metallurgical industry grows with our population it will mean greater and greater foreign investments. Are these then to be forgotten when we are passing tariff legislation?

Not only our own Americans but other miners in foreign countries are willing to sell us their cheap and rich ores. If we insist on making our own ores expensive by placing a protective tariff on foreign ores, then we place in the hands of our competitors the cheap ores of the world, and our manufactures must be increased in cost. The proposition that ores intended for incorporation in goods to be exported will be relieved of duty only half answers the question. Our own machinery and the manufactures of our own country must yet be made of the expensive ore, and the cost is passed on to the consumer, with the argument for each duty that it affects him little. Straws broke the camel's back.

But above all, the tariff puts a premium on the early depletion of our deposits. It will leave posterity only the caved mines that might have been an asset to them. Posterity will have to buy from the foreigner his deep mined ores and the United States will always work on expensive metallic products. The cynical question, "What has posterity done for us?" so glibly asked in reply to such an objection, may be answered by another and more honest question:

"Shall we rob our children?"

Removal of Chlorine From Zinc Electrolyte

A method of preserving electrodes used in the deposition of zinc, by the removal of chlorine from the zinc-bearing solutions prior to electrolysis, has been formulated by Messrs. D. Avery, of Melbourne, and R. H. Stevens, of Hobart, who have patented the process and assigned the patent to the Electrolytic Zinc Co., says *Chemical Engineering and Mining Review.*

The removal of chlorine is effected by the diversion of a portion of the solution from the circuit from time to time, and treatment with Ag_2SO_4 after acidification. The precipitated AgCl is settled and filtered, and the chlorine-free solution returned to the circuit. Silver sulphate is recovered by agitating the chloride with H_2SO_4 and zinc dust to precipitate metallic Ag, which is reconverted into Ag_2SO_4 after filtering and washing, by heating to 250-300 deg. C. in a converting pan. The granulated mass thus obtained is ground prior to reuse.

The Smelter of the Calaveras Copper Co.

Small Plants Often Require Variations From Common Practice in Both Design and Operation—Here Sintering of Flotation Concentrates in Dwight & Lloyd Machine and Intermittent Running of Blast Furnace Are Features

By Edward H. Robie
Metallurgical Editor, *Engineering and Mining Journal*

In looking about for the most advanced practice in copper smelting, one usually goes to the large plants, such as those at Anaconda, Douglas, and Garfield. Operations there are conducted on a big scale, with ample financial backing and with well-trained operating and metallurgical staffs. For these very reasons, however, these large establishments do not have the problems which frequently must be solved in smaller and more remote plants, so, in the quest of new ways of doing things, the small smelter should not be entirely disregarded.

THE CALAVERAS COPPER CO.'S CONCENTRATOR

One of the principal difficulties which the small plant is likely to meet is that of insufficient ore or matte to supply a smelting unit. Before the smelter of the Canada Copper Corporation, at Greenwood, B. C., closed down two or three years ago, this condition was met in an interesting way at that plant. One 20-ft. blast furnace was in operation, but as the ore averaged only approximately 0.95 per cent of copper, and the matte was about 48 per cent, it can readily be imagined that the settler did not fill up rapidly. One small acid-lined converter was more than sufficient to handle what matte the furnace produced. The converter crew would start to blow about 9 a.m. By noon the copper was in the molds, after which time the business of converting was over for the day, and the furnace settler was given a chance to recuperate until the next morning.

At the smelter of the Calaveras Copper Co. at Copperopolis, Cal., which is to be described briefly in this article, there was not sufficient ore for the blast furnace, so this part of the smelter equipment had to go on part time. Most smeltermen hesitate to bank a furnace for more than a few hours. An instance is recorded of one superintendent, who, with the gracious idea of giving the employees Christmas day off, decided to bank his furnaces for the holiday, only to be rewarded by finding them frozen up solid when the blast was again turned on. At the Calaveras plant, however, there is no particular difficulty in running the furnace for five hours and then banking it for nineteen hours; in fact, it is sometimes down for forty-two hours. This smelter has other features of interest, so that a description may not be amiss. The plant has been closed down since October, 1920, but this is no disgrace in these days, and when the copper market improves, operations are likely to be resumed on a greater scale than before.

The ore consists of chalcopyrite, fairly massive, in a gangue of close-grained slate, the analyses running from 1.6 to 2.5 per cent copper. The mine can produce from 500 to 600 tons per day. The ore is carried about one-half mile by electric tram to the coarse-crushing department, where it is discharged into a 250-ton bin. From this bin it passes to a No. 7½-K Gates gyratory crusher, followed by a revolving screen to remove plus 1½-in. material. This oversize is again crushed in a No. 3 Austin gyratory, and the product, united with the screen undersize, is conveyed to the top of the mill building, a distance of about 300 ft., and is discharged into a 1,300-ton bin, from which the ore is removed by Challenge feeders and sent direct to the ball mills of the fine-grinding department.

Three ball mills are provided, an 8 ft. x 30-in. Hardinge, an 8 ft. x 36-in. Hardinge, and an 8 x 6-ft. Allis-Chalmers mill with ¼-in. grate discharge. The average screen test of the ball mill feed and discharge is as follows:

SCREEN TEST OF FEED AND DISCHARGE

	Feed		Discharge	
Size	Per Cent	Cumulative per Cent	Per Cent	Cumulative per Cent
Plus 1 inch	31			
Plus ½ inch	25	56		
Plus 10-mesh	20	76	4	4
Plus 20-mesh			9	13
Plus 40-mesh	13	89	16	29
Minus 40-mesh	11	100		
Plus 60-mesh			21	50
Plus 80-mesh			13	63
Minus 80-mesh			37	100

THE CALAVERAS SMELTER AT COPPEROPOLIS, CAL.

The total capacity of the three mills is 550 tons per day, operating in closed circuit with Dorr duplex classifiers and with 90 per cent of the classifier overflow passing 80 mesh. The mills are customarily run at 18 r.p.m. and with 33 per cent of water in the discharge. Equal quantities of 3- and 4-in. forged steel balls are added as needed. White-iron liners made at a local foundry are used with satisfactory results, but no tests have been made to compare these with more expensive alloy steel liners. With the conditions which exist at this plant there is a preference for the conical type of mill over the grate-discharge mill installed. Less trouble is occasioned by uneven feed, and a higher percentage of time in efficient operation is secured.

After grinding, the pulp goes direct to the flotation department. No. 400 Pensacola Tar & Turpentine Co. oil is added to the ball mills for frothing purposes. The classifier overflow is treated in three units of Callow pneumatic cells, there being four rougher, four finishing, and two cleaner cells in each unit. The concentrates from the roughers and finishing cells pass to two cleaners, and the tailings from these two cleaners are treated in two more cleaners. Typical analyses of feed, finished concentrates, and tailings are given in the table, but these analyses are not absolutely correlative.

AVERAGE ANALYSES

	Cu	Fe	SiO_2	Al_2O_3	S
Feed	2.0	18.7	34.6	24.7	5.0
Concentrates	15.0	25.1	16.0	10.5	21.2
Tailings	0.19	15.8	39.8	27.2	2.0

The ratio of concentration is 8:1. The tailings go to a settling pond, from which clean water is returned to the mill. The concentrates are thickened in three Dorr thickeners to about 50 per cent water.

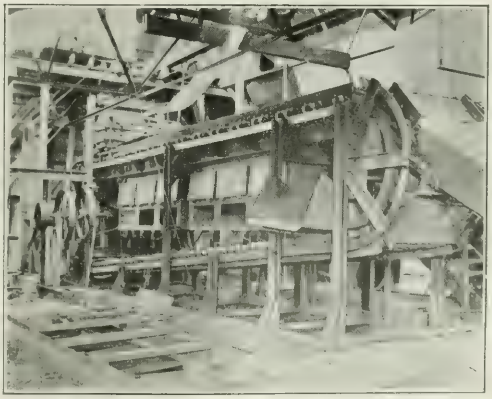
An unusual feature is the entire absence of tables in this mill. With an easily floatable mineral such as chalcopyrite, careful attention to the flotation machines makes tabling unnecessary. The recovery of copper averages above 90 per cent, which is considered satisfactory.

The thickened concentrates are dewatered in an 8-ft Oliver filter, with a 6-ft. filter held in reserve. As the ore is not slimy, there are no filtration troubles; the mechanical agitators provide the only agitation necessary. The filter cake is discharged on to a conveyor belt, which passes over a 75-ton bin. This small bin is used to store concentrates when the sintering plant is shut down for any cause.

Flotation concentrates, at most of the large American copper plants, are roasted or dried in McDougall, Wedge, or Herreshoff multiple-hearth furnaces, and subsequently smelted in reverberatory furnaces. The problem of so preparing fine concentrates that they may be smelted in blast furnaces is a real one at some plants, however. Three methods of doing this have received attention: briquetting, nodulizing, and sintering. Of course, the concentrates can be dumped wet in a blast furnace, as was done at the Morenci, Ariz., smelter of the Phelps Dodge Corporation until it closed down a year or two ago. There a 33-ft. furnace was used, and little coarse ore was charged. A large amount of flue dust was made, but most of it was recovered, and it was remarkable how well the furnace ran. Blast furnaces are not adapted to fine ore smelting, but in a pinch, at a sacrifice of capacity, and with low blast, such work can be done.

Briquetting is not popular—never was, and probably never will be. It is troublesome, somewhat costly, does not remove sulphur, and the briquets have the bad characteristic of breaking up when dumped into a furnace. Nodulizing is a better solution, and has received its principal application at the Braden smelter in Chile. Sintering in Dwight & Lloyd machines gives promise of being an even more satisfactory means of agglomerating the fine particles, especially where there is an abundance of sulphur. It has been used for some years at the Coniston, Ont., smelter of the Mond Nickel Co., where fine ore from the mines, flue dust, and concentrates are mixed and sintered, and the product is charged to blast furnaces. This plant is still running. I do not recall the percentage of sulphur in the sinter, but it is so low that open-heap roasting of the coarse ore is no longer practiced, the sinter and green coarse ore making a charge of sufficiently low sulphur content for economical blast-furnace smelting.

Sintering was also practiced at the Copperopolis plant prior to closing down, with highly satisfactory results. The flotation concentrates from the Oliver filter are conveyed to a hopper-bottom bin above the sintering machine. Into this bin also are discharged a small proportion of fine sinter and all the flue dust which the plant produces. An 8-in. screw in the bottom of the bin feeds into a pug mill, which thoroughly mixes the



THE DWIGHT & LLOYD SINTERING FURNACE

materials and discharges into the feed hopper of the sintering machine. The bottom of the front of this hopper is raised somewhat, so that the ore piles up about two inches higher than the sides of the pallets, thereby increasing the capacity of the machine and tending to make a better sinter with a feed of flotation concentrates.

PAN CONVEYOR FOR CARRYING SINTER TO BINS

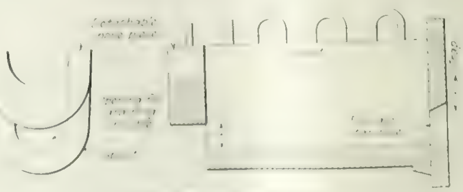
The sintering machine is the standard 42-in. Dwight & Lloyd, and has a capacity of about 100 tons of sinter per twenty-four hours, roasted from about 15 per cent of sulphur down to 5 to 8 per cent. The upper limit of sulphur in the feed is about 18 per cent; more than this results in too great melting of the bed and injury to the grates. The important factors in the successful sintering of the wet plastic flotation concentrates are the proper proportioning of the charge to get the right amount of sulphur and sufficient porosity, and thorough mixing in the bin and pug mill.

The sintering makes a particularly solid cake, and sometimes the sinter from two pallets will stick together as they discharge. From the grates the sinter falls on to a grizzly with ¾-in. openings. The undersize is carried by a pan conveyor to the feed bin, this undersize being ideal material to dilute the sulphur in the charge to the sintering machine, and to make the bed sufficiently porous for the penetration of the air.

The sinter fines are usually ample for the purpose, but, if they are not, a small amount of crushed quartz is added and a corresponding amount taken off from the blast-furnace charge. Fine limestone in small quantities is a great help in keeping the sinter from sticking to the pallets when the sulphur in the charge is too high, and the use of the lime rock or foul clay is an aid in the subsequent smelting of the sinter. The coarse sinter is carried by a pan conveyor to a fire-proofed bin, from which it is drawn to the charge floor of the blast furnace.

The 40 x 120-in. Power & Mining Machinery Co. (now Worthington Power & Mining Works) blast furnace has twenty 5-in tuyères and is 10 ft. high from the tuyères to the top of the jackets. Because of the high percentage of alumina in the concentrates, this furnace was not expected to smelt more than 100 tons per day, but it can handle more than double that amount, particularly if the sinter is charged hot. So, rather than limp along on low coke and blast, it was found advisable to operate the furnace but one shift a day. The average running time is about five hours, and sometimes it is necessary to skip a day entirely. Of course, with continuous running the coke consumption would be a little less and the labor charge slightly lower.

Before banking the furnace the ore column is lowered, extra coke is added, and the whole covered with a layer of flue dust. Experienced metallurgists will wonder what happens to the settler. To operate but one shift a day, the settler was reduced in size so that it would be full of matte at the end of the run. It was evident that if the furnace were tapped in back, the hole in the breast jacket would not always be drained and would cause trouble in starting. A specially cast water-cooled spout was therefore designed, as shown in the sketch below. The front end of this spout is made almost as deep as the back end, so that there is no trap to the spout itself. A heavy water-cooled nose piece was made to fit the end of the spout, so that the top of this nose piece would provide the desired trap, the bottom being 3-in. above the bottom of the inside of the spout. This leaves an opening about 3-in. square, which is low enough to drain the furnace to the bottom of the hole in the breast jacket. This hole is plugged each morning with a small piece of asbestos rope and clay, and it is easy to punch this out at the end of the run, so that the furnace is always thoroughly drained directly into the settler. Each day, at the end of the run, the matte is tapped out of the settler, which is completely drained. The settler lining lasts indefinitely, but with the intermittent running it is necessary to dig out the accumulation of solidified matte and slag about once in three weeks. When the plant is reopened it is planned to have portable settlers, so that one can be kept in reserve and placed in position while the accumulations in the other are being removed. Not all of the flotation concentrate is sintered for this would make too high grade a matte. A typical furnace charge is about as follows:



BLAST FURNACE SPOUT

BLAST FURNACE CHARGE IN POUNDS

Sinter	2,200
Wet flotation concentrates	900
Coarse sulphide ore	200
Lime rock	150
Quartz	150
Total	3,600
Coke 11.8 per cent	425

Analyses of the sinter, matte and slag are approximately as follows:

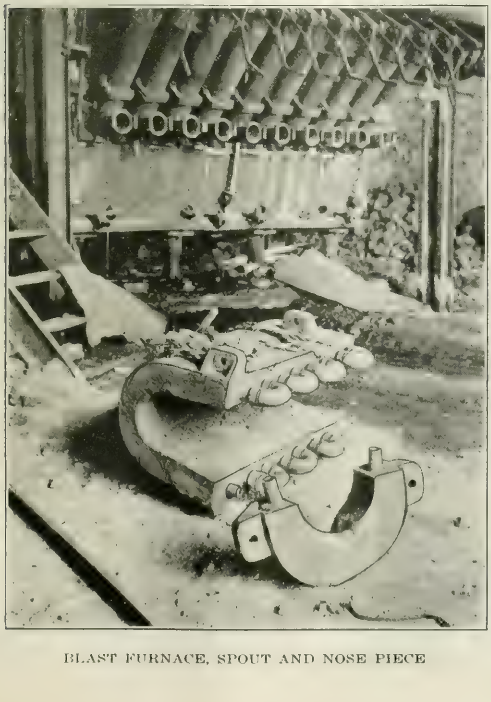
ANALYSES OF CHARGE AND PRODUCTS, IN PER CENT

	Cu	FeO	SiO_2	Al_2O_3	CaO	MgO	S
Sinter	16	36	18	11		5	7
Matte.......	50						
Slag ...	0.5 to 0.6	36	34	13	6	7	

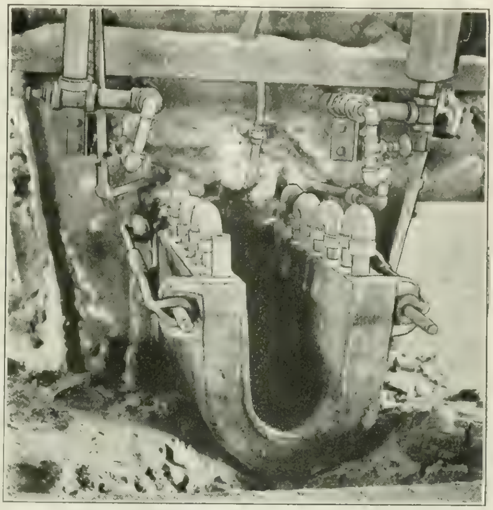
The total coke consumption is almost 12 per cent of the charge, but as 92 per cent of the charge is ore, the cost of coke per ton of ore is not excessive. Nearly 30 per cent of the ore charged is flotation concentrates taken direct from the filter and containing about 20 per cent of water. This is dumped in, on top of the coke, and covered with the remainder of the charge, so only a little of it blows out, and the dust loss is small. The slag is almost an exact bisilicate, considering the alumina as an acid. The furnace smelts ten tons of charge per hour, or 7.2 tons per square foot of hearth area per twenty-four hours, with an average blast pressure of twenty-two ounces. This is fast smelting, and is made possible by the excellent character of the sinter produced by the Dwight & Lloyd machine, the furnace running especially fast when hot sinter is fed.

Sometimes the matte runs as high as 55 per cent without causing trouble. The usual practice is to tap about four tons of matte after the furnace has been running two hours, and ten tons more at the end of the run. The matte is tapped into 1½-ton pots, cooled with water sprays, crushed to —1 in. in a small Dodge crusher, and carried on an inclined conveyor belt to a bin, from which it is sacked, loaded on motor trucks, and hauled fifteen miles to the railroad station, where it is shipped to Tacoma.

As the precious metals amount to only about one ounce of silver per ton of matte, electrolytic refining is not economical, and plans are being made to refine locally when smelting is resumed. Experiments have already been conducted with a small reverberatory in which the matte has been blown to finished copper by blowing air into the bath of matte, with an ordinary pipe. It is planned, however, to convert the matte to blister in a small bessemer converter and use the reverberatory only for the final simple refining process.



BLAST FURNACE, SPOUT AND NOSE PIECE



THE BLAST-FURNACE SPOUT. NOTE METHOD OF ATTACHING

The whole scheme of smelting as outlined is more economical than would be the roasting and reverberatory smelting of such a small quantity of ore. It is also probably more economical to operate a large furnace one shift than a smaller furnace twenty-four hours a day. There are opportunities for a plant of this kind in many districts where smelting facilities are not available or satisfactory.

My thanks are due to Mr. S. M. Levy, general manager of the Calaveras Copper Co. at Copperopolis, for his kindness in explaining the novel features of his plant and granting permission for the publication of the data given.

Electric Smelting of Tin Ore

Tin ores become conductors of electricity at moderate temperatures, according to an article in *Metall u. Erz*, Vol. 18, pp. 77-78, abstracted in the *Journal of the Society of Chemical Industry*, so that by using large pieces of ore as a resistance, sufficient heat can be developed to melt it and reduce it to metal on the addition of coal. It is not generally necessary to add any slagging material, nor is it necessary to protect the tin oxide from going into the slag. It is preferable to carry out the process in a trough furnace with a low charging shaft and two or more electrodes dipping into the bath. Ore and coal are charged and the metal is tapped from the bottom until the hearth is nearly full of slag, which should be rich in tin. This is cleaned by adding a charge of coal only to separate its tin contents as metal. Pure metal may be so obtained and the tin content of the slag reduced to 0.3 per cent, and the losses by volatilization are much less than by other processes.

Air Receiver Calculations

Solutions of Simple Compressed-Air Problems Frequently Confronting the Master Mechanic, Applicable to Drills, Air Haulage, Storage and Compressed-Air Machinery

By Walter S. Weeks

Written for *Engineering and Mining Journal*

A NUMBER of calculations involving the air receiver are presented here, and although known perhaps to those working with compressed-air haulage, they may not be so familiar to others. The first type of problem is the determination of the amount of free air available in a receiver while the air pressure is dropping from one given pressure to another. For example: An air receiver has a capacity of 500 cu.ft. The pressure in the receiver is 100 lb. per sq.in. gage. How long is it possible to operate a drill from the receiver alone if the drill requires 100 cu.ft. of free air per minute and the lower limit of operating pressure is 70 lb. per sq.in. gage?

Let us first develop the formula and then solve the problem. It will be remembered that the formula connecting pressure, volume, temperature, and weight of air is

$$PV = wRT$$

where P = pressure in lb. per sq.ft. absolute;
V = volume in cu.ft.;
w = weight of air in lb.;
R = constant = 53.4;
T = absolute temperature (Fahrenheit + 460).

At the start of the operation of the drill let the weight of the air in the receiver be w_1, V the volume of the receiver, and T the absolute temperature which remains constant. Let P_1 be the pressure in lb. per sq.ft.

Then at the start,

$$P_1V = w_1RT \qquad (1)$$

Let w_2 be the weight of air in the receiver when the drill stops and the pressure has dropped to 70 lb. gage. Let P_2 be the pressure in lb. per sq.ft.

Then at the finish,

$$P_2V = w_2RT \qquad (2)$$

From (1) $w_1 = \dfrac{P_1V}{RT}$

From (2) $w_2 = \dfrac{P_2V}{RT}$

The weight drawn from the receiver is $w_1 - w_2$.

How many cubic feet of air at atmospheric pressure has been drawn out?

Let P_3 = the atmospheric pressure in lb. per sq.ft.
Let V_{at} = the volume at atmospheric pressure.

Then:

$$P_3V_{at} = (w_1 - w_2)RT = \left(\frac{P_1V}{RT} - \frac{P_2V}{RT}\right) \times RT$$

$$\text{or} \qquad V_{at} = \frac{V(P_1 - P_2)}{P_3} \qquad (3)$$

The pressures are in lb. per sq.ft., but as the unit of conversion to sq.in., 144, appears in both the numerator and denominator of the right hand member, it may be cancelled, leaving the symbols representing lb. per sq.in. In the numerator, as we have the difference of two pressures, either gage or absolute pressures may be used. P_3 is, then, always the absolute pressure of the atmosphere in lb. per sq.in. We shall assume it to be 15. To solve the numerical problem: $V = 500$, $P_1 = 100$, $P_2 = 70$, $P_3 = 15$.

$$V_{at} = \frac{500\ (100 - 70)}{15} = 1{,}000$$

The receiver will supply 1,000 cu.ft. of free air above 70 lb. The drill will operate 1,000 ÷ 100 = 10 minutes.

The same formula is used to determine the time to raise the pressure in a receiver with a given compressor. Example:

A receiver has a capacity of 1,000 cu.ft. How long would it take a compressor supplying 500 cu.ft. of free air per minute to raise the pressure from 70 lb. per sq.in. gage to 100 lb. per sq.in. gage.

First, how many cubic feet of free air must be put in?

$$V_{at} = \frac{1000\ (100 - 70)}{15} = 2{,}000$$

$$\text{Then } \frac{2{,}000}{500} = 4 \text{ minutes.}$$

Sometimes it may be necessary to help out a compressor when an intermittent drain of the air exceeds the capacity of the compressor, such as the operation of an air hoist for hoisting or hauling. Example:

A small geared hoist pulling cars out of a tunnel requires 120 cu.ft. of compressed air per minute at 60 lb. per sq.in. gage. Whatever the pressure in the receiver, the air is wiredrawn through the throttle valve to 60 lb. The haul requires six minutes. The compressor supplies 300 cu.ft. of free air per minute. The receiver may be pumped up to 90 lb. per sq.in. gage at the start and the pressure must not drop lower than 60 lb. at the finish of the haul. What must be the size of the receiver?

The free air used by the hoist each minute is $\frac{75}{15} \times 120 = 600$ cu.ft.

The air receiver must supply 600 − 300 = 300 cu.ft. per minute, or a total of 1,800 cu.ft. of free air.

$$V_{at} = \frac{(P_1 - P_2)\ V}{15}$$

$$1{,}800 = \frac{30\ V}{15}$$

V = 900 cu.ft., which is the needed capacity of the receiver.

The calculation of the size of a large underground storage reservoir for compressed air is a problem of this type.

Another style of problem requiring a different formula is this: There are two receivers containing air at some pressure. If a valve is opened connecting the two, what will be the pressure in both?

See illustration. Let V_1 be the volume of A and let V_2 be the volume of B.

Before the valve is open let P_1 be the pressure in A in lb. per sq.ft., and w_1 the weight of air in A. Let P_2 and w_2 be the pressure and weight respectively in B.

After the valve is open, the total weight of air is $w_1 + w_2$ and the total volume is $V_1 + V_2$.

$$w_1 + w_2 = \frac{P_1V_1 + P_2V_2}{RT}$$

Let resultant pressure be P.

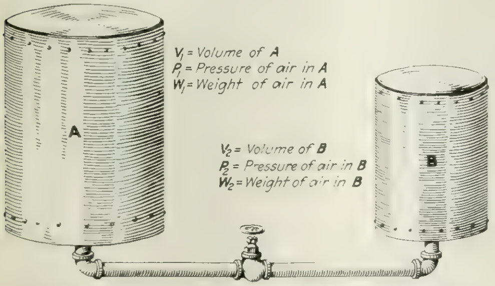
$$\text{Then} \quad P(V_1 + V_2) = \left(\frac{P_1V_1 + P_2V_2}{RT}\right) \times RT \qquad (4)$$

$$PV_1 + PV_2 = P_1V_1 + P_2V_2 \qquad (5)$$

Let us study this formula for a moment. As a symbol for pressure occurs in every term, we may divide through by 144, leaving the symbols representing lb. per sq.in. instead of lb. per sq.ft. The symbols represent absolute pressures. Let us denote the corresponding gage pressures by the subscript g, and rewrite the formula:

$$(P_g + 15)V_1 + (P_g + 15)V_2 = (P_{1g} + 15)V_1 + (P_{2g} + 15)V_2$$

The terms involving the atmospheric pressure cancel and leave gage pressures. So in this formula and in those derived from it the pressure may be gage or absolute and the pressures in lb. per sq.in. or per sq.ft.


V_1 = Volume of A
P_1 = Pressure of air in A
W_1 = Weight of air in A
A
V_2 = Volume of B
P_2 = Pressure of air in B
W_2 = Weight of air in B
B

TWO AIR RECEIVERS AT DIFFERENT PRESSURES CONNECTED BY A VALVE

To continue from (5)

$$P = \frac{P_1V_1 + P_2V_2}{V_1 + V_2}$$

Example:

A has a capacity of 1,000 cu.ft. and the pressure is 90 lb. per sq.in. gage. B has a capacity of 500 cu.ft. and the pressure is 60 lb. per sq.in. gage. What will be the pressure if they are connected?

$$P = \frac{90 \times 1{,}000 + 60 \times 500}{1{,}500} = 80$$

The resultant pressure will be 80 lb. per sq.in. gage.

Another form of equation (5) is used in the calculation of compressed-air haulage systems to determine the size of the stationary storage so that when the tank on the locomotive is connected to it, this tank will be charged to a given pressure.

In the cut let A be the stationary storage and B be the tank on the locomotive. P_1 is the pressure in the storage and is usually about 1,000 lb. per sq.in. gage. P_2 is the pressure in the locomotive tank when ready for charging and is usually about 250 lb. per sq.in. gage. Example:

The tank on the locomotive holds 48 cu.ft., and we wish to charge to 800 lb. per sq.in. gage. What should be the capacity of the stationary storage? Transposing equation (5)

$$PV_1 - P_1V_1 = P_2V_2 - PV_2$$

$$V_1 = \frac{V_2(P_2 - P)}{P - P_1} = \frac{V_2(P - P_2)}{P_1 - P}$$

$$V_1 = \frac{48\,(800 - 250)}{1{,}000 - 800} = 132 \text{ cu.ft.}$$

That is, if we have receiver capacity of 132 cu.ft. and pump it up to 1,000 lb. between chargings, we can charge instantly to 800 lb. To determine the capacity of the compressor, use equation (3) to determine the amount of free air to put in to bring the pressure back to 1,000. The air put in divided by the time in minutes between charging gives the free air per minute that must be supplied by the compressor.

Queensland's Mineral Output in 1920

The value of the mineral production of Queensland for 1920, according to official records just completed, was £3,462,701, which is nearly £1,000,000 more than for 1919. The output of gold continued to fall (the yield being only £489,700), and the drop in prices of rare metals that followed the release of surplus stocks held by Great Britain after the war caused the practical closing down of all the mines producing wolfram, molybdenite, and bismuth in Queensland; but the high prices ruling at the beginning of the year for tin, copper, lead, and silver resulted in an increased production of these metals, amounting in value, with that of coal, to over £1,000,000, and this in the face of high wages and cost of materials, some shortage of explosives, and a coastal shipping strike which for a time stopped supplies and interrupted the dispatch of ores overseas.

There was a substantial increase in coal production in 1920, which is showing unmistakable signs of expansion in all coal-mining districts, and in the output of gems (sapphires), which rose from £42,880 in 1919 to £65,800 in 1920. Of the total mineral production of more than £3,400,000, copper is responsible for over £1,500,000. Unfortunately, the activity which marked mining generally in the early part of the year underwent a severe check before its end, and present indications are that there will be a big falling off in 1921.

The silver-lead mines at Indooroopilly, near Brisbane, that have been opened up during the last two years, in 1920 yielded, from 173 tons of ore, silver to the value of £3,708 and lead worth £3,449, or a total of £7,157 and an average value of over £41 per ton. The holders of the two producing mines were marking time during a considerable part of the year, and results ought to be better for 1921. The absence of any large lode outcrops in this field militated against successful prospecting by ordinary methods; and experiments by some operators with the "electrical ore finders" that have been watched with some interest have proved quite unsuccessful, sinking having been taken considerably below the depth at which the "diviners" said ore would be found, but without the predicted result.

THE PETROLEUM INDUSTRY

Daily Average of April Petroleum Production Sets Record

THE outstanding fact of current petroleum statistics, according to the U. S. Geological Survey, is that stocks continue to pile up. Since May, 1920, pipe-line and tank-farm stocks of domestic petroleum, plus stocks of Mexican petroleum held in the United States by importers, have increased more than thirty-seven million barrels, an amount equal to almost a month's domestic production, and the quantity of crude oil now in storage is the greatest on record.

During April the production of petroleum continued to increase, the daily average for the month being the record figures of 1,334,633 bbl. Although imports during the month decreased somewhat, and consumption increased slightly, stocks at the end of April were more than six million barrels greater than at the beginning of the month.

Substantial increased daily average production during April is reported for Wyoming, Arkansas, Kansas, Oklahoma, California, and Kentucky, and smaller increases are reported for Montana, Colorado, New York, Indiana, and Tennessee.

Imports for April, amounting to 10,043,924 bbl., show a decrease in daily average as compared with March, of 62,078 bbl., although for the first four months of the year imports increased more than twenty-three million barrels as compared with production of the similar period of 1920.

The accompanying figures, compiled from company reports to the U. S. Geological Survey, show the quantity of petroleum removed from producing properties. Oil consumed on the leases is not included. This item and net changes in producers' stocks at the beginning and end of the year are obtained by annual canvass and are included in the final statistics of production:

Oil-Well Drilling Permitted Through Operating Mines

SPECIAL CORRESPONDENCE

An important decision that affects oil and gas operators is Illinois has just been rendered by the U. S. Circuit Court at Springfield, Ill., with reference to the right of an oil or gas company to drill through an operating mine.

The Superior Coal Co., of Gillespie, Ill., prevented the drilling of oil or gas wells through its mines in Macoupin County, Ill, by means of a blanket injunction secured on Aug. 14, 1915, in the Macoupin County Circuit Court, of Illinois, in the case of Superior Coal Co. vs. Ernest A. Ibbetson et al. One of the defendants in this suit, the Goag Oil & Gas Co., of New York, carried the case to the U. S. Circuit Court of the Southern District in Illinois, where the case was heard by Judge Fitzhenry.

The coal company offered the testimony of mining superintendents, mine inspectors, miners' union officials, and other parties interested in coal mining in Illinois. The Goag company presented the testimony of mining engineers and oil geologists and affidavits from large gas and oil producers who operate gas and oil wells in the Pennsylvania, West Virginia, and Ohio oil and gas fields that are situated in coal-mining districts where the two industries have been jointly carried on for many years with no trouble, interference, or danger. A final decree was recently entered in favor of the Goag Oil & Gas Co., which is given the right to drill through the large pillars of the Superior Coal Co. on filing a bond of $5,000 to protect the coal company in case a well is not properly cased, cemented, or plugged.

Only gas has been found on the coal companies' land, and the number of wells permitted on forty acres has been restricted to three.

PETROLEUM PRODUCED IN THE UNITED STATES IN MARCH, 1921, APRIL, 1921, AND APRIL, 1920

(Barrels of 42 U. S. gallons)

	March, 1921 (a)		April, 1921		April, 1920	
[illegible]	Total	Daily Average	Total	Daily Average	Total	Daily Average
[illegible]	10,482,000	338,129	10,170,000	[illegible]	8,265,000	275,500
[illegible]	9,682,000	312,323	9,552,000	318,400	8,273,000	275,767
[illegible]	6,721,000	216,807	6,168,000	[illegible]	5,062,000	168,733
[illegible]	2,978,000	96,000	2,757,000	91,900	1,895,000	63,167
[illegible]	3,086,000	99,548	3,289,000	[illegible]	3,239,000	107,967
[illegible]	2,105,000	67,903	[illegible]	[illegible]	3,742,000	124,733
[illegible]	165,000	5,323	149,000	[illegible]	136,000	4,533
[illegible]	915,000	29,516	1,174,000	[illegible]	781,000	26,034
[illegible]	189,000	6,097	202,000	[illegible]	109,000	3,633
[illegible]	158,000	5,097	176,000	[illegible]	124,000	4,133
[illegible]	193,000	6,226	171,000	5,700	172,000	5,733
[illegible]	71,000	2,290	74,000	[illegible]	54,000	1,800
[illegible]	88,000	2,839	116,000	[illegible]	63,000	2,100
[illegible]	768,700	24,797	777,700	[illegible]	715,500	23,850
[illegible]	963,000	31,065	765,000	[illegible]	884,000	29,466
[illegible]	760,000	24,516	691,000	[illegible]	654,000	21,800
[illegible]	675,000	21,774	636,000	[illegible]	636,000	21,200
[illegible]	469,000	15,129	443,000	[illegible]	431,000	14,367
[illegible]	193,000	6,226	182,000	[illegible]	180,000	6,000
[illegible]	(c) 10,000	322	(c) 300,000	[illegible]		
[illegible]	77,000	2,484	76,000	[illegible]	51,000	1,700
[illegible]	24,000	774	26,000	[illegible]	23,000	767
[illegible]	97,000	3,129	96,000	[illegible]	8,000	267
[illegible]	86,000	2,774	84,000	[illegible]	76,000	2,533
Colorado	10,000	322	10,000	333	8,000	267
Tennessee	1,300	42	1,300	43	1,500	50
[illegible]	40,965,000	1,321,452	40,039,000	[illegible]	35,583,000	1,186,100

(a) [illegible] (b) [illegible] (c) Included [illegible] receipts by refineries. (d) [illegible]

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Development of the Chloride Volatilization Process by the U. S. Bureau of Mines*

Experimental Work So Far Conducted at the Salt Lake Station Indicates Value of This Method for Treating Oxidized, Semi-Oxidized and Carbonate Ores of Copper, Lead and Silver

BY THOMAS VARLEY AND C. C. STEVENSON

THE art of treating ores by the chloride volatilization process is still in the experimental stage and has not been sufficiently developed to make it possible to state definitely what place it will occupy in the metallurgical industry. The theory upon which the process operates has received attention for the last twenty years, and much research and experimental work has been conducted. Much of the experimental work done has never been published, and it seems that the accumulation of such results, if made known, would be an important aid to the further development of the process. The object of this paper is, therefore, to bring salient features of the process to the attention of the metallurgical industry, both for the purpose of furnishing information, and receiving from interested parties any comments which the reading of this article may suggest. A bulletin covering the work done at the Intermountain Experiment Station of the U. S. Bureau of Mines, situated at Salt Lake City, Utah, is in course of preparation.

The chloridizing roast is usually accompanied by appreciable losses due to the volatilization of the metals as chlorides during the roast, these losses often running as high as 30 per cent, depending upon the temperature, the character of the ores, and the associated gangue material. It was not until 1891 that Croasdale, (*Engineering and Mining Journal*, Aug. 29, 1903,) by observing flue and stack deposits from the chloridizing roast, recognized the possibility of making volatilization a major instead of a minor feature of the roast. He then made tests on a large number of ores from different localities, the result of which showed the general application of the process. The main difficulty, as stated by Croasdale, was the lack of a suitable means for recovering the fume from the furnace gases.

In 1913, Cottrell (*Mining & Scientific Press*, March 29, 1913; also *Trans.* A. I. M. E., September, 1918), announced his invention of the electrostatic precipitator, which solved the problem of separating the solids from the furnace gases.

About 1915 the U. S. Bureau of Mines, through Ralston (*Trans.* A. I. M. E., Vol. LVII, 1917, p. 634), began an investigation at its Intermountain station, of the chloride volatilization process as a possible means of ore treatment. Since that time the Intermountain station of the Bureau, in co-operation with the department of metallurgical research, University of Utah, has gone extensively into the problem, both from a theoretical and semi-commercial standpoint. At present, volatilization is one of the major problems being investigated at the station. Other investigations have been instigated by G. H. Wigton (U. S. Patent No. 1,264,685; April 30, 1918), of Eureka, Utah; by S. I. Clawson (U. S. Patent No. 1,262,453; April 9, 1918), of Salt Lake City, and by others.

POSSIBILITIES OF THE PROCESS

The commercial utilization of the process will fill a long-felt want in the metallurgical industry. It is especially adapted to the treatment of oxidized and semi-oxidized and carbonate ores of copper, lead, and silver. Ores of this character are difficult to treat by gravity concentration or flotation. In the former method of treatment their tendency to slime upon crushing and their lower specific gravity, as compared with the sulphide minerals, create serious losses. In the latter method of treatment, much has been done in the way of sulphidizing oxide and carbonate ores, with subsequent recovery by flotation of the artificial sulphides. Difficulties in proper sulphidizing and low recoveries more than balanced the low cost of treatment in many plants, and in few instances has it proved successful.

In addition to the minerals named above, gold present in ores has been quite readily volatilized. Zinc does not volatilize if an oxidizing condition is maintained in the roasting operations. Some excellent results have been obtained on zinc concentrates containing silver and lead. Practically all the silver and lead, but very little zinc, has been volatilized. Experiments have shown that this is probably one of the best methods of making a clean-cut separation of lead and zinc.

No great amount of work has been done on sulphide ores, because of the fact that the need of such a method for the oxidized and carbonate ores is more pressing. Some experiments, however, carried out on sulphides are encouraging. When the sulphur content is more than about 5 per cent, a preliminary roast is usually necessary before chloride roasting and volatilization.

METHODS OF EXPERIMENTATION: ANALYSIS OF ORE SAMPLES

The ores experimented with are always analyzed both for their chemical and mineralogical constituents; the latter by the microscope, to identify and determine the physical condition of the minerals. Both are extremely necessary. By the microscope examination it is possible to determine the size of crushing necessary to liberate from the gangue the greatest amount of mineral that can economically be recovered. The compactness or porosity of the ores in which the minerals occur is an important factor; usually the compact ores require finer crushing.

After the crushing size of the ore has been determined, it is then necessary to calculate, from analyses, the amount of chloridizing salts that must be added to insure the presence of sufficient chlorine to give complete chloridization and volatilization of the minerals.

MUFFLE TESTS

The assay muffle is usually used for the preliminary determination, and is heated to the temperature necessary to effect volatilization. This temperature varies with different ores, but when silver is present it is usually about 1,050 deg. C. Ordinarily, 100 grams of crushed ore is used, this being thoroughly mixed with salt or calcium chloride. These mixed charges, contained in 5 or 6-in. roasting dishes, are then placed in the heated furnace. Several series of tests are made, in which the varying factors are time of roast, temperature of furnace, fineness of crushing of ores, and varying amounts of salt and calcium chloride. The residues after roasting are weighed and assayed, and from these results the percentage of metals volatilized is calculated. In these experiments none of the fumes evolved can be caught.

ELECTRIC TUBE TESTS

Tests are also made by means of a horizontal electric furnace; a small boat containing the mixed charges is placed in a silica or porcelain tube, and then the tube is placed in the furnace. It is possible to pass air through the tube at any desired rate and also to collect the fumes and measure the gases. For this reason, and because of the control of temperatures, this apparatus is more desirable for preliminary experiments.

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*From U. S. Bureau of Mines *Reports of Investigations*, No. 2247.

LABORATORY VOLATILIZATION PLANT

The present plant consists of a rotary kiln, dust chambers, a double-unit electrostatic precipitator, and a Stevenson chloride-injector, constituting a complete miniature chloride volatilization plant.

FLEXIBILITY OF THE PLANT

The kiln has three speeds, either one, two, or three revolutions per minute. The speed affects the capacity, ore transit, and dusting. The ore feeder is equipped with eight different speeds, which permit variation in the rate of feeding the ore from about 1½ to 12 lb. per hour. The rate of feed affects the capacity and length of time that the ore is in the furnace. The velocity of the gases is regulated by means of slide dampers arranged in the channel that convey the gas. The gas velocity affects the dusting, type of fume produced, and the concentration of the chloridizing atmosphere in the furnace. The chloride injector has forty-eight different speeds, which will feed from [illegible] to about 20 oz. of chloridizing reagents per hour.

The treaters are constructed in two available units of [illegible] and [illegible] respectively. These units may be used separately or collectively, which is equivalent to using either a two-, four-, or [illegible]-tube treater. The number of tubes used affects the velocity of the gas in the treater and the clearance.

The furnace is fired with a [illegible] torch, using [illegible] illuminating gas under [illegible] pressure [illegible] and air at about [illegible]-lb. pressure. Any desired temperature up to 1,250 deg. C. can be maintained without difficulty.

PRELIMINARY SMALL-KILN TESTS

Tests are made in the small laboratory plant both for research investigations and as preliminaries to the large-kiln tests. From 10- to 25-lb. samples are desirable. The ore, with part of the chloridizing reagents, is fed into the upper end of the furnace by means of a mechanical ore feeder, and the remaining portion of the chloridizing reagents is injected directly onto the charge in the front or heated end of the furnace.

CONFIRMATORY LARGE-KILN TESTS

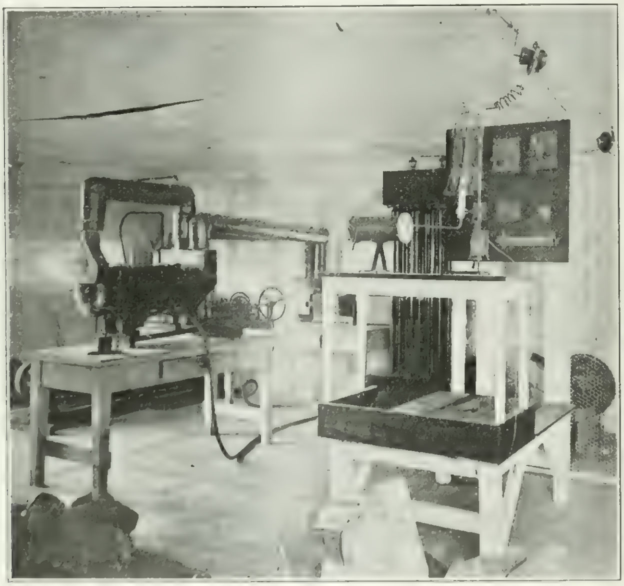
From 200 to 2,000 lb. of ore is usually taken in making final tests in the large kiln (Bulletin No. 11, Utah Engineering Experiment Station, Department of Metallurgical Research, June, 1919, p. 24). In comparative tests the results obtained in the small plant have been almost duplicated in the large installation. The following results are typical for the two kilns:

RESULTS

[illegible]

IMPROVEMENT

The first tests that were made in the small furnace were conducted for the purpose of improving the extraction of silver from an ore containing [illegible] per cent lead and 6.80 oz. silver per ton. Previous work on the ore resulted in good extraction of the lead, but 60 to 65 per cent was the best obtainable for silver. The usual method of making volatilization tests is to mix the ore and chloridizing reagent or reagents and to feed the mixture by a screw feeder or other means into the cool end of the furnace. The rotation of the kiln and the slope of the frame on which the furnace is mounted cause the charge to migrate downward toward the front and heated end. When the charge becomes heated, a chloridization of the metals is effected, with a subsequent evaporation of the metal haloid.



EXPERIMENTAL LABORATORY

Three-tube rotary furnace at the left; electric tube furnace on stand in center and Cottrell treater at the back.

CHEMICAL REACTIONS

A decided difference of opinion exists as to the chemical reactions that take place. It is our opinion that different reactions are involved, depending on the chloridizing conditions brought about in the furnace.

The three following equations show the reactions that are most likely to take place, assuming silver as the metal to be chloridized and volatilized.

No. 1 (equation according to Croasdale):

$$Ag_2S + 2O_2 = Ag_2SO_4$$

$$2NaCl + Ag_2SO_4 = 2AgCl + Na_2SO_4$$

If sulphates were present, this reaction would probably take place during some stage of the roast.

No. 2: $RO + 2NaCl = Na_2O + RCl_2$

Experiments have shown that silver, lead, and other metals can be chloridized and volatilized in the absence of sulphur. This reaction, represented by equation 2, would likely take place to some degree, providing the temperature were high enough and all the salt had not volatilized as sodium chloride before the charge could reach the temperature necessary to promote the reaction.

No. 3: $2NaCl + SiO_2 + H_2O + \text{heat} = Na_2SiO_3 + 2HCl$

$$4HCl + O_2 \leftrightarrows 2H_2O + 2Cl_2$$

It is doubtful whether this reaction would take place if the sodium oxide had nothing with which to combine. It is known that sodium oxide is difficult to form. However, if silicates in the gangue are available for combining, it is possible to get a reaction with part of the salt. This reaction is probably the most effective and represents the chloridizing of most of the metal present in an oxidized ore.

On the assumption that the equations given are correct, even to the complete chloridization of all the silver in the ore at some time during the thermal treatment, a condition remains that would be likely to prevent complete volatilization of the silver.

Per Cent [illegible] Content Volatilized, Small Kiln		Per Cent Crude Ore Content Volatilized, Large Kiln	
Silver	Lead	Silver	Lead
93	[illegible]	90	88
8[illegible]	[illegible]	90	92

Shall we assume that the metal is volatilized immediately upon being chloridized, or should we accept a more logical theory, that time is required for the metal haloid to evaporate? The action of the chloridizing roast preparatory to leaching is sufficient evidence that the chlorides are formed at relatively low temperatures and without being completely evaporated.

The following reaction could logically be expected to occur at increased temperature with at least part of the metal haloid:

$$2RCl_2 + O_2 + \text{heat} \leftrightarrows 2RO + Cl_2$$

As the charge passes through the furnace, the temperature continues to increase, and part of the salt rapidly volatilizes as sodium chloride, the remainder entering into the chloridizing reactions. The result is that the metallic chloride, which does not evaporate rapidly in the zones of lower temperature, is conveyed into the hotter regions, where the chloridizing atmosphere becomes lean. It would not require a strong imagination to conceive a decomposition or reversal of reaction, in which the metal would be left with the calcine as a non-volatile compound or element. Experiments have shown that the silver remaining in the calcine from a high temperature roast (1,000 deg. C.) is not present as chloride. It may be that some of the silver compounds occurring in complex oxidized ores are not chloridized at the relatively low temperature. If this were the case, it could logically be assumed that the chloridizing reagent or reagents might be volatilized or decomposed and dissipated before the silver would be in an available state to be chloridized.

By this reasoning, the most logical method of volatilizing metals from an ore would be to place the charge, consisting of ore and part of the chloridizing reagents, in the furnace, permit the charge to become heated to the proper temperature, and then supply the remaining portion of the haloid salt to the heated charge in the zone of high temperature. This method of supplying the chloridizing reagents would produce a highly chloridizing atmosphere directly where it is needed.

THE FIRST TEST

The following is the record of the first test made, wherein the chloridizing reagents were supplied to the charge in the front and heated end. This test was made for the purpose of chloridizing and volatilizing the lead and silver in an oxidized zinc ore, leaving high-grade zinc calcine.

The charge was fed into the feed end of the furnace by means of a screw conveyor. In addition, 4 per cent of hydrated calcium chloride was fed by hand at regular intervals to the charge in the fire box, instead of introducing it with the charge. The temperature was 1,010 deg. C. Steam was passed into the fire box. Good oxidizing conditions were provided.

Dense fumes were evolved, especially when the portions of chloridizing agent were supplied to the charge in the fire box. The following assays show the results:

Charge	Assay of Material			Per Cent Volatilized	
	Silver, Oz.	Lead, Per Cent	Zinc, Per Cent	Silver	Lead
Original ore (10 lb.)	6.8	7.4	32.6		
Calcine with all $CaCl_2 \cdot 2H_2O$ added in charge . ..	1.32	1.58		74.3	73.0
Calcine with $CaCl_2 \cdot 2H_2O$ added to fire box	0.68	0.63	44.86	90.3	92.0

These results are conclusive, and show definitely the advantage of adding part of the chloridizing reagent at the hottest point in the furnace, thereby giving a strong concentration of chlorine vapors at the critical temperature and at the time the chemical reactions take place.

SUMMARY OF RESULTS ON VARIOUS TESTS

Ore	Feed Assays						Amount of Reagents		Per Cent Volatilized		
	Gold Oz	Silver Oz	Lead Per Cent	Zinc Per Cent	"Insoluble" Per Cent	Sulphur Per Cent	NaCl Per Cent	$CaCl_2 \cdot 2H_2O$ Per Cent	Gold	Silver	Lead
Oxidized zinc concentrate		6.80	7.40	32.6	13.6		6	6	.	85	80
Oxidized silver-lead ore, Utah	0.07	9.39	15.7	1.25	62.0	4.47	10	10		80	89
Silver-lead ore, California..............	....	9.66	1.07	1.83	56.0	4.92	5	10		80	
Oxidized silver-lead ore, Nevada........	0.03	3.56	5.35	.			5	10	70	87	80
Oxidized silver-lead ore, South America		12.0	1.60	..	77.2	0.86	5	7	..	75	80

PHYSICAL CONDITIONS AFFECTING CHLORIDE VOLATILIZATION

Sintering — Sintering is promoted by the chloridizing reagents, common salt being especially active. The salt, upon decomposing, liberates its chlorine and combines possibly as a silicate or sulphate, both of which are fusible at the temperatures required to volatilize silver chloride. Most sulphide ores tend to sinter, which results in sealing the metal within the ore particles and protects it from the chloridizing gases, thus causing low extraction. This objectionable feature is usually overcome by the use of some inert non-fusible material, such as limestone. The addition of 5 to 15 per cent of lime rock will prevent sintering in some of the most troublesome ores. Use of calcium oxide would be still better, because no carbon dioxide would be given off to dilute the gases.

Baking—In making preliminary muffle or tube tests, baking and sintering should not be confused. Baking is the result of a crust-forming action in the charge, taking place in the regions of lower temperature in the furnace. Two causes are responsible for most baking —the evaporation of moisture, and the temporary fusing of salts that are later decomposed at the high temperatures. The evaporation of moisture from the ore causes precipitation of the soluble salts and deposition of suspended matter, both of which act as a binder and crust the particles of ore together. The low temperature fusion of sundry salts —either those contained in the ore, those supplied as chloridizing reagents, or salts formed from the reactions— serves as a binding medium and causes some trouble in the feed end. Baking forms rings of crusted ore in the feed end of the furnace, which continue to build up on the lining until the ore flows back into the dust chamber. Baking is not a serious difficulty. The crust is easily broken, and a heavy drag or rabble properly placed will prevent its formation.

Ore Transit—The ore transit should be as slow as possible, in order to reduce dust losses and prevent a high insoluble content in the fume. A linear travel of about 15 ft. per minute in a commercial kiln is usually sufficient to mix the charge and maintain the desired capacity.

Gas Velocity—The gas velocity should not exceed the speed necessary to carry away the combustion gases and fume. High velocity causes a high dust loss, low-grade fume, and a dilute chloridizing atmosphere over the charge in the furnace. A velocity of 10 to 20 ft. per second is usually sufficient in a properly designed kiln.

Temperature — The necessary temperature required for chloridizing and volatilizing the metals from an ore depends entirely on the metals to be volatilized. Copper and lead will volatilize at much lower temperatures than gold and silver. However, a temperature of 1,000 deg. C. should completely volatilize all the metals except zinc, provided the charge does not sinter.

Time—The time required to evaporate the metal haloids depends on the temperature and concentration of the chloridizing atmosphere. Forty to sixty minutes, under proper temperature and chloridizing conditions, should be sufficient.

U. S. Chamber of Commerce Has a Natural Resources Section

Several mining engineers are represented in the recently organized Department of Natural-Resources Production of the Chamber of Commerce of the United States of America, including Sidney J. Jennings, R. V. Norris, Van. H. Manning, and J. E. Spurr. The chairman of the committee is C. S. Keith, of Kansas City, Mo., and the vice-chairman, J. H. Ross, of Winter Haven, Fla. The other members of the committee are: P. B. Noyes, of Oneida, N. Y.; Christy Payne, of Pittsburgh, Pa.; E. T. Meredith, ex-Secretary of Agriculture, of Des Moines, Ia., and W. D. Davis, Bartlesville, Okla.

The Department of Natural-Resources Production is one of eight departments which have been organized in the Chamber of Commerce of the United States of America. The other departments are: Fabricated Production, Domestic Distribution, Foreign Commerce, Finance, Insurance, Transportation and Communication, and Civic Development.

MEN YOU SHOULD KNOW ABOUT

Arthur Thacher, of St. Louis, Mo., is visiting the zinc district of Wisconsin.

George R. Trask, mining engineer of Wallace, Idaho, was in New York City last week.

W. H. Rubey will do oil geologic work for the U. S. Geological Survey in the vicinity of El Dorado, Ark.

Howard R. Ward, consulting mining engineer, has moved his office to 45 West 18th St., New York City.

R. C. Moore, of the U. S. Geological Survey, is making geological studies in Garfield and Cane counties, Utah.

Forest Rutherford, consulting mining engineer, of New York City, has gone to Canada on mine examination work.

E. P. Mathewson returned to the United States on June 7 from an extended trip to England and the Continent.

Hjalmar E. Skougor, consulting engineer, of New York City, has returned from his three months' trip to European countries.

Edwin Ludlow, president of A. I. M. E., was in St. Louis, Mo., recently attending the meeting of American Engineering Council.

F. L. Ransome represented the University of California at the centennial celebration, on June 4, of the University of Virginia.

John Edwin, mining engineer, has just returned from Surinam, Dutch Guiana. He was in New York City for a few days this week.

A. W. Newberry, mining engineer, has returned to New York City from his recent trip to Washington, D. C., Chicago, Ill., and other cities.

Theodore Chapin, who has been doing private geologic work in the Tampico oil region, has resumed his duties with the U. S. Geological Survey.

J. Meyer, recently professor of chemistry at the University of Breslau, has succeeded Prof. W. Biltz as professor in the Bergakademie at Clausthal.

Philip N. Moore, mining engineer, has returned to his practice in St. Louis, Mo., after spending two years at Washington, D. C., on the War Minerals Relief Committee.

W. A. Lamport, president, and **C. A. McLean**, director of the Peterson Lake Mining Co., Cobalt, Ont., were in New York City recently in connection with the [illegible] of the company.

Chester F. Lee, mining engineer, of Seattle, Wash., is in the East Kootenay district of British Columbia, investigating silver-lead properties for Seattle and Vancouver, B. C., investors.

John D. Northrop and wife, who have been in South America during the last year, sailed from Cristobal, Panama, by the "[illegible]" on May [illegible], and landed in New York City on June 4 last.

E. D. Frohmann, of Pittsburgh, Pa., has gone to Europe, where he will make a special study of the application of high-temperature cements for boiler and metallurgical furnace linings.

J. Dix Fraser, superintendent of the Atikokan Iron Co., was in Port Arthur, Ont., recently. Mr. Fraser's visit was relative to the sale of some of the holdings of the Atikokan Iron Company.

T. A. Rickard, editor of *Mining and Scientific Press*, delivered the principal address at the commencement exercises of the School of Mines of the University of Montana, Butte, Mont., on June 3.

W. J. Olcott, president of the Oliver Iron Mining Co., was in New York last week attending the meeting of the presidents of the various subsidiary companies of the U. S. Steel Corporation.

C. E. Siebenthal, geologist of the U. S. Geological Survey, was in St. Louis recently consulting with representatives of local zinc and lead interests. He has returned to Washington, D. C.

Joseph Mierzynski, of Chicago, president of the Palatine Mining & Development Co., accompanied by the board of directors of the company, recently inspected the company's holdings in northern Minnesota and Canada.

John J. Rutledge, superintendent of the U. S. Bureau of Mines station at St. Louis, Mo., has been transferred to a similar position at Urbana, Ill. **G. J. Salmon** has been designated as acting superintendent of the St. Louis station.

Heath Steele, mining engineer, with the mining department of the American Metal Co., Ltd., New York City, has been placed in charge of the Mexican enterprises of that organization. His address will be care of Cia. Minera de Peñoles, S. A., Monterrey, N. Leon, Mexico, D. F.

H. C. George, chief engineer for the Wisconsin Zinc Co., Platteville, Wis., has resigned to take a position as "Oil recovery engineer" in the U. S. Bureau of Mines, with headquarters in San Francisco. Mr. George was director of the Wisconsin State School of Mines at Platteville from 1908 to 1911.

D. B. Dowling, of the Canadian Geological Survey, and party are on the way to the Mackenzie River district, where they will make a general survey of the country from the mouth of the Peace River to the vicinity of the Arctic Circle. Their work will connect up detailed work to be done by three survey parties already in the field.

Mining engineers and geologists recently visiting New York City included the following: **T. M. Crampton**, now of Silverhorn, Pioche, Nev.; **Archibald Little**, of Detroit, Mich.; **B. F. Tillson**, of Franklin, N. J.; **Ozni P. Hood** and **E. A. Holbrook**, of the U. S. Bureau of Mines, Washington, D. C.; **Paul B. R. Cook**, formerly at Sofia, recently from Constantinople; **Chas. B. Murray**, of Cleveland, Ohio; **Mowry Bates**, of Tulsa, Okla.; **Charles Laurence Baker**, of Cordova, Ill.; **Theodore H. Crook**, of Beaumont, Tex., and **George L. Klingaman**, of San Francisco, Cal.

OBITUARY

David Goodale, graduate in mining engineering of the University of California, native of San Francisco, Cal., and member of the firm of Atkins, Kroll & Co., of that city, died suddenly at his home in Berkeley, Cal., on May 24 last.

Roy F. Smith, mining engineer, for the last three years engaged on mine examinations and geological work with the Empire Zinc Co., of Colorado, died at Gilman, Col., on May 17 after a brief illness. Mr. Smith was a native of Denver, Col., where he received his preliminary schooling before entering the Colorado School of Mines, from which he received the degree of engineer of mines in 1911. Immediately after graduation he entered U. S. Government employ, but at the end of a year resigned to accept a position with the Empire Zinc Co. During the eight years he served that company he filled various positions from mine surveyor to mine superintendent. He had shown much ability in mine geology and examination work. Mr. Smith was buried at Denver by the Masonic fraternity, he having been a Thirty-second Degree Mason and a Shriner. He had just joined the A. I. M. E.

Dr. Tulio Ospina, long the director of the National School of Mines at Medellín, Colombia, died at Panama Hospital on Feb. 8, 1921, as the result of an operation. Dr. Ospina was born at Bogotá about 1856, the son of Mariano Ospina Rodríguez, a prominent South American statesman and president of Colombia during 1857-1861. Young Ospina spent his youth in Medellín and in Guatemala. When of age he went to the United States for study, and was graduated from the University of California about 1880. Returning to Colombia, he devoted himself to the geology, mining, and the metallurgical development of his country, ultimately becoming the leading Colombian authority in those fields. Dr. Ospina held the chairs in geology at the University of Antioquia, where he was rector for a time, and at the National School of Mines at Medellín, which he finally served as director.

At the time of the Second Pan-American Scientific Congress, at Washington, D. C., in 1915-16, Dr. Ospina was a special delegate from Colombia, and presided at the sessions of the Division of Mining, when also he presented a paper, "The General and Economic Geology of Colombia." Broad interests and varied activities brought Dr. Ospina into a number of historical and other societies, carried him as a deputy several times to the Antioquia Legislature, and for a term or two to the National Congress at Bogota.

THE MINING NEWS

LEADING EVENTS

WEEKLY RÉSUMÉ

The Ingalls committee has completed its draft of a bill providing for a revision of the United States mining laws, the text of which is given in this issue. At Washington, Senator Nicholson has introduced a bill calling for the creation of a Federal Department of Mines with Cabinet representation. Secretary Fall is said to favor one-man administration of the War Minerals Relief Act, and has offered the post to Ira E. Robinson, a lawyer, of West Virginia.

In Colorado, the Arkansas River, swollen beyond its normal flow, has caused great damage in Pueblo, though the A. S. & R. smelter is said to have escaped serious injury. In Utah, the Utah Apex Mining Co. has filed exceptions to the accounting made by the Utah Consolidated Mining Co. In Nevada, at Tonopah, strike conditions are reported unchanged. Wages were cut at Virginia City and Gold Hill on June 1. In the Lake Superior district, the rate for transporting ore on the Great Lakes has been fixed. Independent operators in the district cut wages June 1. Three companies at Chisholm, on the Mesabi Range, have refused to pay the village tax levy.

Arkansas River Floods Pueblo, Colorado

Heavy Rains, Cloudburst and Failure of Two Dams Result in Devastation of City—A. S. & R. Smelter Reported Undamaged

Heavy rains in the Arkansas Valley above Pueblo, Col., caused floods that devastated the town on the night of June 3 and the following day. Barely had the population begun to recover from this disaster when a cloudburst, coupled with the failure of two dams on Beaver Creek thirty miles west of Pueblo, again flooded the city, doing serious damage.

The Pueblo smelter of the American Smelting & Refining Co. occupies a position on the bank of the Arkansas River directly in the path of the flood. Wires received at the company's New York offices indicated that the plant was shut down but in good condition, with no known loss of life among the employees. The plant of the Colorado Fuel & Iron Co. is said to be above harm's reach.

Later reports had it that the Platte River has risen sufficiently to flood sections of Denver. The mines at Cripple Creek were reported to be closing down on account of washouts on the Colorado Midland railroad and because of power shortage caused by injury to the Arkansas Valley power plant.

Revision of United States Mining Laws Proposed

Ingalls Committee Completes Draft of New Bill Providing for Amending and Codifying Statutes Relating to Location of Mining Claims on Public Domain—Secretary Fall and Director Bain Still To Pass on Recommendations

The full text of the bill drafted by the Ingalls committee providing for the revision of the mining laws of the United States is given as follows:

"A bill to revise, amend, and codify the laws of the United States regulating the location of mining claims on the public domain, and for other purposes.

"*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled.* That this act may be cited by the short title of 'United States Mining Act.' Wherever the word 'person' occurs in this act it shall be construed to import the plural or singular as the case demands, and shall include individuals, associations, partnerships, and corporations.

"*Sec 2.* In all cases lands valuable for minerals shall be reserved from sale, except as otherwise expressly directed by law.

"*Sec. 3.* With the exceptions hereinafter noted, all valuable mineral deposits in lands belonging to the United States, both surveyed and unsurveyed, are hereby declared to be free and open to exploration and purchase, ownership and operation, and the lands in which they are found to occupation and purchase, by citizens of the United States and those who have declared their intention to become such, under regulations prescribed by law. Provided, that this act shall not affect deposits of potassium, coal, phosphate, sodium, oil, oil shale, or gas; nor shall it pertain to withdrawals of public land which may have been, or may hereafter be, made; nor shall it apply to lands acquired under the act of March first, nineteen hundred and eleven (Thirty-six Statutes, page nine hundred and sixty-one) known as the 'Weeks Law.'

"*Sec 4.* Proof of citizenship, under this act, may consist, in the case of an individual, of his own affidavit thereof; in the case of an association of persons unincorporated, of the affidavit of their authorized agent, made on his own knowledge or upon information and belief; and in the case of a corporation organized under the laws of the United States, or of any state or territory thereof, by the filing of a certified copy of its charter or certificate of incorporation.

FORM AND SIZE OF CLAIM—REQUIREMENT AS TO DISCOVERY—EXPLORATION ON LAND CLASSIFIED AS NON-MINERAL

"*Sec. 5 A.* Every full mining claim upon unsurveyed lands shall be located in the form of a square containing forty acres laid out on cardinal lines, conforming to the system of public land surveys, but claims may also be located in the form of a square containing ten acres laid out on cardinal lines, conforming to the system of public land surveys. Other fractional claims shall be located in the same manner as full claims, but their area and form may be governed by available areas. When mining claims are located upon surveyed lands they shall conform to the subdivisions of the public land surveys. A full mining claim on surveyed lands shall be a quarter-quarter section or lot, but legal subdivisions of forty acres may be subdivided into ten-acre tracts. Other fractional claims on surveyed lands shall be located in the same manner as full claims, but their area and form may be governed by available areas.

"*B.* Subject to limitations contained in this article, discovery of valuable mineral shall not hereafter be necessary in order to locate and hold a mining claim, but when a claim is recorded in the United States Land Office, the records shall include a sworn statement as to whether or not a discovery has been made. A claim located and recorded without discovery on land classified as mineral may be held for five years without discovery, after which it shall be open to relocation under the same conditions as though it were a claim upon which the required expenditure for development had not been made; provided, however, that upon failure to make discovery within the period of five years a locator shall have the right to hold the claim or claims for further annual terms, not exceeding five years, by payment into the United States Land Office annually in advance fifty dollars for each acre or fraction thereof, which annual payments shall be in lieu of any further requirements for assessment work.

"*C.* Should the owner of a claim located without discovery of valuable mineral make such a discovery during such five-year period, or during such five-year extension thereof, as stipulated in Article 3 of this section, he shall file a sworn statement as to that fact with the other papers in the United States Land Office, showing the nature of such discovery and of the mineral discovered. Upon the verification of such discovery by a United States deputy mineral surveyor, delegated by the officer in charge of said Land Office to make an examination, which examination shall be at the expense of the claimant, such discovery thus established shall entitle the owner of the claim to hold and possess it under the same conditions as though discovery had been made before the original record was filed in said Land Office. If discovery of a valuable mineral be made by drilling more than one hundred feet in depth, affidavits by at least two persons thoroughly acquainted with the facts, setting forth the nature of the discovery and the place, depth and time at which it was made, shall be accepted by the United States Deputy Mineral Surveyor, delegated by the officer in charge of said Land Office to make examination, as prima facie evidence of discovery, provided that such affidavits be made within thirty days following the discovery.

"*D.* Where no proceedings have been initiated in the United States Land Office to acquire a non-mineral estate in public land classified as non-mineral, mining claims may be located thereon with or without discovery, but in the absence of a discovery a subsequent location on such land shall not be recognized if made by the original locator, or by any person in privity with him, within two years after the prior location had become invalid.

"*E.* One discovery shall be sufficient to support the holding and patenting of a maximum of four contiguous full-claims, aggregating 160 acres (if held in common ownership), or sixteen contiguous ten-acre claims, aggregating 160 acres, if held in common ownership.

"*F.* No person shall hereafter locate any mining claim or placer ground in Alaska as attorney for another unless he is duly authorized thereto by a power of attorney in writing, duly acknowledged and recorded in any recorder's office in the judicial division where the location is made. Any person so authorized may locate mining claims on placer ground for not more than two individuals or one association under such power of attorney, but no such agent or attorney shall be authorized or permitted to locate more than two mining claims on placer ground for any one principal or association during any calendar month. No person shall hereafter locate, cause or procure to be located, for himself, in Alaska, more than two such claims, not to exceed twenty acres each in the case of an individual, or forty acres if an association, in any calendar month; and no such claim in Alaska which is longer than three times its greatest width shall hereafter be patented. Any claim attempted to be located in violation of this article shall be null and void, and the whole area thereof may be located by any qualified locator as if no such prior attempt had been made.

"*G.* Final entry and payment shall be made for all mining claims located hereafter within seven years from the date of the original location, exclusive of the time consumed in adverse suits and contests, except that in the case of extensions obtained under the provisions of Article B of this section the time limit for final entry and payment shall be twelve years from the date of the original location.

"*H.* In all cases of an application for a patent to mineral land a discovery shall be a condition precedent.

Marking, Notice and Recording of Locations—Annual Development Work

"*Sec. 6. A.* The location of a claim must be distinctly marked on the ground so that its boundaries can be readily traced and such markings shall include the posting of a permanent monument extending not less than two feet above the ground at each corner of the claim. At the time when the claim is monumented there shall also be posted in a conspicuous place on the claim a notice of location, which shall be according to a form prescribed by the United States Surveyor General and in conformity with the terms of this act. All notices of location of mining claims hereafter made shall contain the name or names of the locators, the date of the location, and such a description of the claim or claims located by reference to some natural object or permanent monument as will identify the claim, and such notice of location of all claims, whether located before or after the effective date of this act, shall be recorded in the United States Land Office for the district in which located; the claims located after the effective date of this act shall be recorded within ninety days after the date of location; all claims located prior to the effective date of this act shall be recorded within one year after said date.

"*B.* On each claim located after the effective date of this act, and until a patent has been issued therefor, not less than five dollars' worth of labor shall be performed or improvements made during each year for each acre or fraction thereof comprised in such claim; or in lieu of the performance of such labor a sum computed at the rate of five dollars for each acre or fraction thereof may be paid each year, including the year of location, into the United States Land Office for the district; on each claim located after the tenth day of May, eighteen hundred and seventy-two and before the effective date of this act, and until a patent has been issued therefor, not less than one hundred dollars' worth of labor shall be performed or improvements made during each year. On all claims located prior to the tenth day of May, eighteen hundred and seventy-two, ten dollars' worth of labor shall be performed or improvements made during each year for each one hundred feet in length along the vein until a patent has been issued therefor; but where such claims are contiguous, and are held in common, such expenditure may be made upon any one claim.

"*C.* Upon failure to comply with the conditions as to annual work or payments, as provided in Article B of this action, the claim or mine upon which failure occurred shall be open to relocation in the same manner as if no location of the same had ever been made, provided that the original locator, or locators, or any person, or persons, in privity with him or them, shall be disqualified for a period of one year from making such relocation and a resumption of work shall not save the original locator, or locators, their heirs, assigns, or legal representatives from the effects of such failure. Provided further, that a sale to an innocent purchaser for value after such failure and after such resumption shall cure such failure in the absence of a relocation prior to such sale.

"*D.* Upon the failure of any one of several co-owners to contribute his proportion of the expenditures required by the terms of Article B of this section, the co-owners who have performed the labor or made the improvements, or who have paid the equivalent thereof to the United States Land Office as is required by Article B of this section, may, at the expiration of the year, give such delinquent co-owner personal notice in writing by publication in the newspaper published nearest the claim for at least once a week for thirteen consecutive weeks, and if at the expiration of ninety days after such notice in writing or by publication such delinquent should fail or refuse to contribute his proportion of the expenditure required by this section, his interest in the claim shall become the property of his co-owners who have made the required expenditures.

"*E.* The period during which the annual work is required to be done, as specified in this section, shall be the calendar year during which location of claim be made. Provided, that if it be impossible to finish the work begun during the calendar year of location, and if the work has been diligently and continuously prosecuted, completion of the work, by diligent and continuous prosecution thereof, in the ensuing calendar year shall hold the claim. Provided, however, that this permission may not be construed as a waiver of the performance of the obligatory assessment work during the second calendar year. Provided, further, that on claims located on placer ground in the Territory of Alaska said annual work shall be done during the calendar year in which they are located, and regardless of the time of year in which location may have been made.

Extralateral Rights and Ownership in All Minerals and Surface Embraced Within the Claim

"*Sec. 7.* Subject to the existing extralateral rights of mining claimants or patentees, the holder or patentee of a mining claim located hereafter shall have the exclusive right of possession and enjoyment of the surface held by him and of the minerals covered by this act which lie beneath the claim and within vertical planes passing through the surface boundaries of said land, but shall not have the right to follow any mineral deposit beyond said planes. And the holders or patentees of claims heretofore located shall have similar exclusive possession of all the minerals covered by this act which lie beneath the claim and within vertical planes passing through the surface boundaries of said land that is not covered by any existing extralateral rights.

Proceedings of Patent

"*Sec. 8. A.* A patent for any land claimed and located for valuable deposits may be obtained in the following manner: Any person, association, or corporation authorized to locate a claim under this act, having claimed and located a piece of land for such purposes, and having complied with the terms of this act, may file in the proper district land office an application for a patent, under oath, showing such compliance, together with proof of a discovery of valuable mineral, together with a plat and field notes of the claim or claims in common, made by or under the direction of the United States Surveyor General, showing accurately the boundaries of the claim or claims, which shall be distinctly marked by monuments on the ground. The claimant shall post a copy of such plat, together with a notice of such application for a patent, in a conspicuous place on the land embraced in such application previous to the filing of the application for a patent, and shall file an affidavit of at least two persons that such notice has been duly posted, and shall file a copy of the notice in such land office.

"*B.* Upon compliance with the terms of Article A of this section the claimant shall be entitled to a patent for the land, in the manner following: The register of the district land office, upon the filing of such application, plat, field notes, notices, and affidavits, shall, for the period of sixty days, publish a notice, that such application has been made, in a newspaper to be by him designated as published nearest to such claim; and he shall also post such notice in his office for the same period. The claimant at the time of filing this application, or at any time thereafter, within the sixty days of publication, shall file with the register a certificate of the United States Surveyor General that twenty dollars' worth of labor has been expended or improvements made upon the claim by himself or grantors for each acre of the claim; or that cash has been paid into the United States Land Office to an amount bringing the total expenditure up to twenty dollars for each acre of the claim; and that the plat is correct, together with such further description by such reference to natural objects or permanent monuments as shall identify the claim; and shall furnish an accurate description to be incorporated in the patent. At the expiration of the sixty days of publication the claimant shall file his affidavit, showing that the plat and notice have been posted in a conspicuous place on the claim during such period of publication. If no adverse claim shall have been filed with the register and the receiver of the proper land office, at the expiration of the sixty days of publication, it shall be assumed that the applicant is entitled to a patent, upon the payment to the proper officer of five dollars per acre, and that no adverse claim exists; and thereafter no objection from third parties to the issuance of a patent shall be heard, except if it be shown that the applicant has failed to comply with the terms of this act. Provided, however, that in the District of Alaska adverse claims authorized and provided for in this and the following section may be filed at any time during the sixty days' period of publication or within eight months thereafter, and the adverse suits authorized and provided for in the following section may be instituted at any time within sixty days after the filing of said claims in the local land office. Provided, further, that where the claimant for a patent is not a resident of or within the land district wherein the vein, lode, ledge, or deposit sought to be patented is located, the application for patent and the affidavits required to be made in this section by the claimant for such patent may be made by his, her, or its authorized agent, where said agent is conversant with the facts sought to be established by said affidavit.

ADVERSE CLAIMS AGAINST APPLICATIONS FOR PATENT

"*Sec. 9. A.* Where an adverse claim is filed during the period of publication, it shall be upon oath of the person or persons making the same, and shall show the nature, boundaries, and extent of such adverse claim, and all proceedings, except the publication of notice and making and filing of the affidavit thereof, shall be stayed until the controversy shall have been settled or decided by a court of competent jurisdiction, or the adverse claim has been waived. It shall be the duty of the adverse claimant, within thirty days after filing his claim, to commence proceedings in a court of competent jurisdiction, to determine the question of the right of possession, and prosecute the same with reasonable diligence to final judgment; and a failure to do so shall be a waiver of his adverse claim. After such judgment shall have been rendered, the party entitled to the possession of the claim, or any portion thereof, may, without giving further notice, file a certified copy of the judgment-roll with the register of the land office, together with the certificate of the Surveyor General that the requisite amount of cash or labor has been expended or improvements made thereon, and the description required in other cases, and shall pay to the receiver five dollars per acre for his claim, together with the proper fees, whereupon the whole proceedings and the judgment-roll shall be certified by the register to the Commissioner of the General Land Office, and a patent shall issue thereon for the claim, or such portion thereof as the applicant shall appear, from the decision of the court, rightfully to possess.

"*B.* If it appears from the decision of the court that several parties are entitled to separate and different portions of the claim, each party may pay for his portion of the claim with the proper fees, and file the certificate and description by the Surveyor General, whereupon the register shall certify the proceedings and judgment-roll to the Commissioner of the General Land Office, as in the preceding case, and patents shall issue to the several parties according to their respective rights.

"*C.* Nothing contained in this section shall be construed to prevent the alienation of a title conveyod by a patent for a mining claim to any person whatever. If, in any action brought pursuant to this section, title to the ground in controversy shall not be established by either party, the jury shall so find, and the judgment shall be entered according to the verdict. In such case costs shall not be allowed to either party, and the claimant shall not proceed in the land office or be entitled to a patent to the ground in controversy until he shall have perfected his title. The adverse claims referred to in this section may be verified by the oath of any duly authorized agent or attorney in fact of the adverse claimant cognizant of the facts stated.

DESCRIPTION OF CLAIMS

"*Sec. 10.* The description of mining claims upon surveyed lands shall designate the location of the claims with reference to the lines of the public survey. Where such claims are upon surveyed lands and conform to legal subdivisions no further survey or plat shall be required. Where patents have been or shall be issued for claims upon unsurveyed lands, the Surveyor General, in extending the public survey, shall adjust the same to the boundaries of said patented claims so as in no case to interfere with or change the true location of such claims as they are officially established upon the ground. Where patents have been issued for mineral lands, those lands only shall be segregated and shall be deemed to be patented which are bounded by the lines actually marked, defined, and established upon the ground by the monuments of the official survey upon which the patent grant is based, and Surveyors General in executing subsequent patent surveys, whether upon surveyed or unsurveyed lands, shall be governed accordingly. The said monuments shall at all times constitute the highest authority as to what land is patented, and in case of any conflict between the said monuments of such patented claims and the descriptions of said claims in the patents issued therefor the monuments on the ground shall govern, and erroneous or inconsistent description or calls in the patent descriptions shall give way thereto. Where by the segregation of mineral lands in any legal subdivision a quantity of agricultural land less than forty acres remains, such fractional portion of agricultural land may be entered by any party qualified by law, for homestead or pre-emption purposes.

SURVEYS

"*Sec. 11.* The Surveyor General of the United States may appoint in each land district containing mineral lands as many competent deputy surveyors as shall apply for appointment to survey mining claims. The expenses of the survey of mining claims, together with the cost of publication of notices, shall be paid by the applicants, and they shall be at liberty to obtain the same at the most reasonable rates, and they shall also be at liberty to employ any United States deputy surveyor to make the survey. The Commissioner of the General Land Office shall also have power to establish the maximum charges for surveys and publication of notices under this act; and, in case of excessive charges for publication, he may designate any newspaper published in a land district where mines are situated for the publication of mining notices in such district, and fix the rates to be charged by such paper; and, to the end that the Commissioner may be fully informed on the subject, each applicant shall file with the register a sworn statement of all charges and fees paid by such applicant for publication and surveys, together with all fees and and money paid the register and the receiver of the land office, which statement shall be transmitted, with the other papers in the case, to the Commissioner of the General Land Office.

VERIFICATION OF AFFIDAVITS. NOTICE OF CONTENT.

"*Sec. 12.* All affidavits required to be made under this act may be verified before any officer authorized to administer oaths. All testimony and proofs may be taken before any officer authorized to administer oaths within the land district where the claims may be situated, and, when duly certified by the officer taking the same, shall have the same force and effect as if taken before the register and receiver of the land office. In cases of contest as to the mineral or agricultural character of land, the testimony and proofs may be taken as herein provided on personal notice of at least ten days to the opposing party; or if such party cannot be found, then by publication of at least once a week for four consecutive weeks in a newspaper, to be designated by the register of the land office as published nearest to the location of such land; and the register shall require proof that such notice has been given.

LAND REQUIRED FOR MINING PURPOSES OTHER THAN IN MINERAL CLAIMS

"*Sec. 13. A.* Where unoccupied land belonging to the public domain, not contiguous to a mining claim, is required by the proprietor of such claim for mining or metallurgical purposes, such non-adjacent land may be located and may be embraced and included in an application for a patent for such claim, and the same may be patented therewith, subject to the same preliminary requirements as to survey and notice as are applicable to mining claims; but no location hereafter made of such non-adjacent land shall exceed ten acres, and payment for the same must be made at the same rate as fixed by this act for a mining claim. The ten acres of non-adjacent land provided for in this section must be in the form of a square, two sides of which must coincide with lines of the public survey. The owner of a mill, or reduction works, now owning a mine in connection therewith, may also receive a patent for his mill site or works sites as provided in this section.

"*B.* Where unoccupied land belonging to the public domain, either contiguous or non-contiguous to a mining claim, is needful in large areas for mining and metatllurgical purposes, the surface rights of such land may be acquired in parcels or lots, conforming to the lines of the public surveys, without limit as to aggregate area, providing the application has been approved by the Secretary of the Interior. Land thus located and acquired under the provisions of this article shall be subject to the same provisions as to survey and notice as are required for the location and purchase of mineral lands in this statute; provided, however, that no land that has been officially classified by the Federal Government as being capable of irrigation from any known source may be located under the terms of this article. Lands located under this article shall be paid for at the rate of ten dollars per acre.

"*C.* The tenure of the surface provided for in Article B of this section refers solely to the occupancy of the surface, and the mineral rights underlying land thus acquired shall be in all cases reserved and shall be subject to location and patent under regulations and provisions promulgated by the Secretary of the Interior in harmony with the general provisions of this act governing the location of mineral lands.

MINERAL DEVELOPMENT FUND

"*Sec. 14.* All moneys paid into the United States Land Office in lieu of annual labor or improvements and for extension of tenure beyond five years where no discovery has been made, as provided for in this act, are hereby reserved, set aside, and appropriated, as a special fund in the Treasury, to be known as the 'Mineral Development Fund,' to be used and expended, under the direction of the Secretary of the Interior, within the state or territory, and as nearly as practicable within the mining district from which payments were made, for general purposes of developing the mineral resources of the several mining districts.

SPECIAL PROVISIONS

"*Sec. 15.* Wherever, by priority of possession, rights to the use of water for mining, agricultural, manufacturing, or other purposes, have vested and accrued, and the same are recognized and acknowledged by the local customs, laws, and the decisions of courts, the possessors and owners of such vested rights shall be maintained and protected in the same; and the right of way for the construction of ditches and canals for the purposes herein specified is acknowledged and confirmed; but whenever any person, in the construction of any ditch or canal, injures or damages the possession of any settler on the public domain, the party committing such injury or damage shall be liable to the party injured for such injury or damage.

"*Sec. 16.* All patents granted, or preemption or homesteads allowed, shall be subject to any vested and accrued water rights, or rights to ditches, and reservoirs used in connection with such water rights, as may have been acquired under or recognized by the preceding section.

"*Sec. 17.* The President is authorized to establish land districts, and to appoint the necessary officers under existing laws, wherever he may deem the same necessary for the public convenience in executing the provisions of this act.

"*Sec. 18.* Subject only to such general limitations as may be necessary to exempt navigation from artificial obstructions, all land and shoal water between low and mean high tide on the shores, bays, and inlets of Behring Sea, within the jurisdiction of the United States, shall be subject to exploration and mining for gold and other precious metals by citizens of the United States, or persons who have legally declared their intentions to become such, under such reasonable rules and regulations as the miners in organized mining districts may have heretofore made or may hereafter make governing the temporary possession thereof for exploration and mining purposes. Provided: That the rules and regulations established by the miners shall not be in conflict with the mining laws of the United States; and no exclusive permits shall be granted by the Secretary of War authorizing any person or persons, corporation, or company to excavate or mine under any of said waters below low tide; but citizens of the United States or persons who have legally declared their intention to become such shall have the right to dredge and mine for gold or other precious metals in said waters, below low tide, subject to such general rules and regulations as the Secretary of War may prescribe for the preservation of order and the protection of the interests of commerce; such rules and regulations shall not, however, deprive miners on the beach of the right hereby given to dump tailings or pump from the sea opposite their claims, except where such dumping would actually obstruct navigation; and the reservation of a roadway sixty feet wide, under the tenth section of the act of May fourteenth, eighteen hundred and ninety-eight, entitled 'An act extending the homestead laws and providing for right of way for railroads in the District of Alaska, and for other purposes,' shall not apply to mineral lands or town sites.

"*Sec. 19.* No act passed at the first session of the Thirty-eighth Congress, granting lands to states or corporations to aid in the construction of roads or for other purposes, or to extend the time of grants made prior to the thirtieth day of January, eighteen hundred and sixty-five, shall be so construed as to embrace mineral lands, which in all cases are reserved exclusively to the United States, unless otherwise specially provided in the act or acts making the grant.

"*Sec. 20.* No possessory action between persons, in any court of the United States, for the recovery of any mining title, or for damages to any such title, shall be affected by the fact that the paramount title to the land in which such mines lie is in the United States; but each case shall be adjudged by the law of possession.

"*Sec. 21.* The Secretary of the Treasury is hereby authorized and directed to pay, out of the moneys heretofore or hereafter covered into the Treasury from deposits made by individuals to cover cost of work performed and to be performed in the offices of the United States Surveyors General in connection with the survey of mineral lands, any excess in the amount deposited over and above the actual cost of the work performed, including all expenses incident thereto for which the deposits were severally made or the whole of any unused deposit; and such sums, as the several cases may be, shall be deemed to be annually and permanently appropriated for that purpose. Such repayments shall be made to the person or persons who made the several deposits, or to his or their legal representatives, after the completion or abandonment of the work for which the deposits were made, and upon an account certified by the surveyor general of the district in which the mineral land surveyed, or sought to be surveyed, is situated and approved by the Commissioner of the General Land Office.

"*Sec. 22* Where by special act of Congress land has been opened to exploitation under the mineral land laws of the United States but subject to any special limitation or condition expressed in such special act, this act shall not be construed as waiving such limitation or condition.

"*Sec. 23.* So much of the act of August fourth, eighteen hundred and ninety-two (Twenty-seven Statutes at Large, page 348) as provides for the entry of lands chiefly valuable for building stone under the provisions of the law relating to placer mining claims is hereby amended by striking out the word 'placer' and hereafter this act shall be substituted for the placer mining law in the making of such entries.

"*Sec. 24* The provisions of this act shall not apply to public lands in the states of Michigan, Wisconsin, Minnesota, Missouri, Kansas, or Alabama.

REPEALING SECTION

"*Sec. 25.* The following sections of the Revised Statutes, that is, Section 2320, relating to the size of lode claims; Section 2322, relating to rights in mining claims; Section 2323, relating to tunnel rights; Section 2338, relating to rights initiated prior to May tenth, eighteen hundred and seventy-two; Section 2329, providing for the location of placer claims; Section 2330, relating to placer claims; Section 2331, relating to the survey and segregation of mineral lands; Section 2332, relating to claims held for a statutory period and to liens on claims; Section 2333, relating to the patenting of placer claims; Section 2336, relating to intersecting veins; Section 2338, relating to state rules for working mines; Section 2341, relating to pre-emption and homestead entries of lands designated as mineral lands; Section 2342, relating to the designation of agricultural lands; and Section 2344, relating to rights acquired under prior existing law; also the act of Congress approved June sixth, eighteen hundred and seventy-four (Eighteen Statutes at Large, page 61) relating to expenditures of labor and improvements on mining claims; and the act of Congress approved February eleven, eighteen hundred and seventy-five (Eighteen Statutes at Large, page 315) relating to tunnel work, are hereby repealed: Provided, that nothing contained in this act, except as expressly provided, shall be construed to affect any right heretofore initiated."

Mesabi Operators Refuse To Pay Village Tax

Oliver, Shenango and M. A. Hanna Companies Claim Part of Chisholm Levy Is Illegal—Interesting Fight Expected

Three iron-mining companies owning property in the village of Chisholm, Minn., on the Mesabi Range, have refused to pay in full the real-estate tax levy of the village as of November, 1920, on the ground that a part of it was unauthorized and illegal. The companies in question, namely, the Oliver Iron Mining Co., the Shenango Furnace Co. and the M. A. Hanna Ore Co., offered to pay the state, county and school district levy, which was a little less than half of the total assessment, but the treasurer of St. Louis County stated he could not accept any part payment of the tax.

The assessment against real estate by the village for all village purposes was 32.7 mills in 1919, as compared to 50.2 mills in 1920, an increase of 17.5 mills. The total number of mills levied against the mining companies by the state, county, village and for the school district was 92.1 mills divided as follows: Village of Chisholm 50.2 mills; school district; 26.5 mills; St. Louis County, 9.98 mills, and the State of Minnesota, 5.42 mills. The Oliver Iron Mining Co., with a total assessment of $625,000 against it, offered to pay $301,569.56; the Shenango Furnace Co., with a total assessment of $22,000, offered to pay $10,000, and the M. A. Hanna Ore Co. offered $10,000 exclusive of the tax levied against it by the village.

The mining companies contend that 20 mills is the limit the village can levy for its general fund, and this has not been exceeded in this particular fund, but other departments were created which were not authorized, therefore creating unlawful levies. The companies were not explicit in their charges and stated that the matter probably would be taken to the courts if the village does not make a change.

Arrested for Amalgam Theft

C. J. Sinclare, of Denver, Col., was arrested on May 25 at Deadwood, S. D., charged with the theft of amalgam from the Homestake Mining Co.'s mills at Lead. It is said that the thefts extend over a period of ten years.

Dardanelles Mine at Chloride, Ariz., Opened Rapidly

Over 12½ per Cent of Initial Expense Already Returned by Ore From Development and Exploration

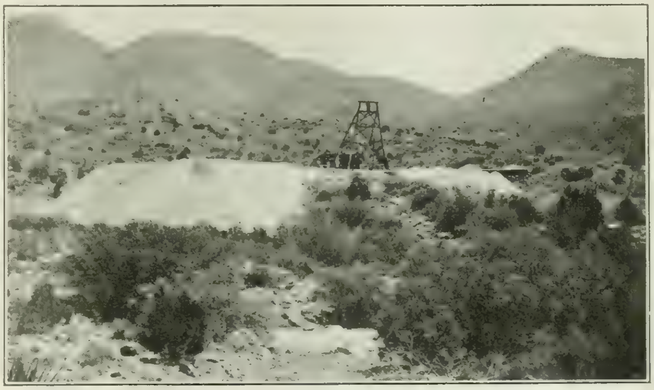
The property of the Dardanelles Mining Co., embracing five claims covering about seventy-five acres and known as the Memphis group, lies about one mile north-northeast of Chloride, Ariz., on the western slope of the Cerbat Range. Numerous veins pass through the claims, and the activity of the early prospectors is shown by a dozen or fifteen shallow shafts, pits, and adits. In none of these was found sufficient encouragement for more thorough development. Portions of the surface are covered by a deep gravel wash. This was responsible for the part now being worked escaping the attention of later-day miners. Several years ago the group was taken over by Anna E. Durkee, through whose efforts a company was formed and financed, Etienne A. Ritter, of Colorado Springs, having made a favorable report on the property.

In a district notorious for complex ores and known as a producer of lead-silver, the Dardanelles has proved the existence of an orebody whose values are in gold with some silver and practically no lead and zinc. Active work was begun in October, 1919, and has continued to date without interruption. The ore from development and exploratory work at a comparatively shallow depth that has been shipped to the smelter has thus far returned over 12½ per cent of the amount spent in opening up the property. The company has accomplished a large amount of development work in a short time and at comparatively small outlay. Operations have been in charge of S. Ford Eaton, the engineer and manager. H. L. McCarn is consulting engineer. The necessary financing has been accomplished privately. The company maintains no office.

Preliminary examination and trenching disclosed a promising vein running practically north and south through the ground. Apparently this vein had produced ore beyond the limits of the Memphis group in both directions. Further trenching uncovered a branch vein striking toward the large vein with the probable intersection or junction under the gravel wash.

A shaft was started, with windlass, at about the point of intersection. Bedrock and vein matter were encountered at a depth of 26 ft. At 50 ft. there was a considerable flow of water, and at that stage a 15-hp. gasoline hoist and 30-ft. headframe were installed.

The first station was cut at the 100 level. The water flow at this point was about 20,000 gal. per twenty-four hours, which was handled with a bailer. A 12-ft. crosscut to the west tapped the spur vein and opened up a lens of ore 30 ft. wide. Samples of this ore assayed as high as $60 per ton in gold and silver, with no zinc and lead. This particular lens of quartz ore in the vein matter was found to be about 25 ft. long and averaged 20 in. in width. A small quantity of this ore was shipped.



SHAFT AND DUMP, DARDANELLES MINING CO., NEAR CHLORIDE, ARIZ.

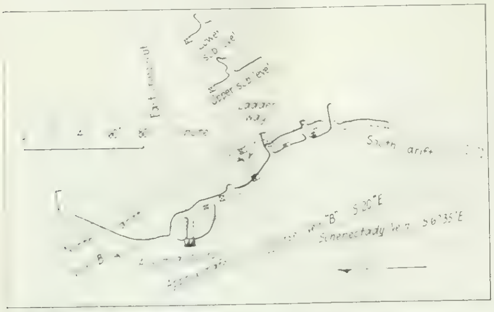
Drifts were then driven north and south on this spur. About 50 ft. to the south the junction with the main vein came into evidence. Crosscutting there showed the vein matter to be 20 ft. wide, with broad bands of high-grade occurring throughout nearly the entire width. From these lenses samples ran as high as $334 in gold and silver. From the development work on the level in this shoot three carloads of ore were shipped to the smelter. Returns showed a value of about $50 per ton. This ore shoot proved to be about 40 ft. long. Continued drifting both north and south on the 100 level opened up no more ore shoots, but proved the continuity of the vein.

In July, 1920, a gasoline-driven plunger pump was added to the equipment, and sinking was resumed. Water increased steadily, until at a depth of

180 ft. the daily flow was about 80,000 gal. The handicap with the small equipment being too great for further sinking, a level was started at the 160-ft. mark.

Thirty feet of crosscutting to the west brought the face into the vein at a lean portion. A drift to the south, however, entered the main ore shoot at 75 ft. Crosscutting showed up vein matter for a width of 18 ft., with high-grade lenses similar to those on the 100 level in evidence. The south drift has been advanced a total of 270 ft., showing the vein structure to be consistent.

A raise was driven to the 100 level in the main ore shoot. Two sublevels proved the continued occurrence of high-grade lenses and considerable milling ore. Several more car lots were shipped, and the ore held well above the $40 mark.



MAP OF 100 AND 160 LEVELS, DARDANELLES MINE

A drift has been driven to the north in the vein on this level for 150 ft. In this working the vein has averaged 5 ft. in width. General samples run from $4 to $20 per ton in gold and silver. In the last 40 ft. the vein matter has widened considerably, values in the lenses running as high as $300 per ton.

A raise has been started on the footwall quartz. The last three samples taken from 30 in. of this quartz ran $31.60, $57.20, and $61.40, respectively. Development work to date includes a 180-ft. shaft, 800 ft. of drifting, 170 ft. of raising and 250 ft. of crosscuts.

A partial analysis of the last car lot of ore was: Gold, 1.45 oz.; silver, 14.85 oz.; lead, none; zinc, 1.3 per cent; copper, trace; insoluble, 66.6 per cent; sulphur, 7.6 per cent, and iron 9.2 per cent. The values are distinctly associated with the iron, making the ore amenable to concentration.

On the 160 level the vein has been opened up for 100 ft., being 3 to 18 ft. wide, with less pronounced [illegible] carrying high-grade lenses. The work has been done with gasoline power and hand steel. Working conditions are good. The ground is somewhat inclined to cave but is properly timbered [illegible]. Labor troubles have been conspicuous by their absence. The company plans to install complete electrical equipment and to sink a large double-compartment shaft. This will be used as the permanent working shaft.

According to H. L. McCarn, the formation at the Dardanelles is granitic, gneissic and schistose phases predominating, with hornblende (?) as the main dark silicate. As a whole, schist is the dominant rock, but acidic bands and segregations are common, though, on the other hand, portions of the formation approach amphibolite in denseness and basicity.

Close folding and strain are noticeable, and along the main fissure, opened by the work in progress, crushing and movement are evidenced in a most pronounced manner. No post-mineral faulting — at least no marked displacement of ore streaks — has been observed, but the oblique and lateral movements previous to ore deposition have permitted much irregular mineralization to extend out into the country rock adjacent to the vein.

The metallic values are found in a fine-grained pyrite, slightly cupriferous, with galena and blende in almost negligible amounts, and more or less vein quartz. These minerals have replaced susceptible portions of the strained rock. In much of the ore, replacement of the sinuous bands of the schist by a fine bronze-like pyrite, with little or no secondary quartz, is characteristic, and such ore is usually rich both in gold and silver. The replacement and preservation of the schistosity or other original or induced structure (extending even to the minute texture of the rock), and the conversion of the rock into high-grade ore make this an interesting type of replacement orebody.

In parts of the vein where there has been less movement and crushing there is a larger development of secondary or vein quartz with disseminated pyrite and arsenopyrite. This ore, usually of lower grade than the "soft" ore to which reference has been made, is probably due, in part at least, to the more common processes of vein filling. Where the quartz is dark in color the gold content are greater.

The course of the vein on which the principal work has been done is approximately N. 25 deg. W., with easterly dip averaging between 70 and 75 deg., but changes in dip and the influence of intersection fractures cause curves in the horizontal plane of the vein. In most places the foot wall is well marked, and when the vein is not more than five or six feet wide the hanging wall is sometimes definite, but where the replacement is most intense ore has been found to extend into the hanging wall a distance of 15 ft.

Independents Cut Wages in Lake Superior District

10 Per Cent Reduction Makes Scale 5 Per Cent Lower Than That Paid by Oliver Company

All independent iron mining companies in the Lake Superior district have posted notices of a decrease in wages of 10 per cent for all labor, effective from June 1. This decrease, combined with the one of Feb. 1 for 15 per cent, makes a total of 25 per cent. Wages have therefore declined from peak prices of $5.33 to $4 a day at present, the latter also being the rate of pay in the latter part of April, 1918.

This decrease brings the scale of wages paid by the independent mining companies 5 per cent below that established by the Oliver Iron Mining Co. which took effect May 16. Salaried men were not affected by this last cut, as their wages had not risen in proportion to those of labor.

Great Lakes Ore Transportation Rate Fixed

The transportation rate on iron ore on the Great Lakes has been fixed on a basis of 80c. a ton free from port at the head of Lake Superior. On this basis the carrying charges will be 72c. from Marquette, 60c. from Escanaba to Lake Erie ports, and 48c. from Escanaba to South Chicago. The charges for this season are the same as in 1919, but much lower than they were in 1920, when the season chartering was done on a basis of $1.10 free from port from the head of Lake Superior.

Utah Apex Files Exceptions to Utah Con. Accounting

The Utah Apex Mining Co., of Bingham Canyon, Utah, has filed exceptions to the accounting of the Utah Consolidated Mining Co., for ore extracted from disputed ground, claiming a value of $1,180,937 for ore extracted thus interest of $240,530, making a total of $1,421,467. This is in comparison with figures compiled by the Utah Consolidated showing $658,986 for ore extracted plus interest.

Utah Compensation Rating Bureau Appointed

A compensation rating bureau has been created in Utah, which is to co-operate with the state industrial commission in fixing rates and other duties. Classifications and rates as published by the National Council on Workmen's Compensation Insurance have been adopted by the commission as standard rates for insurance companies operating in Utah, carrying workmen's compensation.

The imports of magnesite averaged 3,797 tons monthly over a period of ten months ended with April. During April the imports were 326 tons. During March the imports were 6,931 tons, but the total imports during 1920 were 43,154 tons, an average of practically 3,500 tons monthly.

NEWS FROM WASHINGTON

By **PAUL WOOTON**
Special Correspondent

Federal Department of Mines Proposed

Senator Nicholson Introduces Bill Seeking Proper Recognition of Mining Industry's Importance—Cabinet Representation a Feature

With the introduction on June 6 by Senator Nicholson, of Colorado, of a bill (S 1957) to establish a department of mines the first gun has been fired in the campaign which has for its object the securing of recognition on the part of the Federal Government commensurate with the importance of the mining industry. Mining and agriculture constitute the country's basic industries. Agriculture long has had representation in the Cabinet of the Chief Executive. Senator Nicholson believes that the time is ripe to make another effort with the object of securing equal recognition for the mining industry.

The Nicholson bill recites that the scope of the department shall include all the metal-mining industries, and all the non-metallic mining and quarrying activities. The coal, petroleum and gas industries are also to be included in the department.

The department of mines, as proposed by Senator Nicholson, is to be made up of four bureaus and three divisions. One bureau will be that of mining technology, which will cover the field now regarded as that of the Bureau of Mines. A bureau of mining and applied geology will handle the work now being done by the Geological Survey. A bureau of the public mineral domain would have as its field "the classification of public lands, the carrying out of the mineral leasing regulations, the recording of mineral claims and the granting of patents and all other similar activities pertaining to the public domain." The fourth bureau is one of mineral markets, which would have as its function "the investigation of the problems of marketing the crude metals and mineral products of the United States." The bill specifies that this bureau's study is to include foreign as well as domestic markets.

The three divisions proposed in the bill are to be responsible directly to a secretary of mines. They are to be known by the following names: "Mineral Statistics," "Publications," and "Accounting and Disbursing."

In addition to the taking over of the Bureau of Mines and the Geological Survey, the General Land Office, and the War Minerals Relief organization are to be absorbed in the proposed department.

Alaska Legislature Makes Recommendations to Washington

Resolutions by the Legislature of the Territory of Alaska have been presented by the Vice-President to the Senate with the following objects in view: Establishment of Government radio stations at various points convenient to mining and oil districts; an amendment to the mining law allowing dredging or hydraulicking of mining claims by groups; substitution of road work for the assessment fee on unpatented mining claims; an appropriation which will enable the Geological Survey to determine more exactly the extent of coal, oil, and other mineral resources in Alaska; dependable ocean transportation for ores and other Alaska products; an investigation by the Federal Trade Commission as to smelter charges and practices at the Tacoma smelter; and change of the assessment work year to a fiscal, rather than an annual basis.

Arno C. Fieldner Appointed Head of Pittsburgh Station

The important post of superintendent of the Pittsburgh station of the U. S. Bureau of Mines has been filled by the appointment of Arno C. Fieldner. Mr. Fieldner has been the acting superintendent of the station since June, 1920. An administrative assistant will be employed, so that Mr. Fieldner may carry on the greater part of his research work. He will continue to discharge the duties of supervising chemist. As superintendent, Mr. Fieldner will receive a salary of $5,000.

While Mr. Fieldner has demonstrated that he has unusual executive ability, he has been disinclined to accept an administrative position. Former Director Cottrell, of the Bureau of Mines, and Director Bain each has been anxious that Mr. Fieldner should continue uninterruptedly on his research work. A determined effort has been made to secure a properly qualified person, other than Mr. Fieldner, for the position. The difficulty is, however, that such engineers are unwilling, or are not in a position, to make the sacrifice.

Mr. Fieldner formerly was a member of the U. S. Geological Survey. He went with the Bureau of Mines the time its work was separated from that of the Geological Survey. During the war, he was transferred to the Chemical Warfare Service, where he attained the rank of major. On June 13, 1919, he was re-transferred to the Bureau and was made supervising chemist at Pittsburgh. Since the promotion of E. A. Holbrook to be assistant director of the Bureau, Mr. Fieldner has acted as superintendent at Pittsburgh.

One-Man Administration Likely for War Minerals Act

Secretary Fall Offers Position to Ira E. Robinson, Lawyer, of West Virginia

In all probability the administration of the War Minerals Relief Act will be lodged in the future in a single individual. It is understood that Secretary Fall has tendered this position to Ira E. Robinson, of Grafton, W. Va. It is Secretary Fall's desire to complete at the earliest possible moment the settlement of all war minerals claims. As most of the work in this connection has been done, he believes that it will be unnecessary to continue the commission form of administration.

Secretary Fall has pointed out the possibility that the existing law may be capable of more liberal interpretation than was accorded it by the commission appointed by his predecessor. This doubtless accounts for his desire to place this work in the hands of an attorney of learning and reputation, such as is Mr. Robinson.

Mr. Robinson was born in 1869. He began the practice of law in Grafton in 1891. He was a member of the Senate of the West Virginia Legislature from 1902 to 1904. In 1907 he was appointed a judge on the bench of the Supreme Court of Appeals of his state. He attained the rank of Chief Justice in 1910, a position he retained for five years. Since that time he has devoted his chief attention to lecturing before the West Virginia University College of Law. Mr. Robinson is known nationally as a result of his contributions to legal periodicals. As this is written, Mr. Robinson has not indicated his acceptance of the position tendered him by Secretary Fall.

Appropriation Allowed To Aid Non-Metallic Industry

Committees Approve of Allotting $35,000 for Scientific and Technologic Investigation

The Bureau of Mines will receive a supplemental appropriation of $35,000 for "scientific and technologic investigations concerning the mining, preparation, treatment, and utilization of heavy clay products, cement, feldspar, slate, and other non-metallics." The item was not seriously questioned in the House, but the Senate committee eliminated it from the bill. The committee was urged by Senators Pomerene, of Ohio; Underwood, of Alabama, and McNary, of Oregon, to allow this assistance to be extended to the non-metallic industries and finally withdrew objections.

NEWS BY MINING DISTRICTS

London Letter

East Rand Proprietary's Serious Position—Naraguta Tin Mines Issues Report on Company's Gold Operations

By W. A. DOMAN

London, May 24—Kept alive for more than a year past by the high price of gold the East Rand Proprietary Mines is now beginning to show the red light. Not that the danger signal was invisible before, but the time has arrived when some definite step must be taken in regard to the future. The management have never concealed the seriousness of the position, either from themselves or the shareholders. They have indicated the difficulties, and in some respects the shareholders used to think the bad points were over-emphasized.

The gold "premium" benefits no longer. It scarcely meets the increased costs that were stuck on by everyone when the embargo on selling was lifted. The Union Government does not like the idea of the mine closing down, as in addition to loss of revenue there would be industrial and economic troubles. A committee therefore was appointed to study the question. The only conclusion it seems to have reached is that the life of the mine could probably be prolonged for a time —beyond nine months now suggested —if the East Rand Proprietary be amalgamated with the Cinderella Consolidated and the Witwatersrand Deep, two neighboring properties.

It is all a question of working costs. The ore is there, but the gold cannot be economically extracted at the present level of working expenses. The Cinderella and the Witwatersrand Deep are somewhat as broken reeds, though the former cannot be said to have had a fair chance. It ran up against the East Rand Proprietary Mines seven or eight years ago in regard to the question of pumping, and as agreement could not be reached and funds ran out the Cinderella ceased operations. The East Rand Proprietary Mines is now feeling the burden of water, and last year spent nearly $110,000 in keeping the mine clear. It is suggested that the government should subsidize the company to the extent of the pumping charges. No decision has yet been reached. If an amalgamation of the three companies should be carried through it would entail a tremendous writing down of capital. The following table shows how the matter stands:

	Cinderella	E. R. P. M.	Wit. Deep
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

Full details of the scheme have not yet reached this side; it is obvious however that not one of the companies has anything like the number of workable claims shown above.

The Naraguta (Nigeria) Tin Mines has issued a report by Clyde Allan, a member of the Institution of Mining and Metallurgy, and supported by F. O. D. Bourke, the general manager, dealing with the gold discoveries on the company's property. Although reference has been made to alluvial gold in the past, it is only now that anything like real importance seems to be attached to gold at all. One of the company's properties is called Birnin Gwari, and here both alluvial and lode gold is found. Hitherto attention has been confined to the alluvial, but the deposit has proved disappointing, and operations have been concentrated on the lode. In one spot at a depth of 6 ft. below the surface some "good-grade ore" was cut. The description is by no means definite. A shaft "A" was sunk to 50 ft., or 2 ft. below water level, and a crosscut put out to the east cut the shoot which had dipped out of the shaft at 35 ft. The shoot was 12 ft. wide and ranged in value "from 3 dwt. to 10 oz. per ton," the value at water level being much higher than near the surface. Water was too strong for the shaft to be sunk below 60 ft., but a sample obtained at this depth showed 30 dwt. The shoot "is not very long," but "everything points to it lengthening as it goes down." From the shoot at 50 ft. 14½ cwt. of ore yielded 8 oz. gold. Though there is nothing at the moment to enthuse about, owing to the vagueness of the report, the results obtained are to be considered as distinctly encouraging.

I learn that the Central Mining & Investment Corporation report, which is about to make its appearance, will show that if it had not been for the gold "premium" the whole of the group of companies which the Central Mining controls would have shown a small loss last year—taking crushings in the aggregate. The important item is that of wages.

AUSTRALIA

Queensland

Mount Morgan Must Cut Wages 25 Per Cent to Break Even—Accountants Verify Company's Statements

Brisbane, April 30—Mount Morgan, the last of the copper producing companies in Queensland and the last but one in Australia to cease operations, has now been closed for nearly six weeks, and is still inoperative. The company said there must be a reduction of 20 per cent in wages before it can carry on. The matter was referred to the Industrial Arbitration Judge, who, at the men's request, appointed two mining accountants to examine the books of the company, and these experts have just made their report, which more than bears out what the company has said. In a few days a ballot is to be taken by the employees to decide whether they will accept the proposed reduction and go to work or allow the mine and works to remain idle indefinitely.

CANADA

British Columbia

Sale of Standard Silver-Lead Said To Be Arranged

Silverton—It is understood that negotiations have been completed providing for sale of property here of the Standard Silver-Lead Mining Co., to at present unknown interests. The consideration involved is reported as $75,000. The Standard's holdings consist of a number of Crown granted claims, extensively developed, and which rank among the premier dividend-paying operations in the province, shareholders having realized about $2,700,000 in profits since operations under company account were begun over ten years ago. The immense bonanza orebody, noted for its high-grade silver-lead contents, appeared near exhaustion a year or so ago, and since that time activity has gradually dwindled until latterly a few lessees have been stoping out small bodies of ore not considered sufficiently large to mine under company account. There yet remains an extensive tonnage of low-grade zinc-bearing ore in some of the lower levels. The milling plant is complete, possessing a larger capacity than any other mill in the Slocan. It is understood the present arrangements are subject to ratification by shareholders at a special meeting to be held later.

Salmo—Following the amalgamation of Motherlode and Nugget mines under a plan of operation providing for the milling of Nugget ore by the Motherlode mill, operations that began May 1, have since been maintained, about eighty tons per day being handled.

Stewart—Labor trouble, growing out of a reduction of wages, has stopped work at the Premier mine, in the Salmon River district. Dale L. Pitt, the manager, recently announced a cut which would make the pay as follows: Miners, $5.50 a day; muckers, $5; laborers, $4.75 and $5. The men claim that this is too drastic a change, that it means a reduction ranging from 75 cents to $1.25 a day, and that there has not been a corresponding drop in the board and lodging charge of $1.25 a day. According to reports, the men held a meeting at Stewart to voice their protest and to organize for a strike. Resolutions were passed providing for housing the strikers and for picketing the road to the mine. It was also decided that no freight for the Premier would be handled at the dock and that the workmen on the tramway would be interviewed. The mill crew and the tram workers, from last advices, are not affected. Two hundred tons of ore was shipped south by the "Prince Albert," which left Stewart some time ago, the same having been loaded by men who had not joined the strike.

Trail—Ore shipments received at the Consolidated smelter during the week ended May 31 were as follows:

Mine	Locality	Tons
Chatterboy	Danville, Wash.	53
Knob Hill	Republic, Wash.	35
Last Chance	Sandon	47
Company Mines		7,783

Ontario

Several Gold Discoveries Made Recently in Northern Part of Province

During the last few weeks several gold discoveries have been made throughout northern Ontario, and there is a great deal of activity in the bush. More prospectors are out than at any time in the last two years, owing to the lower costs of supplies, and particularly to the great interest being taken in gold properties.

Cobalt—During the week ended May 27 the La Rose Mines was the only shipper from Cobalt, sending out 84,000 lb. of concentrates.

Porcupine—It is understood that for the fiscal year ending June 30, the McIntyre Gold Mines, of Porcupine, will show an increase of about $1,000,000 in ore reserves. Last year the average of the ore reserves was $11.13 a ton.

Development work is being pushed on the Crown vein of the North Crown Mines, in Porcupine, but the mill will not be reopened until a sufficient supply of ore is assured for continuous operations.

The Marcus Daly Estate, through its representative, James W. Gerard, former American ambassador to Germany, has obtained the control of the Goldale Mining Co. C. H. Poirier, of New York, has concluded his examination of the company's properties and is now arranging for beginning mining operations.

The Hollinger Reserve, lying west of Hollinger Consolidated, has been purchased by a syndicate headed by E. A. Osler & Co., of Toronto. The new company to be organized will be known as the McEnaney Gold Mines.

At the Vipond meeting last week no definite progress was made in the matter of raising funds for reopening the property. A committee has been appointed to study ways and means for raising money and to take the necessary steps.

It is stated that arrangements have been made to finance the reopening of the Miller-Independence property in Boston Creek. An issue of $50,000 bonds has been partly subscribed for by the shareholders.

Larder Lake—The mill of the Larder Lake Gold Mines was recently destroyed by fire, with a loss of $60,000. It will be rebuilt, and some new equipment has already been bought.

Kirkland Lake—It is expected that by the middle of June cement will be poured for the foundations for the new Ontario Kirkland mill. The first deliveries of machinery will be made within a few days.

MEXICO

Coahuila

La Parrena Company Shuts Down San Salvador and Encantada Mines—Work Stopped in La Constancia

Sierra Mojada—The American Smelting & Refining Co. is carrying on development work in the San José mine and is retimbering the shaft in the Fronteriza mine, on which a lease has been renewed. Between fifty and sixty men are employed. W. B. Gates is superintendent.

The Cia. Minera La Parrena has suspended work in the San Salvador and Encantada mines because of the decline in price of silver and lead. An exploratory crosscut is being extended toward the contact to the north in the Almaden mine for the purpose of locating the extension of the Trinidad orebody toward the west of the Trinidad mine. The Cia. Minera de Peñoles owns a 50 per cent interest in the Parrena company. I. Ragaz is in charge.

Operations have been suspended in the properties of the Cia. Minera La Constancia since the decline in prices of silver, copper, lead, and zinc. Two 500-cu.ft. cross-compound two-stage steam-driven Ingersoll-Rand air compressors have just been received by the Constancia company, together with full equipment of air drills and other machinery. S. F. Shaw is general manager.

Operations have been suspended at the Veta Rica mine, belonging to the Cit. Metalurgica Mexicana. T. A. Hilbert is superintendent.

ARIZONA

Phelps Dodge To Deepen Two Shafts—C. & H. Completes Headframe at Cole No. 3 Shaft

Bisbee—Some new development work is being started in the Warren district by the Phelps Dodge Corporation. The White Tailed Deer shaft in the Don Luis section is to be sunk further, and additional prospecting is to be done from the deepened shaft.

The Cuprite shaft is to be deepened. The present bottom is at the 300 level. The first operation will be to raise from the 400 level to the 300. When this connection has been made, sinking will be carried below the 400 level. The hoisting equipment has been moved from the Uncle Sam shaft and installed at the Cuprite.

The Calumet & Arizona Mining Co. has finished the erection of a new headframe at the Cole No. 3 shaft. A small amount of repair work is being done in the shaft. After this has been completed a station will be cut at the 500 level and drifts started. No work has been done in this shaft for years. Certain surface showings in the vicinity and the development of ore on the Boras claim near Cole No. 3 ground make prospecting particularly desirable.

The Boras Leasing Co. has cut 20 ft. of high-grade sulphide ore in an intermediate drift 60 ft. above the 700 level. This ore is the downward extension of the sulphide stope on the 600 level. Connection of this intermediate has been made with the winze in which the Night Hawk Leasing Co. recently opened up some high-grade chalcopyrite and bornite ore.

The Night Hawk company has resumed sinking of the winze on the Lone Star fraction. The winze continues in good ore.

Jerome—Joseph Irving is engaged in testing the ores of the Dundee-Arizona company to determine their amenability to a leaching treatment.

Duncan—The property of the Duncan Mining & Milling Co. will be sold to the highest bidder, under receivership sale, at the property on July 2. The sale must bring at least two-thirds of the appraised value, which is $49,000. Assets besides the mine consist of a complete new cyanide mill and complete mining equipment.

H. W. Evans, formerly of the Duncan M. & M. Co., has purchased the lease on the Norman King mine held by Utter brothers. A small force is working.

NEW MEXICO

New Strike of Torbernite Ore Reported at White Signal

White Signal—A strike of torbernite has been made in a claim owned by Dr. S. S. Warren, of Deming, and Willard Holt, of Lordsburg. The vein is 8 in. to 2 ft. wide. A 100-lb. test sample has been sent to the Bureau of Mines at Tucson.

Fierro—A gold strike is reported from Cactus Flat, where Charles Schafer has opened a big quartz vein in rhyolite about half a mile west of the Silver City stage road. Some tellurium is reported. H. A. Hoover, of El Paso, and E. D. McIntosh, of Mogollon, are interested.

Chloride—It is reported that the Silver Monument mine has placed a contract for a 100-ton concentrating-flotation mill with the El Paso Foundry & Machine Co. E. R. Hutchens, formerly of White Oaks, N. M., is manager.

Tonuco—Ben Farrer, Basil Prescott, and William Fink, of El Paso, have taken a lease on the Tonuco fluorspar property. Ten men are working. William Fink will be in charge.

COLORADO

Interesting Ore Occurrence in Hope Company's Tunnel

Aspen—The Hurricane Leasing Co., operating the mines of the Hurricane M. M. & L. Co., have not suspended operations at any time in the last five years. The statement to the contrary in the issue of March 16 was erroneous, according to the company.

The ore discovered in the tunnel of the Hope Mining, Milling & Leasing Co. occurs in the Weber formation, west of the quartz porphyry, in the same *loci* as the ore of the Annie mine at higher altitude. The peculiar feature is that it occurs as wire silver, intermixed with sulphide in the form of polybasite at a vertical depth of 1,600 ft. or 2,200 ft. along the pitch of the vein.

UTAH

Cardiff Hauling Down Big Cottonwood From Lower Bins—Contract Squabble Cuts Park City Shipments

Salt Lake City—The Cardiff has begun hauling ore down Big Cottonwood Canyon from its lower bins, where about 2,000 tons is stored. The road to the mine from the lower bins will not be open before July.

Park City—Shipments for the week ended May 27 amount to 993 tons as compared with 1,651 tons the week preceding. This was due to the absence of ore from the Silver King coalition and Daly West mines, which are engaged in a controversy with the American Smelting & Refining Co. over ore contracts. Shippers were: Ontario, 438 tons; Judge allied companies, 555 tons.

Eureka—Ore shipments for the week ended May 27 amounted to 123 cars, as compared with 128 the week preceding. Shippers were: Tintic Standard, 39 cars; Chief Con., 36; Dragon, 12; Iron Blossom, 7; Iron King, 6; Eagle Blue Bell, 5; Victoria, 3; Gemini, 2; Eureka Bullion, 1; Eureka Hill, 1; Little May, 1; Swansea, 2.

NEVADA

Wages Cut on Comstock Lode June 1—Candelaria To Start Building New Cyanide Plant—Conditions Unchanged at Tonopah

Mina—The Mina Mercury Co. is installing two "D" retorts, with a combined capacity of 2,000 lb. of ore each, at its mine near Mina. The ore runs about 10 per cent mercury. Wood is to be used as fuel at present, but oil-burning attachments are to be installed later.

Virginia City—In accordance with [illegible] agreement between operators [illegible] wages were reduced at both Virginia City and Gold Hill on June 1. [illegible]

[illegible] has resigned the superintendency of the North End Group and will be succeeded by the president, J. B. Kendall.

Rochester—The rumor that the employees of the Rochester Silver Corporation had gone on strike again has been officially denied. Mine and mill are running to capacity. Wages for underground men at present are: Miners $5.50 and muckers $5 per day.

Tonopah—Strike conditions in the Tonopah and Divide districts continue unchanged. The companies are still importing men from outside districts and making an attempt to resume operations. On May 26 all shift bosses of the Tonopah Mining Co. refused to take charge of the strike breakers underground and quit their positions. This act has served to encourage the strikers, although it is generally considered by conservative men that it will tend to hasten the possibility of an indefinite shutdown.

On May 24 Governor Boyle held independent meetings with the operators, strikers, and business men. He expressed himself as believing that a wage reduction is inevitable and urged the strikers' committee to permit a secret ballot by the mine workers as a whole to decide whether or not they would be willing to return to work at the reduced wage, and asked that he be allowed to address the men in open meeting. The following day the meeting was held, but in the meantime the radical element, encouraged by protests from men employed by companies operating under the old wage scale, changed their minds entirely, and the meeting became a farce. A rising vote was used instead of a secret ballot, with the natural result that it was unanimously decided to stay out, and the meeting was purposely adjourned without giving Governor Boyle opportunity to address the men.

SOUTH DAKOTA

Homestake Dividends Likely To Be Increased—Clover Leaf Under Option to Talbot Associates

Lead—Dividends amounting to 25c. per share have been received by stockholders of the Homestake company for the month of May. This is the first dividend paid by this company since September, 1919, and is a forerunner of regular monthly distributions. In all probability the dividends will be increased until the regular dividend of 65c. per share, which was paid before the war, will again be paid stockholders. The property is operating at full capacity.

Deadwood—An option has been taken on the Clover Leaf property at Roubaix by E. W. Talbot and associates, of Deadwood, from the owner, Mrs. [illegible], of Paris. The property comprises about 800 acres of mineral ground on Elk Creek, eight miles southeast of the Homestake. It is equipped with a hoist, compressor, and a 240-ton stamp mill. It is considered one of the better mining propositions in the Black Hills. Up to 1904 it was a regular producer of gold, and is credited with a production of several million dollars. It has been idle for seventeen years owing to a change in ownership. Heretofore it has been impossible to secure an option, the owners asking a cash sale price. The new organization will start work immediately under the direction of E. W. Talbot, who had charge of the Millikin interests' operations in this section until work was suspended several years ago. The present mine and mill equipment will be electrified and modernized. Diamond drilling will be started to prospect the known orebodies as well as new territory, and this will be followed by the unwatering of the underground workings and extensive mining operations. The mine is very wet, and suitable pumps will be installed to handle the water. It is also probable that the creek which passes near the shaft will be diverted.

Chronology of Mining

May, 1921

May 1—A. S. & R. Co. cut executives' salaries 20 per cent. "Porphyry" copper companies make effective further wage cuts, likewise companies in the Coeur d'Alene district, Idaho, and on the Mother Lode in California. United Verde Extension smelter at Jerome, Ariz., closed down.

May 4—Rochester Silver Corporation in Nevada put into effect 50c. wage cut resulting in strike of 120 employees; men returned, accepting cut, May 11.

May 5—Anaconda Copper Co. resumed limited mining of silver-zinc ore at Butte, Mont.—Oliver Iron Mining Co. began loading ore for shipment. —Jerome Verde Copper sold to Jerome Verde Development Co., controlled by United Verde Extension.

May 6—Mining companies in Slocan district, British Columbia, cut wages 75c.

May 8—Blast furnace of Gulf States Steel Co., Birmingham district, Alabama, resumed operations.

May 9—American Zinc Institute held annual meeting at St. Louis, Mo.

May 10—H. Foster Bain confirmed by Senate as Director of U. S. Bureau of Mines.

May 15—Phelps Dodge Corporation closed offices at Douglas, Ariz.

May 16—Wages cut 20 per cent by Oliver Iron Mining Co. and other U. S. Steel Corporation subsidiaries. A. I. M. E. organized Philadelphia Section.

May 20—Reduced freight rates on Pioche, Nev., high-grade ores became effective, to continue until Nov. 15, 1921.

May 31—Arizona Copper Co., Ltd., closed mines and smelter. Interstate Commerce Commission, sitting at Chicago, heard complaints by Lake Superior Iron Ore Association concerning freight rates on iron ore in Michigan, Wisconsin, and Minnesota.

THE MARKET REPORT

Daily Prices of Metals

June	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
2	13 @13.125	30.25	31.25	4.75	4.60	4.60@4.65
3	13 @13.125	29.75	30.50	4.75	4.60	4.55@4.60
4	13.00	29.50	30.25	4.75	4.60	4.50@4.55
6	12.875@ 13	28.875	29.50	4.625@4.75	4.50	4.50@4.55
7	12.75 @ 13	28.625	29.375	4.50@4.75	4.50	4.50
8	12.75 @ 13	28.75	29.50	4.50@4.75	4.50	4.45

*These prices correspond to the following quotations for copper, "delivered": 13.25@13.375; 13.25@13.375; 13.25; 13.125@13.25; 13@13.25; and 13@13.25c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

June	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
2	73¼	73⅝	76½	172½	173¾	22¼	22⅛	27	27¾
3	72⅝	73⅛	76	170¼	171½	22⅛	22	26⅝	27⅜
4	...	...	...	...	...			...	...
6	72¾	73⅛	76	168¼	169¾	22¼	22⅛	26	27
7	72¾	73¼	76	165¾	167	22⅝	22½	26¼	27½
8	73	73⅛	76	167½	169	22⅞	22⅝	26½	27¾

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

June	Sterling Exchange	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	June	Sterling Exchange	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
2	388	99¼	57⅝	33½	6	380	99¼	57⅜	34
3	388¼	99¼	58⅛	33⅞	7	377½	99¼	58⅛	34⅞
4	385	99¼	57¾	33⅞	8	377	99¼	58⅛	34⅞

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, June 8, 1921

The metal market has declined during the last week, along with securities and foreign exchange, the condition being a general one and not due to weakness of any one metal. Consuming demand is generally absent, and no indications of a revival of business activity except for a few specialties are yet in evidence.

Copper

That the recent rise in the price of copper was caused entirely by the export demand is plainly evidenced by the quick recession now that foreign orders have practically ceased. It may take some weeks for exchange to climb up to the figures of two or three weeks ago, and if this is the case copper may fall still further, for the European countries seem to be in no urgent need of the metal, and former purchases no doubt took into account future needs and were made with the possibility of the present unfavorable exchange conditions in mind. Domestic demand has at no time been sufficient to strengthen the market. The large producers are generally quoting 13.50c. delivered, and it is understood that the Copper Export Association has not been offering the metal during the last week for less than 13.875c. delivered in Europe. Some smaller interests which have quoted June or July copper at 13.25 and 13.375c. in the last two or three days have been disappointed at losing the business, some of which it is reported has been placed as low as 13c. delivered. Not much copper could be obtained at these prices, but the amount is quite sufficient to supply the current demand. Slightly higher prices are asked for August.

Lead

On Monday, June 6, the American Smelting & Refining Co. reduced its official contract price of lead from 5 to 4.75c., New York and St. Louis. The demand for lead continues very weak indeed, so that even the small quantities pressing on the market are capable of depressing the price to a marked extent. Of course the import price also has some bearing, and it is this which prevents a greater differential between New York and St. Louis. Only certain grades of lead can be obtained at the prices which we quote, as producers of more favored or special brands, who are in a good financial position, continue to quote as high as 5.25c. They are indifferent about booking business at the current low prices, for they feel that the reaction is only a temporary one. The mine production is believed to be considerably less than the smelter production lately, and no large stocks are on hand. White-lead manufacturers report business to be excellent, and electric and cable companies are also using lead in satisfactory quantities. Forward lead is in somewhat greater supply than prompt lead apparently, judging by the higher prices which certain lots of the latter have brought.

Zinc

Although the market has been more active than for several weeks, and larger tonnages have been sold, the sales were made mainly because of price concessions, and the level is now even below the low prices current in the middle of April, before the market strengthened. In fact, the present price of 4.45c. is the lowest since early in 1908. No early improvement is anticipated.

The zinc and lead markets are now on a par, also an exceptional situation. There has been some inquiry for future zinc, for which a 5-point premium is asked. High-grade zinc is still selling for 6.25c. Zinc is cheap enough to store and hold; at any rate it pays the producers now to buy it rather than to mine it.

Tin

The recession in the price to below the 30c. level was unexpected. It was, of course, brought about by the decline in London and in sterling exchange, and has offered opportunities for considerable speculation. Demand from consumers does not seem to have been stimulated to any appreciable extent, though tin-plate manufacturers may be slightly more active. One of the largest mills has just suffered a two-million-dollar fire, in which the stock of tin plate was entirely destroyed. Prices for forward delivery continue to be approximately the same as for spot, althought slight discounts may be made.

Arrivals of tin, in long tons: Total for May, 1,355; June 1st, London, 75; 3d, London, 75; 6th, London, 130; Straits, 225; 7th, Straits, 125.

Gold

Gold in London: June 2d, 105s. 5d.; 3d, 106s.; 6th, 107s. 7d.; 7th, 109s. 3d.; 8th, 107s. 11d. On June 1st, the gold holdings of the United States were $3,175,037,198, the greatest in the history of the country.

Foreign Exchange

Sterling has had a violent reaction lately because of money transfers occasioned by German reparations payments. Other exchanges have also generally felt this influence. On Tuesday, June 7th, francs were 8.125c.; lire, 4.895c.; and marks, 1.525c. New York funds in Montreal, 12 per cent premium.

Silver

Sterling exchange continued to decline the last week, touching $3.76 on June 7, and has seriously affected the export price for silver. The London price has stiffened to offset the decline in sterling exchange, with a sharp advance on June 7 to 34⅞d. on spot demand and scarcity of offerings. China has been a buyer in the London market, and on June 6 America was reported as a buyer. The Indian bazaars have also been moderate buyers, so that the London market has been steady. There has been some demand in this market for San Francisco shipment the last week. China exchanges show slight improvement. The market closes quiet, with tendency uncertain.

Mexican Dollars—June 2d, 44¼; 3d, 44½; 4th, 44¼; 6th, 44; 7th, 44½; 8th, [illegible].

Other Metals

Quotations cover wholesale lots unless otherwise specified.

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 22@23c. per lb.; 22½c. for imports, duty paid.

Antimony—Chinese and Japanese brands, [illegible] W.C.C. brand, [illegible] per lb. Cookson's "C" grade, spot, [illegible]. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony (200 mesh), [illegible] per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, [illegible].

Bismuth—[illegible] per lb. [illegible]

Cadmium—[illegible] per lb. [illegible] quantities, $1.10@$1.25 per lb.

Cobalt—Metal, [illegible] per lb. [illegible]

Iridium—Nominal, [illegible] per oz.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz.

Palladium—$70 per oz.

Platinum—$75 per oz.

Quicksilver—Nominally, $46@$48 per 75-lb. flask. San Francisco wires $48.50.

[1]**Rhodium**—$150 per troy oz.

[1]**Selenium—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.**

[1]**Thallium Metal—Ingot, 99 per cent pure, $20 per lb.**

[1]**Tungsten Metal—Wire, $35@$60 per kilogram, according to purity and gage.**

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 45@55c. per long **ton** unit, f.o.b. Atlantic ports.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $7.45; Mesabi bessemer, 55 per cent iron, $7.20; Old Range non-bessemer, 51½ per cent iron, $6.70; Mesabi non-bessemer, 51½ per cent iron, $6.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5.80; old bed concentrates, 63 per cent, $6.70; Harmony, cobbed, 63 per cent, $6.70; new bed low phosphorus, 65 per cent, $9.50.

Manganese Ore — 25c. per unit, seaport; chemical ore (MnO_2) $55@$60 per gross ton, lump; $70@$75 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

Titanium Ores—Ilmenite, 52 per cent TiO_2, 1¾@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, [illegible], f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Zinc and Lead Ore Markets

Joplin, Mo., June 4—Zinc blende, per ton, high, $28.05; basis 60 per cent zinc, premium, $22.50; Prime Western, $21; fines and slimes, $17.50@$15; average settling price, all grades of zinc, $23.10.

Lead, high, $62.50; basis 80 per cent lead, $50; average settling price, all grades of lead, $51.91 per ton.

Shipments for the week: Blende, 4,252; lead, 1,483 tons. Value, all ores the week, $175,350.

Lead was lowered $5 again this week, with weak demand. Offerings for zinc blende resolved around $22.50 for the choicest ores and $21 for ordinary grades late this afternoon, with light demand, buyers asserting the market should be $20 basis according to metal prices. This is a drop of $2.50 per ton for zinc. The production, purchase, and shipments were close during May. Unless buying develops later today June will open with purchases below the production. The Athletic M. & S. Co. has closed down its Fort Smith smelter for wage adjustment.

Platteville, Wis., June 4—No shipments for the week. Shipments for the year: Blende, 11,461; lead, 910 tons. Shipped during the week to separating plants, 293 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,700@$3,000; No. 2, $1,200@$2,000; spinning **fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to** be added as export sales tax. Market dull; little buying and shipping.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) **$24@$30 in bags, car load lots; (off-color) $22@$26 in bags carload lots; all f.o.b. South Carolina** points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7 per long ton, f.o.b. Cartersville, Ga. Small lots sell for as low as $5.

Bauxite—High-grade French bauxite, $8@$12 per ton, Atlantic ports. American quotations the same. Consumers generally well supplied. Prices vary according to grade. Crude, unground, $16.50 per ton; ground, $22; calcined, ground, $35; unground, $45, f.o.b. plant.

Chalk—English, extra light, 5@5½c. Domestic light, 4½@5c.; heavy, 4@4½c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$10; **washed,** $10@$12; **powdered, $15@$20; bags** extra, **per net ton, f.o.b. mines,** Georgia; powdered **clay, $15@**$20, f.o.b. Virginia points. **Domestic lump, $10@$20; powdered, $25@$30; imported lump,** $15@$25, **f.o.b. Ameri**can **ports;** powdered, **$35@$45, f.o.b** New **York**

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b. New England points.

Feldspar—Crude, $7@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$25 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $15, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $32, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 7@7½c. per lb.; chip, 5½@6c.; dust, 3¼@4c. No. 1 flake, 6½c.; amorphous crude, ¾@2¼c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$2 per net ton; 1½ in., $1.50@$2. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead - Burned — $38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $6.75; 68 per cent, $6.25; 68@66 per cent, $6.

Pumice Stone—Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 14c., c.i.f. Atlantic seaport; furnace size, 14c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 12 @ 14c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$40, talcum powder grade. Southern talc, powdered, carload lots, $10@$14 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic — White arsenic, 6½c. per lb. in carload lots.

Sodium Nitrate—$2.85@$3 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $18@$20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; $33@$35 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.50@$1.75 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 15c. per lb. of chromium contained; 4 to 6 per cent carbon, 16@17c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $75@$80, f.o.b. furnace; resale, $90, delivered; English, $75@$80, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $30@$32, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $45@$50; 50 per cent, $75@$80; 75 per cent, $140@$185.

Ferrotungsten—Domestic, 70 to 80 per cent W, 50@55c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$5@$6 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 21.50c. per lb.; wire, 15c.

Lead Sheets—Full lead sheets, 8.25c.; cut lead sheets, 8½c. in quantity, mill lots.

Nickel Silver — 31½c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets 17¼c.; sheathing, 16¼c.; rods, ⅝ to 3 in., 14¼c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina, $35@$50 per ton, f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $60@$70 per net ton, shipping point; arches, keys, wedges, $75; splits, soaps, $85.

Fire Brick—First quality, 9-in. shapes $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $75@$80 per net ton; 9-in. arches, wedges and keys, $100; soaps and splits, $110.

Silica Brick—9-in., per 1,000: $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, June 7, 1921

The steel market has grown duller than was believed possible, being more depressed now than it was expected to become in July, traditionally the dullest month of the year. Such buying as occurs is chiefly in carload lots.

The great majority of steel buyers expect prices to be lower within a short time, say by Aug. 1, but the manner in which prices will go down is not outlined. The statement is not confirmed as to there being a general policy of cutting, but the trend is indicated by a Corporation wire subsidiary, which has met a $3 price on nails, 25c. under the former market.

Steel ingot production is at the rate of about 25 per cent of capacity, or about half what was considered the minimum percentage possible before the war. The extreme lightness of production encourages the belief that there will be some sort of revival in August.

Pig Iron—Bessemer iron has sold in carload lots at $23, Valley, this replacing the former nominal quotation of $24. Basic can be done at $21.50, or 25c. decline. Foundry remains quotable at $23, probably because no inquiry has disturbed the quotation. W. P. Snyder & Co. report average prices on actual transactions in Valley iron in May at $24.25, Valley, for bessemer, and $21.875 for basic.

Coke

Connellsville—Furnace, $3.25@$3.75; foundry, $4.50@$5.

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[1] Foote Mineral Co., Philadelphia, Pa.

War Finance Corporation Act

Government Has Issued a Circular of Information for Loan Applicants

A CIRCULAR has been issued by the War Finance Corporation, Washington, D. C., outlining, in a general way, the requirements of the corporation regarding advances to American exporters, banks, and bankers. It recites the law, gives the procedure that should be followed in making application for advances, and shows the papers, documents, and other evidence required by the corporation. Copies may be obtained free by applying to the corporation, or to the nearest Federal Reserve Bank.

Section 21 of the War Finance Corporation Act, as amended, the provisions of which were the subject of the joint resolution of Congress reviving the activities of the corporation, is as follows:

Sec. 21. (a) That the corporation shall be empowered and authorized, in order to promote commerce with foreign nations through the extension of credits, to make advances upon such terms, not inconsistent with the provisions of this section, as it may prescribe, for periods not exceeding five years from the respective dates of such advances:

(1) To any person, firm, corporation, or association engaged in the business in the United States of exporting therefrom domestic products to foreign countries if such person, firm, corporation, or association is, in the opinion of the board of directors of the corporation, unable to obtain funds upon reasonable terms through banking channels. Any such advance shall be made only for the purpose of assisting in the exportation of such products, and shall be limited in amount to not more than the contract price therefor, including insurance and carrying or transportation charges to the foreign point of destination if and to the extent that such insurance and carrying or transportation charges are payable in the United States by such exporter to domestic insurers and carriers. The rate of interest charged on any such advance shall not be less than 1 per centum per annum in excess of the rate of discount for ninety-day commercial paper prevailing at the time of such advance at the Federal Reserve bank of the district in which the borrower is located; and

(2) To any bank, banker, or trust company in the United States which after this section takes effect makes an advance to any such person, firm, corporation, or association for the purpose of assisting in the exportation of such products. Any such advance shall not exceed the amount remaining unpaid of the advances made by such bank, banker, or trust company to such person, firm, corporation, or association for such purpose.

(b) The aggregate of the advances made by the corporation under this section remaining unpaid shall never at any time exceed the sum of $1,000,000,000.

(c) Notwithstanding the limitation of Section 1, the advances provided for by this section may be made until the expiration of one year after the termination of the war between the United States and the German government as fixed by proclamation of the President. Any such advance made by the corporation shall be made upon the promissory note or notes of the borrower, with full and adequate security in each instance by indorsement, guaranty, or otherwise. The corporation shall retain power to require additional security at any time. The corporation in its discretion may upon like security extend the time of payment of any such advice through renewals, the substitution of new obligations, or otherwise, but the time for the payment of any such advance shall not be extended beyond five years from the date on which it was originally made.

Latest Transvaal Gold Production

The following table summarizes Transvaal gold production since 1917:

[illegible]

	1921	1920	1919	1918	1917
January	[illegible]	[illegible]	[illegible]	[illegible]	782,634
February	[illegible]	[illegible]	[illegible]	[illegible]	721,121
March	[illegible]	[illegible]	[illegible]	[illegible]	787,094
April	[illegible]	[illegible]	[illegible]	[illegible]	742,778
May		[illegible]	[illegible]	[illegible]	[illegible]
June		[illegible]	[illegible]	727,696	759,724
July		[illegible]	[illegible]	[illegible]	757,890
August		702,083	[illegible]	[illegible]	[illegible]
September		682,173	[illegible]	[illegible]	738,231
October		662,472	723,722	679,764	[illegible]
November		[illegible]	677,970	[illegible]	[illegible]
December		[illegible]	[illegible]	641,245	722,419

Movements of Ores and Metals

Imports and exports of the more important metals and ores as reported by the Bureau of Foreign and Domestic Commerce for April, 1921, and the figures for April of 1920 as finally revised, are as follows:

IMPORTS, APRIL 1920 AND 1921

(In Pounds, Unless Otherwise Stated)

	April, 1920	April, 1921
Antimony ore, contents	19,457	26,400
Antimony matte, regulus or metal	2,062,022	5,223,381
Brass, fit only for remanufacture	3,788,761	612,939
Copper:		
Ore, contents	4,508,154	2,086,083
Concentrates, contents	1,498,321	3,647,147
Matte, regulus, etc., contents	1,759,982	805,775
Imported from (in part):		
Canada	1,954,266	252,677
Mexico	2,775,763	2,636,950
Cuba	125,440	1,375,104
Chile	278,563	832,388
Spain	122,090	274,870
Unrefined, black blister, etc.	14,182,933	10,109,145
Refined, in bars, plates, etc.	5,677,419	19,070,079
Old, etc., for remanufacture	38,542	389,339
Composition metal, copper chief value	146,221	
Lead:		
Ore, contents	4,667,636	988,534
Bullion, contents	10,212,502	11,380,892
Imported from (in part):		
Canada	809,928	496,181
Mexico	10,616,142	11,562,680
Chile	685,590	234,627
Pigs, bars and old	962,474	4,558,440
Imported from (in part):		
Spain		2,199,302
Mexico	958,889	2,359,138
Canada	3,240	
Manganese ore, long tons	35,088	47,260
Imported from (in part):		
Cuba, long tons	3,030	
Brazil, long tons	22,035	31,350
British India, long tons	2,150	14,910
Tungsten ore, long tons	29	108
Pyrites, long tons	21,882	24,059
Imported from:		
Spain, long tons	19,005	21,609
Canada, long tons	77	
Tin ore, long tons	1,394	607
Tin bars, blocks, pigs, etc.	10,345,130	2,483,655
Imported from (in part):		
United Kingdom	937,601	605,203
Straits Settlements	6,930,919	1,814,441
Hongkong	781,314	43,838
Zinc:		
Ore, contents	6,993,054	88,283
Imported from:		
Canada	34,935	
Mexico	4,510,839	88,283
Blocks, or pigs, and old	1,718	6,269,176

EXPORTS OF COPPER, LEAD AND ZINC

(In Pounds)

	April, 1920	April, 1921
Copper:		
Ore, contents	105,400	167,900
Unrefined, black, blister, etc.	1,412,318	
Refined, in ingots, bars, etc.	58,112,481	40,256,030
Exported to (in part):		
France	10,889,955	10,800,273
Germany	14,003,294	15,837,896
Netherlands	2,727,689	1,166,600
United Kingdom	8,798,829	7,976,634
Canada	2,210,644	1,541,713
Composition metal, copper chief value	17,870	68
Old and scrap	1,220	40
Pipes and tubes	193,687	184,046
Plates and sheets	678,275	342,813
Wire, except insulated	3,949,038	711,858
Lead:		
Pigs, bars, etc.:		
Produced from domestic ore	[illegible]	136,641
Produced from foreign ore	[illegible]	[illegible]
Exported to (in part):		
Canada	667,128	18,983
Argentina	[illegible]	224,077
Japan	448,000	224,000
United Kingdom	1,288,000	
Zinc:		
Dross	314,461	
Produced from domestic ore	[illegible]	[illegible]
Produced from foreign ore	1,698,670	
Exported to (in part):		
France	9,837	2,618
Japan	168,059	112,000
United Kingdom	[illegible]	
[illegible]	[illegible]	388,412

COMPANY REPORTS

Granby Consolidated Shows Deficit

A report of operations of the Granby Consolidated Mining, Smelting & Power Co., Ltd., for 1920 states that 25,744,327 lb. of copper, 1,054 oz. of silver, and 9,481 oz. of gold were produced. Copper totaling 19,464,796 lb. was sold at an average price of 17.85c. per lb. Cost of production was 15.94c. per lb. f.o.b. smelter. Comparative income account follows:

	1920	1919
Gross receipts	$6,684,123	$6,561,099
Gross operating cost	6,323,814	6,660,054
Net operating profit....	$360,309	(*a*) $98,955
Interest, etc.	507,775	120,884
General expenses and taxes	539,546	764,570
Deficit....	$687,012	$984,409
Dividends....		1,312,537
Surplus.......	497,298	1,124,409

(*a*) Loss.

Tonopah Extension Dividends, $258,542

A report of operations of the Tonopah Extension Mining Co. for the fiscal year ending March 31, 1921, states that 1,150,963 oz. of silver and 11,324.4 oz. of gold were produced in the period covered by the report. Income account follows:

Mining....	$573,411.81	Sales of silver and gold	$1,283,520.72
Milling....	365,544.73	Less treatment and transportation charges	24,056.11
Depreciation of plant...	52,673.76		
Administrative expenses	34,354.54		$1,259,464.61
Balance carried down...	229,336.57	Less bullion in process—decrease	4,143.20
	$1,255,321.41		$1,255,321.41

Balance brought down	229,336.57
Interest received on investments..........	32,279.22
Net inome for year.........	$261,615.79

Surplus March 31, 1920, was $1,693,726.88. Adding net income, $261,615.79, gives a total of $1,955,342.67. Deducting depletion, $197,633.28, and dividends totaling $258,542.48, leaves a surplus March 31, 1921, of $1,499,166.91. Capitalization, 2,000,000 shares of $1 par; 1,292,800 shares outstanding.

Silver King Coalition Surplus Increased

A report of operations of the Silver King Coalition Mines Co. for 1920 states that 10,604,650 lb. of lead, 629,929 oz. of silver, 1,385.5 oz. of gold, and 230,619 lb. of copper were produced in the year. Profit and loss account follows:

Earnings		
Ore sales....	$1,006,687.27	
Lessees' royalties....	36,723.92	
Interest on bonds....	3,820.37	
Miscellaneous income....	8,809.99	
Total income....		$1,056,041.55
Expenses		
Development....	$78,345.45	
Ore extraction....	208,774.23	
Drainage....	6,956.03	
Haulage and hoisting....	114,177.82	
Milling....	59,125.34	
Marketing expense....	26,929.85	
General surface expense....	21,566.58	
General mine expense....	41,882.70	
Mine concentrators....	6,488.90	
Miscellaneous supplies....	227.59	
Taxes....	26,698.04	
Insurance....	3,771.64	
Total operating cost at mine....	$594,944.17	
Salaries, office administration and general expense at Salt Lake City....	18,019.87	
Legal expense, personal injuries, donations, etc....	31,988.11	644,952.15
Net profit before depreciation....		$411,089.40
Less depreciation....		52,729.79
Net profit to surplus....		$358,359.61

Surplus Jan. 1, 1920, was $164,106.45; less 1917 income tax of $10,700.32 and plus profit for 1920 of $358,369.61 gave surplus Dec. 31, 1920, of $511,765.74. No dividends were paid.

Mother Lode Coalition Mines Co.

A report of operations of the Mother Lode Coalition Mines Co. for 1920 states that 8,737.26 tons of copper and 134,943 oz. of silver were produced, at a cost of 8.66c. per lb. delivered, for the copper, after charging depreciation, taxes, and crediting silver, but excluding depletion. Income account follows:

Operating revenue (Alaska)		
Copper sold 13,803,911 lb @ 16.932c		$2,337,226.53
Silver sold — 133,775.35 oz @ 1.0079c		134,831.24
		$2,472,057.77
Operating cost		
Mining and milling	$424,397.93	
Treatment, refining and freight	659,521.15	
Selling and delivery charges....	123,820.94	
General expense....	12,863.85	1,220,603.87
		$1,251,453.90
Miscellaneous income at mine		2,415.54
Profit on metals sold..		$1,253,869.44
Interest....		4,517.50
Total income for year....		$1,258,386.94
Deduct		
Interest on first mortgage 6 per cent ten-year gold bonds....	$60,000.00	
Taxes	29,737.07	89,737.07
Balance to undivided profits		$1,168,649.87
Undivided Profits		
Debit balance Dec. 31, 1919.	$50,601.17	
Income for year, as above...	1,168,649.87	
		$1,118,048.70
Depreciation of construction and equipment	$108,621.92	
Depletion for year	1,102,242.28	1,210,864.20
Debit balance of undivided profits		$92,815.50

Capitalization, 2,500,000 shares, no par value, valued at $16,822,274.21; first mortgage 6 per cent, ten-year sinking fund gold bonds, $1,000,000.

North Star Mines' Deficit Increases

A report of the operations of the North Star Mines Co. for 1920 indicates that a deficit of $51,415.19 was incurred by the year's operations.

RECEIPTS		
Balance at end of 1919....		$973,069.61
Production		
North Star mine, California....	$718,286.33	
Champion mines (tons crushed, 17,626)...	102,843.17	
Total production....		821,129.50
Champion mines account....		10,534.25
Interest and dividends received....		39,786.85
Total....		$1,844,520.21
DISBURSEMENTS		
Operating expenses		
North Star mine....		$510,319.79
Development expenses		
North Star mine (7,285 ft.)....		135,180.28
Total operating and development....		$645,500.07
Champion mines		
Operating expenses....	$109,338.19	
Development expenses....	3,622.84	
	$112,961.03	
Less old material salvaged....	13,465.79	99,495.24
Improvement		
North Star....		13,223.70
Property purchase....		1,363.08
Investment accounts, profit and loss		11,685.00
Dividend (No. 57), 3 per cent....		75,000.00
Balance, Dec. 31, 1920		
Cash....	$254,615.58	
Investment account....	589,657.54	
Bills receivable....	55,000.00	
Materials and supplies....	98,980.00	998,253.12
Total....		$1,844,520.21

Surplus account deficit on Dec. 31, 1919, was $321,751.55; on Dec. 31, 1920, $373,166.74, derived as follows: Production for the year, $821,129.50, plus interest and dividends ($36,786.85), amounted to $860,916.35; deducting operating and development expenses ($744,995.31), investment account loss ($11,685), depletion ($122,800), and depreciation ($32,851.23), gave a net loss of $51,415.19 carried to surplus.

MINING STOCKS

Week Ended June 4, 1921

Stock	Exch.	High	Low	Last	Last Div.	
			COPPER			
Adventure	Boston	....		50		
Ahmeek	Boston	52¾	51½	51½	Sept '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	7/16	[illegible]	[illegible]		
Allouez	Boston	21	21	21	Mar '19	1.00
Anaconda	New York	41	39½	40	Nov. '20, Q	1.00
Arcadian Consol	Boston	2½	2¼	2¼		
Ariz. Com'l	Boston	9¼	8½	8½	Oct. '18,	.50
Big Ledge	N. Y. Curb	[illegible]	[illegible]	[illegible]		
Bingham Mines	Boston	10	9½	10	Sept '19, Q	.25
Calumet & Arizona	Boston	....	....	50	Mar. '21, Q	.50
Calumet & Hecla	Boston	252	248	248	June '20, Q	5.00
Canada Copper	N. Y. Curb	....		*13		
Centennial	Boston	7⅜	7	7¼	Dec '18, SA	1.00
Cerro de Pasco	New York	28½	27½	27½	Mar '21, Q	.50
Chile Copper	New York	11½	11	11¼		
Chino	New York	25	23½	24	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake			*26½		
Con. Arizona	N. Y. Curb	....		[illegible]	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	..		1¼		
Copper Range	Boston	35	34	34½	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*31	28	*31		
Davis-Daly	Boston	6⅞	6½	6¾	Mar '20, Q	.25
East Butte	Boston	9¼	9	9	Dec. '19, A	.50
First National	Boston Curb	*71	*52	*60	Feb. '19, SA	.15
Franklin	Boston	2½	2½	2½		
Gadsden Copper	N. Y. Curb	....		*25		
Granby Consol	New York	22	22	22	May '19, Q	1.25
Greene-Cananea	New York	23¾	23½	23¾	Nov. '20, Q	.50
Hancock	Boston	3½	3	3		
Howe Sound	N. Y. Curb	2¼	2¼	2¼	Jan. '21, Q	.05
Inspiration Consol	New York	35	33½	34½	Oct. '20, Q	1.00
Iron Cap	Boston Curb	....		6¼	Sept. '20, K	.25
Isle Royale	Boston	21	21	21	Sept. '19, SA	.50
Kennecott	New York	20½	20	20½	Dec. '20, Q	.50
Keweenaw	Boston	....		1⅝		
Lake Copper	Boston	3¼	2½	2½		
La Salle	Boston	2	2	2		
Magma Chief	N. Y. Curb			21		
Magma Copper	N. Y. Curb	20¼	20¼	20¼	Jan. '19, Q	.50
Majestic	Boston Curb	*8	*8	8		
Mason Valley	Boston	1½	1½	1½		
Mass Consolidated	Boston	2¼	2¼	2¼	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	4¼	4	4¼		
Miami Copper	New York	23	21½	22½	May '21, Q	.50
Michigan	Boston	2	2	2		
Mohawk	Boston	52½	51	51	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5½	5	5¼		
Nevada Consol.	New York	11½	11	11½	Sept '20, Q	.25
New Baltic	Boston Curb			3		
New Cornelia	Boston	15½	15	15	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....		*5		
North Butte	Boston	10½	10½	10½	Oct. '18, Q	.25
North Lake	Boston	....		¼		
Ohio Copper	N. Y. Curb			[illegible]		
Old Dominion	Boston	22½	21	21	Dec. '18, Q	1.00
Osceola	Boston	30	28	28	June '20, Q	.50
Phelps Dodge	Open Mar.	†160	†150		Apr. '21, Q	1.00
Quincy	Boston	39½	39	39	Mar '20, Q	1.00
Ray Consolidated	New York	14½	13½	13½	Dec '20, Q	.25
Ray Hercules	Boston Curb			*35		
[illegible]	Boston	38	38	38	June '20, K	2.00
Seneca Copper	Boston	....		16½		
[illegible]	Boston	0.90	0.90	0.90	Nov. '17, Q	.25
[illegible]	New York	6½	6¼	6½	Jan. '20, Q	.25
[illegible]	Boston			1		
[illegible]	Boston	4½	3½	3½	Apr. '17,	1.00
[illegible]	Boston	1½	1¼	1½		
[illegible]	New York	9	8½	8½	May '18, I	1.00
[illegible]	Boston	[illegible]	*60	*64	May '13,	.10
[illegible]	Boston Curb	[illegible]	25	25½	May '21, Q	.25
[illegible]	Boston	4	4	4	Sept. '18,	.25
[illegible]	New York	[illegible]	[illegible]	52½	[illegible] '21, Q	1.00
[illegible]	Boston	[illegible]	[illegible]	1½	Dec. '17,	.30
[illegible]	Boston	[illegible]	[illegible]	1½		
[illegible]	Boston			*40		
[illegible]	Boston	11	11	11		
			NICKEL-COPPER			
[illegible]	New York	[illegible]	[illegible]	[illegible]	Mar '19,	.50
[illegible]	New York			[illegible]	[illegible]	1.50
			LEAD			
[illegible]	New York	[illegible]	76	[illegible]	Mar. '21, Q	1.50
[illegible]	[illegible]			[illegible]	[illegible]	1.75
[illegible]	[illegible]			12	[illegible] '21, Q	.25
[illegible]	[illegible]			[illegible]	Dec. '15,	.05
			ZINC			
[illegible]	New York	[illegible]	[illegible]	[illegible]	[illegible]	1.00
[illegible]	[illegible]			[illegible]	[illegible]	1.50
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.25
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
			GOLD			
Alaska Gold	New York	¼	[illegible]	⅝		
Alaska Juneau	New York	1½	1¼	1½		
Carson Hill	N. Y. Curb	14¼	14½	14½		
Cresson Consol. G.	N. Y. Curb	1 15/16	1 13/16	1⅞	June '20, Q	$0.10
Dome Extension	Toronto			*75		
Dome Mines	New York	18¼	18	18¼	Apr. '21, Q	.25
Golden Cycle	Colo. Springs	‡...	....	*74	Dec. '20, Q	.02
Goldfield Consol.	N. Y. Curb	*7	*6	*7	Dec. '19,	.05
Hollinger Consol.	Toronto	7.27	7.15	7.15	Feb '21, M	.05
Homestake Mining	New York	57	57	57	Sept '19,	.50
Kirkland Lake	Toronto	*48½	*47½	*47½		
Lake Shore	Toronto	1.20	1.20	1.20	Jan '21, K	.02
McIntyre-Porcupine	Toronto	1.97	1.94	1.94	Jan '21, K	.05
Porcupine Crown	Toronto	*23	*21	[illegible]	July '17,	.03
Portland	Colo. Springs	‡		[illegible]	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*4	*3	3	May '19,	.05
Silver Pick	N. Y. Curb	*5	*4	*5		
Teck Hughes	Toronto	*14½	*14½	14½		
Tom Reed	Los Angeles	‡...	....	*80	Dec. '19,	.02
United Eastern	N. Y. Curb	2 9/16	2 9/16	2 9/16	Apr '21, Q	.15
Vindicator Consol.	Colo. Springs	‡...	....	*34½	Jan. '20, Q	.01
West Dome Consol.	Toronto	*8	*8	*8		
White Caps Mining	N. Y. Curb	....	....	*7		
Yukon Gold	N. Y. Curb	1⅛	1	1	June '18,	.02½
			SILVER			
Arizona Silver	Boston Curb	*28	*24	*26	Apr. '20, M	.03
Batopilas Mining	New York	....	....	¾	Dec. '07, I	.12½
Beaver Consol.	Toronto	*32⅛	*32	*32	May '20, K	.03
Coniagas	Toronto	....		1.70	May '21, Q	.12½
Crown Reserve	Toronto	*12	11	*11	Jan. '17,	.05
Kerr Lake	Boston	3¼	3	3	Apr. '21, Q	.12½
La Rose	Toronto	....		*19	Apr '18,	.02
McKinley-Dar.-Sav.	Toronto	*18	*18	*18	Oct '20, Q	.03
Mining Corp. Can.	Toronto	....	....	1.08	Sept '20, Q	.12½
Nipissing	N. Y. Curb	4½	4¼	4½	Apr. '21, Q	.15
Ontario Silver	New York			5	Jan '19, Q	.50
Ophir Silver	N. Y. Curb	....	....	2	Jan. '12,	.10
Peterson Lake	Toronto	*5¼	*5¼	*5¼	Jan '17,	.01½
Temiskaming	Toronto			*18	Jan. '20, K	.04
Trethewey	Toronto	*17	*17	*17	Jan. '19,	.05
			GOLD AND SILVER			
Atlanta	N. Y. Curb	*1½	*1½	*1½		
Barnes-King	Butte	‡		1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*70	*58	*63		
Cashboy	N. Y. Curb	*6	*4	*5		
El Salvador	N. Y. Curb	....	....	¼		
Jim Butler	N. Y. Curb	*10	*8	*9	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*7	*4½	*5	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	¼		
MacNamara M.& M.	N. Y. Curb	*16	*15	*16	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10	†9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1⅛	1 1/16	1⅛	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1⅛	1 1/16	1⅛		
Tonopah-Extension	N. Y. Curb	1½	1⅜	1½	Apr. '21, Q	.05
Tonopah Mining	N. Y. Curb	1⅜	1¼	1 5/16	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	1	15/16	15/16	Dec. '19, SA	.05
			SILVER-LEAD			
Caledonia	N. Y. Curb	*10	*8½	*9½	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	‡		1.10	Dec. '21,	.15
Chief Consol.	Boston Curb	2½	2½	2½	May '21, Q	.05
Consol. M. & S.	Montreal	16½	16	16	Oct. '20, Q	.62½
Daly Mining	Salt Lake	‡		1.50	July '20, Q	.10
Daly-West	Boston			3	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	....	....	2¼	Apr. '21, K	.05
Electric Point	Spokane	*7½	*7	*7	May '20, SA	.03
Federal M. & S.	New York			6¾	Jan. '09,	1.50
Federal M. & S., pfd.	New York	25	24½	24½	Mar. '21, Q	1.00
Florence Silver	Spokane			*12½	Apr. '19,	.01½
Grand Central	Salt Lake	‡		*07½	June '20, K	.03
Hecla Mining	N. Y. Curb	4	3¾	3¾	Mar. '21, Q	.15
Iron Blossom	N. Y. Curb			*20	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	‡		3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*7½		*6½		
Prince Consol.	N. Y. Curb	*37½	[illegible]	*37½	Nov. '17,	.02½
Rambler-Cariboo	Spokane	[illegible]	[illegible]	*4	Feb. '19,	[illegible]
Rex Consol.	N. Y. Curb	*10		*10		
South Hecla	Salt Lake	‡		[illegible]	Sept '19, K	[illegible]
[illegible]	N. Y. Curb	[illegible]		[illegible]	Oct. '17,	
[illegible]	Spokane	[illegible]		1.85	Jan. '21, K	
Tintic Standard	Salt Lake	‡		[illegible]	June '20, Q	
Utah Apex	Boston	[illegible]		2½	Nov. '20, K	
[illegible]	N. Y. Curb	[illegible]		[illegible]	Nov. '17,	
			QUICKSILVER			
[illegible]	Boston	[illegible]		*50	Jan. '19,	.25
			VANADIUM			
[illegible]	New York	31¼	[illegible]	30	Jan. '21, Q	1.00
			ASBESTOS			
[illegible]	Montreal	[illegible]		[illegible]	[illegible] '21, Q	1.50
Asbestos Corp., pfd.	Montreal	...		[illegible]	[illegible] '21, Q	1.75
			MINING, SMELTING AND REFINING			
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] '21, Q	1.00
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] '21, Q	1.75
[illegible]	[illegible]			[illegible]	[illegible] '21, Q	1.50
[illegible]	New York	[illegible]	[illegible]	[illegible]	[illegible] '21, Q	.50
[illegible]	Boston			[illegible]	[illegible] '21, Q	[illegible]

[illegible] gales ‡ [illegible]

INDUSTRIAL NEWS

Portable Column Hoists

Small Type of Compressed-Air or Steam-Driven Hoisting Machines Form Necessary Part of Mine Equipment

The demand for a small and powerful hoist which would be suitable for mine use has resulted in the development of several types and sizes of portable machines that are operated by compressed air or steam and can be easily set up on the ordinary drill column. Owing to the conditions imposed on these machines while in service it has been necessary to combine durability with portability and also to provide a simple means of operation so that the work to be done could be performed by unskilled labor if necessary.

In the mine the uses of such types of hoists are many: The hoisting of ore, rock, timber, tools and machines in raises, winzes and shafts; the hauling of tram cars and the bailing of water. In mills there is considerable use for the portable hoists, and in such work as the moving of stamps and other machinery they will be found invaluable. They have been used to a considerable extent about quarries for haulage and other purposes.

In this review a number of types are described in a general way and a comparative table showing the essential specifications of each is given. The machines are as follows: The "Little Tugger," manufactured by Ingersoll-Rand Co., New York; "Turbinair," Sullivan Machinery Co., Chicago; "Waughoist," Denver Rock Drill Manufacturing Co., Denver; "Little Giant Universal," Chicago Pneumatic Tool Co., New York; "Leadville," Hendrie & Bolthoff, Denver, and the "Holman" Stretcher Bar hoist, which is supplied by the Mine & Smelter Supply Co., Denver.

The "Little Tugger" engine is of the square piston type and gives four impulses per revolution. There are no dead centers and the machine will start in any position. The engine, which is reversible, is controlled by a small lever, which, when thrown forward, causes the hoist to wind over, and a reverse movement secures action in the opposite direction. This arrangement can also be used for braking purposes and is as safe as the brake itself. When the operator releases the throttle it returns automatically to the central position, shutting off the air and stopping the hoist. The engine operates the drum through the medium of a clutch and gears, lever controlled. The drum is entirely free when the gears are released. This feature is especially valuable where a hoist is to be used in locations where assistance is not at hand, as one man can carry the rope any distance without the necessity of having another man at the hoist to pay out the rope under power. The gears are inclosed in a dust-proof case and run in oil, which also lubricates the various bearings. Lubrication is provided by means of an automatic heart-beat lubricator, which operates by the pulsation of air at alternate movements of the piston.

HAULING CARS WITH "LITTLE TUGGERS"

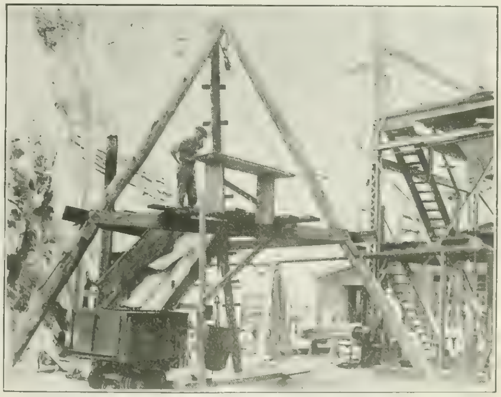
The "Turbinair" hoist consists of a cylindrical drum mounted on a steel frame and completely inclosing the operating mechanism. This comprises a Sullivan "Turbinair" motor and reduction gearing which drives the drum shell. The motor consist of two cylindrical rotors, which are provided with right and left helical flutes or vanes converging to spur teeth in the center. The two rotors mesh together as they revolve under the influence of the incoming air, and this action secures higher economy, long life, and sustained efficiency. The air is used expansively.

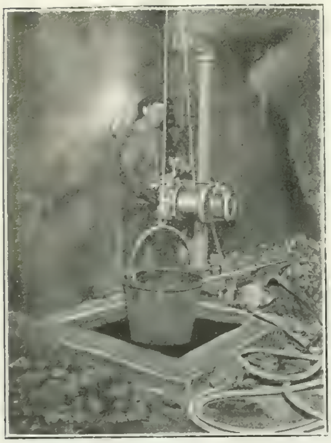
The drum is provided at one end with a hand friction clutch, which permits variable control in hoisting. At the other end is a friction brake by which the hoist is controlled while lowering or paying out the rope from the drum.

The air is admitted at the axis of the drum through a hollow shaft. Ball bearings are employed throughout, oiled by grease plugs, and the engine and gearing are lubricated by an automatic oiler.

The principal parts of the "Waughoist" engine, which is of the rotary-reciprocating type, are the motor housing, the distributor, the cylinder block, the spider, the spider shaft, and the pistons. The entire engine revolves within the motor housing, an oil- and air-tight casting, which protects the engine from the atmosphere and also

"TURBINAIR" HOIST USED IN SLUSHING


SHAFT SINKING WITH A "WAUGHOIST"



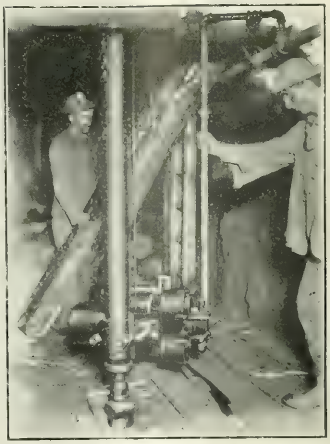
LEADVILLE HOIST USED IN SINKING

serves as an oil reservoir. The distributor, through which the air is supplied to the cylinders, serves not only as a distributor of power but as a support for the cylinder block as well. Fixed to the spider shaft is the spider, a drum-shaped casting which revolves within the motor housing and within which the cylinder block also revolves. Around the inner side of the spider four hardened and ground steel tracks are mounted on which the piston rollers run. The spider hub is mounted on a ball bearing. The cable drum revolves upon the spider shaft and a clutch pinion is mounted on the small end of the spider shaft so that the cable drum gearing can be disconnected from the engine and the drum permitted to run free where desired. Within the four cylinders are four pistons which, as the cylinder block revolves, work in the cylinders and at the same time roll the piston rollers along the track plates on the inner side of the spider, thus practically eliminating sliding surface friction.

The "Little Giant Universal" hoist consists of two double-acting oscillating cylinders set at right angles in a closed case. The cylinders are automatically adjustable to their seats, being held in place by heavy springs. The motor drives the hoist through a chain of gears. The air is controlled by a slide valve and the direction of the rotation is determined by the direction in which the valve is thrown by the operating handle. The valve is self-closing and returns to the neutral position when the handle is released. The load is lowered on the engine by reversing, and the speed of descent or "paying out" is controlled by the operator on the throttle. The throttle is held in a neutral position by heavy centering springs that prevent accidental opening, and when the throttle is closed the "plugged" motor acts as an effectual brake and a load can be held suspended without danger of creeping.

The engine used in the Model "B" "Leadville" type is inclosed and is reversible by a slight movement of the throttle. In effect it is equivalent to a pair of double-cylinder, double-acting reciprocating engines, and hence cannot get on center. It is of the square piston type, containing but three movable parts—two pistons and the crank pin. The covers are fitted with ground joints, no gasket is used, and

HOLMAN HOIST ON A WINZE



A "LITTLE GIANT" HOISTING TIMBER

there are no stuffing boxes or glands. The brake consists of a powerful double-acting steel band, lined with "Raybestos." The main gear is bolted to the drum, and the engine shaft is supported by a long bronze sleeve, oiled automatically from the engine. The drum is mounted on the exterior of this sleeve. The flywheel carries the sliding pinion for releasing the drum and a spring ball catch holds it in either position.

In general appearance and construction Model 5 is similar to the Model "B," although the former is of greater capacity and the increase in size has permitted some change in details.

The Holman Stretcher Bar hoist differs from the other types which have been described, in that the driving mechanism is uninclosed. An ordinary type of cylinder is employed, and this is attached to a frame, which also supports the drum, gearing, and other complementary parts. The frame may be bolted to a column in the same manner as that employed in other types of portable hoists. Three designs are furnished. One makes use of a single cylinder and the two others are provided with two cylinders, one on either side of the drum and equidistant from the center of the drill column.

[illegible] DETAILS OF VARIOUS TYPES OF DRILL COLUMN HOISTS

[illegible]	Ingersoll-Rand [illegible] [illegible]	Ingersoll-Rand [illegible] [illegible]	[illegible]	Denver Rock Drill Waugh[illegible]	Chicago Pneumatic Little Giant	Hendrie & Bolthoff Leadville Model "B"	Hendrie & Bolthoff Leadville Model 5	Mine and Smelter Holman Stretcher Bar Hoist [illegible]	Mine and Smelter Holman Stretcher Bar Hoist Double Cylinder	Mine and Smelter Holman Stretcher Bar Hoist Double Cylinder
[illegible]	2	1½		[illegible]	2	2½	4½	[illegible]	4	6
[illegible]	4	[illegible]	3½		6	[illegible]	6	[illegible]	6	7½
[illegible]	7	1½	[illegible]		8	5	7	[illegible]	7	9
[illegible]	3	[illegible]			2½	3½	3½		2½	3
[illegible] lb.	[illegible] 4,000	[illegible]	⅝-in. 500	⅝-in. 1,000 (c)	[illegible] 325	½-in. 500	½-in. 1,080	[illegible] 200	⅝-in. 200	⅝-in. 200
lb.	1,000 [illegible]	[illegible]	[illegible]	[illegible] 2,000 [illegible]	[illegible] 1,000 [illegible]	700 [illegible]	1,200 [illegible]	[illegible]	650 [illegible]	1,000 [illegible]
[illegible]	4½	4½	3½	4-4½	4½	4½	4½		4½	4½
[illegible]					1	¾	1			
[illegible]	285	150	[illegible]	335	300	200	360	[illegible]	430	800
Length, in.	31	31	22	24	33	25½	28			
Width, in.	16	21	[illegible]	17	17	13	16			
Height, in.	20	21	[illegible]	19	19	13½	18			
[illegible]			160	68-143						
[illegible]				1 [illegible]						
[illegible]				18 to 1, 27 to 1	17 to 1			[illegible]	5 to 1	5 to 1
[illegible]					2½			[illegible]	3	4
Length of stroke, in.					2½			[illegible]	5	4½

[illegible] Rope speed [illegible] 80 lb. [illegible] pressure. [illegible] Rope speed 100 ft. per min. 80 lb. air or steam pressure. (c) At 100 lb. air pressure. [illegible] Rope speed 103 ft. per min. 80 lb. air pressure. [illegible] Rope speed 66 ft. per [illegible] Rope speed 100 ft. per min. 80 to 100 lb. air pressure. [illegible] Rope speed 70 ft. per min. 80 lb. air pressure.

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Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
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Support the Mines Department Bill

THE BILL for a Department of Mines which has been introduced in the Senate by Senator Nicholson, of Colorado, provides that the proposed department shall cover all the mining and quarrying industries, including oil and gas, and that it shall cover the exploring, surveying, mining, treatment, and marketing of the metals or minerals. When, however, these products of the mines pass from the raw into the manufactured state they will pass out of the field of the Department of Mines and enter that of the Department of Commerce. Four bureaus and three divisions, each responsible directly to the Secretary, are provided: a Bureau of Mineral Technology, a Bureau of Mining and Applied Geology, a Bureau of Mineral Markets, and a Bureau of the Public Mineral Domain; a Division of Mineral Statistics, a Division of Publications, and a Division of Accounting and Disbursing.

The first two bureaus represent the present Bureau of Mines and the Geological Survey respectively, only with somewhat changed names, more appropriate to the field which they actually cover, and the real object of their organization. The Bureau of Mineral Markets covers the marketing of the products of the mines, and corresponds with the Bureau of Markets of the Agricultural Department, a department quite analogous to the proposed Mines Department. The Bureau of the Public Mineral Domain is essentially the present Land Office of the Interior Department, practically all of whose activities are concerned either directly or indirectly with the mineral lands of the public domain.

The three divisions are designed to perform the general functions which will serve all the bureaus jointly. All will need statistics, publications, and accounting, and a considerable administrative saving will be obtained by joining the work of all the bureaus in each of these particulars under one head.

The organization proposed leaves intact the organization and personnel of the Bureau of Mines and the Geological Survey as they exist; it creates an industrial or economic bureau to fill the gap which has been so acutely felt in the Government; it removes the longstanding difference between the Geological Survey and the Bureau of Mines as to who shall handle mineral statistics (which was recently in danger of being terminated by this activity being taken over by the Commerce Department), through the creation of an independent division of mineral statistics, to serve not only these two bureaus but the proposed Bureau of Mineral Markets as well.

The new department would entail little or no new expense on the Government. The only new feature would be the sorely needed Bureau of Markets, and part of this expense would be saved by the economies of merging the Statistics and Publications under one head.

A Department of Mines would give a home in the Government to an industry which provides by far the greater part of all the freight on our railroads, and which is one of the two great basic extractive industries of the greatest mining country of the world (the other, of course, being agriculture). Strange, indeed, with the overwhelming importance of this industry to the country, that no adequate recognition of it has ever been made in Washington. Producers of coal, of iron, of petroleum, copper, lead, silver, gold, and the dozens of other mineral industries, will have a complete organization devoted to their interests, and representing in a rounded way their business from prospecting to cashing in.

We think the mining industries—all of them—will not fail to get behind this most important measure, for such a department is more worthy and advisable than some already in existence. It is not a sectional measure: no state of the Union but is represented. It is by no means only a western measure. Coal and iron are eastern and southern industries chiefly; petroleum is a middle and southwestern industry largely, although not thus confined. Many of our central and even eastern seaboard states maintain state geological surveys which are in large part mining bureaus, devoted to fostering of the mineral industries of the state. We hope that all mining interests will get together and boost hard, for what is proposed is for the benefit of every citizen of the United States.

The Proposed New Mining Law

THE BILL to revise the mining laws of the United States, which has been transmitted by the committee of the U. S. Bureau of Mines of which Mr. W. R. Ingalls is chairman, is a notable piece of work, and one that is beforehand assured the respectful consideration of both houses of Congress. It is the culmination of much work done by the Mining and Metallurgical Society of America, in co-operation with the American Institute of Mining and Metallurgical Engineers, the American Mining Congress, and numerous other mining societies and organizations, which, having carried the work as far as it was able, requested the Bureau of Mines to appoint the present committee, which now consists, besides the chairman, of Messrs. Walter Douglas, J. Parke Channing, J. R. Finlay, John Hays Hammond, H. V. Winchell, and L. D. Ricketts. A great deal of work on the bill has been performed by Messrs. James R. Jones and Paul S. Black, law examiners for the U. S. Bureau of Mines, who have successively acted as secretary for the committee.

The bill provides for the repeal of the "apex law," as applied to mining claims erected in the future; and discards the principle of actual discovery of a mineral deposit as a prerequisite to the location of a claim, while providing that discovery must be made before a claim is patented. The present requirements of assessment work for the holding of claims are modified.

A new feature is a provision whereby mine operators may purchase from the Government, at a fixed price per acre, the surface rights of ground for the storage of tailings, in order that such tailings may be preserved and worked at some future date when the present rich ores shall have been exhausted, and may not be allowed to be carried off by streams.

The new provisions cover all classes of metal deposits, but not coal or petroleum, or the mineral deposits which come under the leasing acts.

No rights to any mineral deposits acquired under the existing laws are disturbed.

We hope that this bill will secure prompt passage, and the mining industry should back it up heartily. It has no drawback. It is true that the iniquitous law of the extralateral rights has already done enormous damage, and that it cannot be repealed for existing claims; but there will be many new locations yet made which will be free of this incubus under the proposed law. And when the new law shall have been passed, it may become more common than now to have the owners of mining claims get together to boycott the apex law by vertical boundary agreements, a proceeding which we heartily recommend in all cases.

The enactment of the new provision regarding discovery, making an actual discovery of ore not necessary for the location and holding as unpatented ground of mining claims, is alone worth all the work which has been put into the bill. The old provision was one which encouraged mental dishonesty and disrespect for the law. Mineral land could only be located under the law by swearing to an actual discovery of ore, and there was no alternative in the numerous cases where land had to be located in order to explore it, but to comply with the law and perjure one's immortal soul. Out of this, of course, also arose a mess of law points and decisions. The new, common-sense provision will enable the prospector and miner to be at one and the same time law-abiding and truthful. And all that helps.

Successful Engineers Need Not Apply

THE CRITICAL ENGINEER, or rather, let us say, the engineer who is strictly ethical and carries his professional ideas to the point where he believes it is wrong to deviate one iota from the practice of his branch of engineering—the it-simply-isn't done attitude—will no doubt take exception to X's case as presented by Mr. Edward Thompson in our "What Others Think" of this issue. He will say, perhaps, that the man was "out of his line," that he should have stuck to mining, or that there is always an opening for a good mining engineer in strictly mining work. But this class of the "absolutely ethical" are, we believe, in the minority, and such an argument is quite unfair. There is not, or should not be, any foundation for this opinion, on the contrary, we know several bona fide mining engineers who have gone into work not [illegible] associated with mining and have been successful. One is a prosperous lumberman, another an agriculturist, and still another a clergyman—to say nothing of editors (ourselves excepted), advertising men, salesmen, and other [illegible].

The engineering mind is, primarily, an analytical one, but its application, if it is to be successful in the generally accepted sense, must be tempered with judgment. Sauce for the goose is not always sauce for the gander, so that just what should constitute the proper mixture of these two adjuncts remains uncertain. We have heard from time to time of various recipes for a successful engineer, but, like Mr. Edison's questionnaire, they are open to criticism from one source or another, and cannot be considered a panacea for failure in one's profession.

Existence, for the most part, is comparative, but too frequently our basis of comparison is unfair. We overlook opportunity; often that which we term "luck" is nothing more than the application of good judgment, but we fail to appreciate it as such because we view the other fellow from our own standpoint. None of this proves the fault is with engineering or engineering education; it is rather with the individual. We are told to do so and so, to reason, and "to figure the logical thing." In this connection we can recall a paternal argument that was presented when we had perpetrated some youthful prank simply because "Bill told us to." "And I suppose if Bill told you to jump in the lake you would do that too." Then it was a case of poor judgment, but as time goes on we are supposed to acquire a certain amount of discretion. So, although the "logical thing" may be figured, the application should not be made until the proper proportion of "good judgment" has been added.

We agree with Mr. Thompson, however, that the profession can do a great deal to enlighten prospective mining students; indeed, to many of those who are now pursuing courses at the various mining schools. However, it might be well to bar the highly successful from giving an expression of opinion. Not that we maintain they have always had it easy—far from it; but their example will always be outstanding, whereas the other fellow may offer something that presents an entirely different view.

The Elimination of Waste

WE ARE PLEASED with the press-bulletin report of the American Engineering Council's Committee on Elimination of Waste in Industry. It places over 50 per cent of the responsibility for these wastes at the door of management, and less than 25 per cent at the door of labor. This is a great relief from the storming of labor organs about the ruinous rule of capital, and the groans of capital about the depreciation of labor; and it puts the lack of efficiency where most of us know, in general, that it belongs—in defective organization.

It is not so easy to see how we shall avoid errors of judgment in the future, just as in the past. The program outlined by the committee for this purpose involves "a national industrial information service to furnish more timely, regular and complete information covering current production and consumption and stocks of commodity; a national statistical service covering employment requirements; a national policy regarding public health should be fostered and encouraged; the material program for industrial rehabilitation should be encouraged and should offer opportunities for education and placement to those having physical defects as well as those handicapped because of industrial accidents; a nation-wide program of industrial standardization should be encouraged in conjunction with industrial intervals; the Government should recognize the necessity for a revision of such Federal laws as interfere with the stabilization of industry; a body of principles should be accepted which could be developed for the adjustment and settlement of labor disputes."

To put the above recommendations more pithily, for our own survey, they seem to be, as we interpret them: (1) Monthly statistics of production, consumption and stocks of each commodity (by the Department of Commerce); (2) a Federal employment bureau (by the Department of Commerce or that of Labor); (3) a Department of Public Health (as advocated by President Harding); (4) the education of cripples and finding them jobs; (5) industrial standardization (through the Bureau of Standards, in co-operation with the industries); (6) the repeal of the Sherman Anti-Trust Law; (7) agreement between capital and labor.

It is striking that nearly the whole program is a Government program, along the lines of the increase of functions of the Federal Government and the tendency toward socialistic organization, in the best sense of the word.

By and large, we are impressed with the idea that the elimination of waste is a large subject, and that the solution is too great and too complex for any single report. We are inclined to think that mining engineers should start from the bottom in this problem, and work up—start with their own industry, which is certainly most wasteful and without adequate organization or guidance. Later on, perhaps, we shall be able to show the world by example as well as by precept.

Engineering Foundation Introduces The Alchemist

WE DID NOT SUPPOSE that Engineering Foundation would contribute our next installment of "Bedtime Stories for Mining Engineers," but we have received the following press bulletin, signed by Alfred D. Flinn, secretary:

> TRANSMUTATION OF ELEMENTS
>
> Dr. Charles Benson Davis, of New York City, claims in a paper which he has prepared and submitted to Engineering Foundation that he can make and has made some of the chemical elements, such as gold, silver, platinum, and copper, by transmutation of a common element. He has shown samples of the metals he claims to have made to members of the Engineering Foundation in New York City, and has requested that body to investigate his claims and his methods. Dr. Davis is a reputable chemist, a member of the Society of Chemical Industry, a Fellow of the British Chemical Society, and an honorary member of the Société Académique d'Histoire Internationale. He is the author of several papers which have been published in chemical journals.

A glance at the letterhead assures us that this is a serious matter, not to be treated lightly, as is our wont. It recalls to us the fact that Engineering Foundation represents the collective, concentrated, supersaturated wisdom and judgment of five great national engineering societies; and it bears, moreover, the specific names of fifteen superselected engineers, among whom are familiar to our own profession the names of Edwin Ludlow, Charles F. Rand, Robert M. Raymond, and Joseph W. Richards.

It goes, therefore, without saying that the bulletin would not have been sent to the press unless this last word in engineering tribunals believed that there was something in it. Had there been any reasonable doubt in their minds, of course, they would not have rushed into print before being able to offer the absolute proof. As it is, the only apparent reason for their doing so would apparently be to forestall the claims of other transmuters who might come forward at the same time with the same discovery. We sympathize with this: there is a man in Philadelphia, we have been informed repeatedly, who has been making gold out of base metals on the dead quiet for years. Some of our friends have been providing him with funds.

Let us fairly face the issue, then: Engineering Foundation knows, better than we, that the alchemist, the would-be converter of base metals into gold, has been multitudinous for hundreds of years. He antedated the chemist. It knows that a thousand claimants to success have been false alarms. It is a subject as elusive, hitherto, of successful and scientific demonstration as the divining rod or spirit materialization. Yet we cannot deny its possibility. If a long lanky individual stops you in the street and claims to be Napoleon Bonaparte you have no right to deny the possibility. What do you know of the possibilities of undiscovered psychic laws, or that the law of reincarnation may not be true? And if reincarnation, why not transmigration; and if transmigration, why not transmutation? Of course, the chances are immensely against your new friend being Napoleon, just as they are against Dr. Davis being the finally genuine alchemist: but you or we cannot deny the possibility.

The press dispatch states that Engineering Foundation has read Dr. Davis' paper and has seen the metals he claims to have made by the process; and it adds that Dr. Davis is a reputable chemist, a member and fellow of chemical societies, and an honorary member of the Société Académique d'Histoire Internationale—which, being translated, is the Academic Society of International History. Dr. Davis being an honorary member of this would indicate that International History is his chief specialty. *Histoire* also means a story, a tale, novel, or yarn.

Now, then, either Dr. Davis' claims are true or they are not true. We have studied logic enough to know that. Engineering Foundation does not think they are not true; otherwise it would not have advertised them under its auspices; therefore, it believes they may be true. Those who consider Engineering Foundation the last citadel of engineering judgment, conservation, and progress should act thereon: sell their mining stocks of "gold, silver, platinum, or copper." We face the end of the mining industry, for the production of metals from "a common element" will be a manufacturing proposition only, to be carried on wherever most convenient—certainly not in the present mining districts. We shall know by the bear movement in mining stocks just how much weight is given to the preliminary hunch of Engineering Foundation.

If, however, the unexpected should happen, and Dr. Davis cannot justify the good impression he has made, then we shall have to classify Engineering Foundation with the other suckers who buy divining rods and gold bricks. Certainly this necessity is unlikely, and we shall wire the American Mining Congress to advise Mr. McFadden to divert his energies to some more promising channel than trying to protect the gold industry, for if Engineering Foundation's suspicions are right, we may soon build bridges of gold, and be driven to using shells for money.

WHAT OTHERS THINK

Fact as a Basis for National Policy

Your editorial anent the French-English-American petroleum treaty in the May 21 issue of *Engineering and Mining Journal* is certainly well taken. Since I reached the age of reason and understanding, I have never been able to comprehend why the scientific man occupied the background in most of the efforts to settle great and important economic questions. There is certainly need of a change on the part of governments of the world in the disposition of matters of this kind, and, as you say, "we hail the dawn of a new era, when fact and science shall be the basis for national laws and international agreements, instead of the past ignorant makeshifts of uninformed politicians and so-called diplomats, and tugs-of-war between interested but stupid parties."

Every theory of human conduct must withstand the fires of experience. Otherwise it is a useless theory. The philosophies of nations and of individuals are constantly reshaped in the light of events. At some times the process is gradual; at other times great crises menace, and the most momentous consequences hang upon the decision.

A great many of the theories of the past will be dispensed with, and the manner of conducting national and international questions will be relegated to the scrap heap of political oblivion. Instead of the political diplomat, who buys with hot air and sells for gold, the economic issue will be settled by the geologist or engineer, who will deal with the facts of nature as they are.

Alexander Pope said that the proper study of mankind was man. Likewise the proper study of all economic questions will be the source of these questions, and who will be better able to do this than the economic geologist and mining engineer armed with the proper education and experience? May the precedent of placing Herbert Hoover in the President's Cabinet be extended in all directions, to the benefit of mankind.

Inverness, Fla. **STRAUSS L. LLOYD.**

The Engels Copper Mining Co.

The problem with the Engels brothers in the earlier days was to produce copper, gold, and silver at a low basic price at the mines. Iron and limestone were near and on the properties. Carbonate and oxide ores are only economically worked in a smelter. Our higher grades of sulphide ores are smelting ores, and lower grades require concentrating before treatment in the smelter.

We were stopped from using our smelter because so many did not understand our conditions and also because of the strong prejudice against smelter smoke that was caused from "heap roasting" or burning off the excess sulphur from heavily charged sulphurated ores in the open, and piled in heaps on the ground, which is not necessary with our ores. Our furnace was erected in 1909, and not in 1914, as stated in the *Engineering and Mining Journal* of May 28, 1921.

San Francisco. **HENRY ENGELS**

What Is the Matter With Mining Engineering?

Recently I noticed in one of the magazines an advertisement for a well and favorably known mining school. This read, in part, as follows: "Mining Engineering for Your Profession. A wide and profitable field, not overcrowded." Quite probably I should have taken little notice of this (not that I spurn the reading of advertisements; on the contrary, I find them fully as interesting as much of the text) had it not been for the fact that I had received that morning a letter from a fellow engineer concerning a graduate from this same school. I take the liberty of quoting: "I incidently ran across 'X,' whom you may or may not remember. He is here working for the city engineering department, at street cleaner's wages, and is studying stenography to improve his condition. Now, I ask you, what is the matter with mining engineering when graduates of twelve-years' standing study stenography to place themselves on a equivalent earning plane with the six-months' (or shorter period) student of a business school?

"And yet the colleges still keep grinding out technical men. It seems a crime to educate engineers; it unfits them for business life, and that is the only life if you are not born rich. Engineering teaches you to follow an idea to a logical conclusion. Given certain conditions, the engineer can reason that certain things will happen. When he figures on what men will do, he applies the same principle. He figures the logical thing—and how often do men do the logical thing? He figures if he is industrious and faithful he will succeed—and how many times does he?"

During a period such as we are now experiencing it is quite probable that the field is overcrowded, which is not in accordance with the statement in the advertisement above mentioned. But let us assume a normal condition of affairs—mines, mills, and smelters operating to capacity—and what then? Is such a statement to be accepted as justifiable under those circumstances?

Consider the fact that we have in this country today six hundred universities and colleges—more or less—and at least half of these include an engineering course—mining, civil, electrical, mechanical, civil or a combination of them—in their curricula. True enough, an increase in technical schools has been brought about by a demand; but has that demand come from industry, from a clamor on the part of the prospective student, or is it a form of propaganda to increase attendance at various schools? It is futile to attempt to place responsibility for the conditions noted, until the facts pertinent to the whole matter are more definitely established.

Of all the professions, probably the most romantic to the layman is that of the engineer; but romance goes out of the window oftentimes when the facts are shown in their full significance. It seems to me that mining and other engineers can perform a service not only to themselves but to those who contemplate entering the profession by giving publicity to such possibilities as are offered by their profession and also pointing out the drawbacks. Education comes dear, and though it is all very well to say that success or failure is up to the individual, the prospective student should have the benefit of the experience of those who have been "through the mill." **EDWARD THOMPSON.**

New York City.

TYPICAL COTTAGE FOR USE OF WHITES IN A TROPICAL COUNTRY

Looking After One's Health in the Tropics

Practical Suggestions Concerning Routine Avoidance of Infection and Pollution Common to Warm Climates—Cleanliness, Care in the Preparation Of Food, Sufficient Sleep, and Abstinence From the Use of Alcoholic Beverages Assure Comparative Immunity From Sickness and Disease

BY LLOYD TILGHMAN EMORY

Written for Engineering and Mining Journal

THE general principles of hygiene are the same the world over, and may be applied in any climate. They aim to keep the body sound, free from infection, and at its maximum efficiency. The danger to life and health is greater in nearly all tropical countries than in those that are temperate, owing to a number of causes, among which the most noteworthy is the almost total neglect or ignorance of sanitation among tropical peoples, the high, even temperature and moist atmosphere in which disease-producing organisms flourish and multiply, the great abundance of insect life, and the common pollution of water supplies.

It is sometimes said that the safest procedure in matters of hygiene in strange countries is to conform to the habits of the natives, but this is often a serious error, and has undoubtedly cost many visitors to the tropics their health. Faulty hygienic habits in the natives help to keep alive in the tropics many diseases that have disappeared or are under control in the temperate climates.

SOURCES OF INFECTION

Water—Sojourners in the tropics are likely to suffer from water-borne diseases; namely, typhoid, dysentery, cholera, and intestinal parasites. The only safe rule for general application to *drinking water* in the tropics is that it should be sterilized by boiling or chemical treatment; but the first treatment alone is not sufficient. The water must be kept sterile until consumed, by being put in sterile containers, closed against dust and other contaminations. Native servants are so entirely ignorant of the very meaning of sanitary precautions that they are continually guilty of such actions as stoppering bottles of distilled water with corks they have held in their mouths, wiping out a drinking glass with a dirty rag or paper picked from the floor, drinking direct from the bottles, or washing bottles in unboiled water before filling them.

Food—It is generally asserted, and is theoretically true, that less food is required in the tropics than in colder climates, and the consumption of fats and proteids in particular should be considerably reduced. This, however, should not be attempted by the new arrival, and past habits and temperaments should be considered. The sugars and starches are well adapted to the tropics, as they are not so heating as fats and proteids, and, as a rule, fresh, well-cooked fish is preferable to beef and other meats. Organic acids, such as fruit juices, are especially valuable as well as agreeable, and should be used freely.

Care must be exercised in the use of fresh fruits and green vegetables, not because they in themselves and harmful, but because it is impossible to, disinfect them, and for the reason that they are likely to be contaminated, from unclean water or fecal manuring, with parasites causing intestinal diseases. Fruits such as bananas, mangoes, oranges, and others that are indigenous to the tropics should be thoroughly washed in boiled water, and care taken that they are not over-ripe and that their skins are not broken. The above also applies to salads, which, even under the best conditions, are dangerous. Green vegetables should be thoroughly sterilized by cooking. The habit of eating rice, yams, tannias, cassava, and other native vegetables should be acquired as soon as possible, so as to relieve the monotony of canned food, which soon becomes unpalatable.

Alcohol—The use of alcohol is usually more abused by northern people in the tropics than in their own homes. In real moderation—that is, in amounts that can be completely oxidized in the body—it is not known that alcohol is more harmful in the tropics than elsewhere. In greater amounts it is so, for the reason that alcohol in all climates is a nervous and intestinal irritant. Heat stroke or heat prostration is more frequent with men who have been drinking, and is more likely to be severe when it does occur. Recurrences of malaria and dysentery are not infrequently brought about by drinking sprees. Alcohol also predisposes one in more indirect ways to disease infection, such as rendering a man careless in his choice of associates, neglectful of the quality of his food, or the use of his mosquito net. Hence it is safest to leave it entirely alone.

[illegible] THE TROPICS

There is little to say about clothing that does not apply in other climates. In the tropics one should wear what is comfortable but, owing to excessive perspiration, wash clothes are preferable. Clothes should be boiled in washing and dried on a line, not on shrubs and grass. For men doing active work, fresh clothes should be worn every day, and light woolens have many points to recommend them. A hat, or preferably a sun-helmet, should always be worn, owing to the effects of the actinic rays of the sun. Just how much effect these rays have is a matter for debate, but they apparently cause severe headaches in some persons during the day, often followed by insomnia and other nervous disorders at night. A large amount of the irritability and disposition on the part of the new-comers to "blow up" is probably due to this cause. It must not be forgotten that in the direct sunlight the thermometer often registers 150 to 160 degrees F.

Shoes should always be worn, both in the house and out; in muddy places water-proof or nearly water-proof boots. The reason for this will be more fully explained under "Hookworm." High shoes are better than oxfords for general use, as they protect the ankles from mosquitos and street filth.

Exercise—Regular exercise is probably more important than at home, and is more likely to be neglected, owing to the cheapness of servants and the general relaxation due to a mild, uniform climate. Tennis and golf are probably the best form for office men, as they are not only exercise but they lend an opportunity for the social intercourse so essential to keep one in good spirits.

Bathing—Bathing should be indulged in as often as possible, but is safest under a shower bath, using 5 per cent carbolic or sulphur soap, as skin diseases are more frequent than in the north. A rub-down with bay rum adds considerably to the refreshing effect, and an antiseptic (unscented) powder will be found useful in preventing chafing from heat. For men doing exploration in the bush, Calverts' 20 per cent carbolic soap prevents many infections. It also helps to remove such insects as "bête-rouge" and "ticks." A sponge-off with a formalin solution consisting of a teaspoonful to a pint of water prevents prickly heat, chafing, and dobie-itch.

If clothes become wet from a shower or perspiration, little damage is done as long as the person continues to exercise, but the clothing should be changed at once on reaching camp.

Sleep—More sleep is required in the tropics than at home. Eight hours a night should be the minimum, and a short nap after the mid-day meal is very beneficial to one's health and spirits.

Mosquitos—Certain tropical mosquitos are to be feared as disease carriers, and are truthfully spoken of as "winged serpents." The most frequent diseases, yellow fever, malaria, dengue, and filaria, are now known to be transmitted by them, to say nothing of mosquito worms and other local infections. Unfortunately, one never knows unless he is familiar with the appearances of the species whether the mosquito that has first bitten him is an innocent insect or a serious disease carrier.

Malaria is probably the most prevalent disease, and in some regions 80 per cent of the population is infected; therefore every precaution should be taken to prevent being bitten by mosquitos. The anopheles mosquito appears about the house before dark; hence the importance of being behind screens after sundown and sleeping under nets. However, the appetite of the female anopheles for blood is such that she will fly for distances up to one or two miles to reach the human victim whom she apparently scents, and will spend hours working over a screen or net endeavoring to find a broken thread.

The filaria mosquito has entirely different habits. It breeds in filthy drains close to human habitations, and hides during the day in dark corners of rooms, from which it does not hesitate to swoop out even at mid day if a victim comes along. Filaria is exceedingly common in the Guianas. The advanced stage of the disease manifests itself as elephantiasis, or "Barbados leg," causing the swollen legs and feet that one so often sees on the streets of tropical towns. Therefore: *first, last and all the time,* don't let mosquitos bite you. Wear high shoes; use citronella on your socks; and have your room screened or sleep under a net.

Hookworm—The hookworm is an intestinal parasite which gets into the body, in particular through the skin of the feet, but also through that of other parts. The disease is easily cured, but more easily prevented by wearing shoes all the time, drinking boiled water, and eating well-cooked food.

PERMANENT BUILDINGS BEING ERECTED FOR LABORERS

There are a number of other intestinal parasites common to the tropics, the most familiar of which are round worm, whip worm, tape worm, balantidium coli, and bilharzia.

Hook, Round and Whip Worms—All tropical natives have some or all of these worms, which are a serious menace to health. By observing the following rules they can probably be avoided:

1. Do not walk barefooted under any condition, as these worms can enter the system through the skin. Always wear shoes or slippers whether you are outside or inside of your room.

LABORERS' SHELTERS IN A PRELIMINARY CAMP BUILT OF ROUND POLES AND PALM THATCH

2. Do not eat food brought in from the surrounding country unless it has been well washed and cooked.
3. Be sure to wash your hands after handling articles bought from the natives, and especially before meals, when you directly or indirectly touch your mouth with your fingers.
4. Servants and washwomen who do not look healthy should be examined by a doctor. If he finds them infected, they should receive proper treatment, so that they cannot transmit the disease.

Tape Worms and Balantidium Coli—These usually follow eating inadequately cooked pork. Take care not to eat pork unless it is properly washed and cooked.

Bilharzia—Comes from drinking water; hence observe the rules noted under *Water*.

Many kinds of skin disease can be contracted in the tropics. It is advisable to wash the hands frequently with antiseptic soap, especially after handling articles used by natives. Disease carriers such as rats, flies, fleas, roaches, and mosquitos should be exterminated at every opportunity. Every one should be inoculated against typhoid.

Look at most of the natives you pass on the street, and note how worn out they appear to be. This is due chiefly to hookworm, alcohol, malaria, filaria, and venereal diseases, all of which can be avoided by sanitation, care, and correct living. To sum up: Keep away from mosquitos, get plenty of sleep, eat with moderation, leave alcoholic drinks alone, take regular exercise, and don't worry about your health.

Manganese Deposits Near Volta Grande, Brazil

Graphite and Psilomelane Found Together and in Process of Being Separated and Concentrated By Natural Means

By Horace E. Williams

Written for Engineering and Mining Journal

THE graphitic manganiferous deposits of Volta Grande, in Minas Geraes, Brazil, are specially interesting both because of the occurrence of these two minerals together, as well as for the manner in which they have been and are being separated by natural processes. The occurrence is on a ridge 1,600 m. north of the Rio Parahyba and about 6 to 8 km. east-southeast of the station of Volta Grande on the Leopoldina railway in the southeastern part of the state.

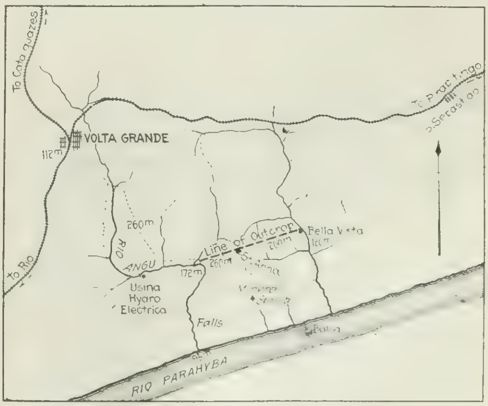

FIG. 1. MAP OF VOLTA GRANDE DISTRICT, MINAS GERAES, BRAZIL

As shown on the sketch map, the exposures of this mineral band extend across the hills in a straight line from the Rio Angú to Bella Vista, a distance of over three kilometers. Beyond these limits, no exposures have been reported, though a systematic search would probably reveal the continuation of the outcrop. The accompanying sketch is a longitudinal section along the vein and shows the four depressions existing between the Angú and Bella Vista. In this section the heavy shaded line at the top of the hills shows where the manganese ore, psilomelane, occurs in considerable quantities, and the depressions between these hills are occupied by the graphite concentrations.

In the depression at *A* a ditch was run in the hillside across the strike, which gave a good section of the material at this place. This section shows a thickness of about 4.35 m., inclosed in the decomposed gneiss, the lower part of which, about 3 m. thick, consists of a tough massive but rather soft material, quite graphitic, with considerable manganese and mica. Above this is a brown earthy umber containing many patches of kaolin and frequent blocks of a siliceous manganiferous rock. Near by, and in the flats just below to the south, large blocks of fairly rich graphite appear on the surface and in the soil covering. Similar deposits of graphite occur in the other depressions along the line of outcrop.

However, the exposures seen in the open cuts on the hilltops, where considerable mining for manganese was carried on during the war, seem to provide a better conception of the nature and evolution of these mineral deposits than can be inferred from the section at *A*. The section observed at these places is fairly uniform, though that at the east end of the outcrops above Bella Vista is the deepest and reveals the situation to best advantage. At this place the surface ore has been removed for a distance of about 400 m. across the top of the hill, and a cut about 70 m. long by 10 to 12 m. deep has been opened up along the vein. The strike is about N. 70 deg. E, dipping 60 to 70 deg. north.

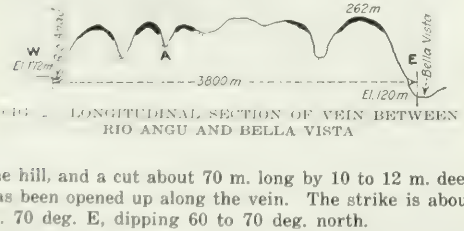

FIG. 2. LONGITUDINAL SECTION OF VEIN BETWEEN RIO ANGU AND BELLA VISTA

In all these exposures the accumulations of surface ore have resulted from the gradual erosion of the soil and the settling of the hard ore toward the south, owing to the northerly dip of the bed, which, on digging, is always found under the northern edge of this surface material.

In the cut above Bella Vista the material is about 2 m. thick, consisting principally of hard ore and kaolin, with scattering blocks of ore in the decomposed gneiss of the foot wall over a width of 2 to 3 m. Also in the cracks and crevices of this gneiss thin irregular sheets of rich tabular ore occur in considerable quantities. The hard ore has a spongy structure and has to be broken up into small pieces to free it from the inclosed earthy matter. The ten or twelve thousand tons of surface ore from the surface diggings were thus broken up and washed before shipment during the war. Several thousand tons of this washed ore are still in the vicinity awaiting shipment.

As may be inferred from the region above Bella Vista, the large accumulations of surface ore, consisting principally of psilomelane, have resulted from the oxidation and hydration of the mineral, originally largely carbonates and silicates. With increase in depth, the spongy ore gradually decreases in amount, the mineral becoming more massive but decreasing in density, with a perceptible increase in the siliceous and graphitic content.

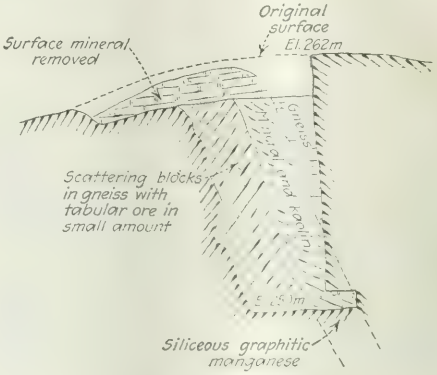
Original surface
El.262m
Surface mineral removed
Gneiss
Gneiss and kaolin
Scattering blocks in gneiss with tabular ore in small amount
El.250m
Siliceous graphitic manganese

FIG. 3. TYPICAL SECTION AT POINT ON VEIN SHOWING MATERIAL REMOVED FROM CUT

This region is one of comparatively heavy rainfall, about 200 cm. annually, the result of which has been to effect a double concentration: removing the graphite content largely from the manganese ore and carrying it down the slopes to deposit it in the depressions and near-by flats.

In the several exposures seen the rocks were completely decomposed, so that the determination of the character of the original rock of this formation is as yet impossible. However, the character of much of the kaolin found would indicate a deposit similar to a pegmatite. Frequently, what appear to be decomposed crystals of diagolite are found in these occurrences of kaolin.

An interesting problem would be to work out the probable changes through which an ordinary deposit of wad and lignite would pass on being subjected to the forces of metamorphism such as these rocks have undergone.

Production of Metals in Mexico During 1920

The following table, supplied by the financial agent of the Mexican government in New York City, gives the metal production of Mexico in 1920.

(Figures in Kilograms)

	Presented for Export	Presented for Coinage	Total Production	Commercial Value
Gold	7,255 427	15,608 8887	(a) 22,864 3157	$30,485,678 00
Silver	1,801,173 464	267,764 764	(b) 2,068,938 228	134,232,712 00
Lead	82,517,598 000		82,517,598 000	28,881,159 00
Copper	49,192,401 000		49,192,401 000	37,878,149 00
Zinc	15,650,590 000		15,650,590 000	5,321,200 00
Mercury	75,748 400		75,748 400	360,562 00
Manganese	1,137,400 000		1,137,400 000	1,603,734 00
Graphite	3,222,941 000		3,222,941 000	483,441.00
Antimony	622,572 000		622,572 000	230,352 00
Tungsten	40,020 000		40,020 000	111,256 00
Molybdenum	4,230 000		4,230 000	13,620 00
Arsenic	2,091,704 000		2,091,704 000	1,338,691 00
Total	156,363,633 291	283,373 6527	156,647,006 9437	$240,940,554 00

(a) Of this quantity of gold 15,603 kilograms [illegible] coined. (b) Of this quantity of silver 223,068 kilograms was coined.

[illegible] the value of the metals [illegible] New York quotation were used.

Molybdenum Mines in Norway*

Production Was Greatly Stimulated by War Prices of Molybdenum—Many Important Norwegian Companies Working Deposits Geologically Similar To Those Found Elsewhere in the World—A Possible Boom in the Metal

By Dr. Eugene Otto Falkenberg

THE WAR CREATED a great demand for most metals, and especially for those used in alloy steels, i.e., manganese, nickel, chromium, tungsten, molybdenum, and vanadium. Only small deposits of manganese occur in Norway, but the country possesses a considerable amount of nickel, and the development that has taken place in the nickel industry is probably fairly well known. The deposits of chromium in Norway are not large, but were worked during the war, and the ore was exported. It is to be regretted, however, that this has not created a mining industry which is likely to continue in competition with the outside world, so that Norway's chrome deposits must probably still be considered as of interest only to economic geologists. There have been no new discoveries of any considerable size. The tungsten deposits hitherto known are found in Orsdalen, near Ekersund, and are relatively small. It is still hoped that the deposits in which tungsten is found with molybdenum may be profitably developed.

It would be of advantage if the prospectors all over the country had a better knowledge of the tungsten minerals, as these, unlike the blue molybdenum and the glistening golden pyrite, are easily overlooked even by an experienced prospector. The geology of Norway gives ground for hope that tungsten deposits larger and richer than those now known will be discovered. Vanadium is found in Norway only as a component of other ores, and in such small amounts that it cannot be profitably extracted at present. The remaining steel-improving metal is molybdenum, and it is of this that I shall speak.

Norway has only one molybdenum mineral, molybdenite, which, however, occurs in considerable quantities, and in a number of localities, especially in the southern part: in Lister, Mandals, and Stavanger amts. It is also found in Nordlands amt.

EARLY DISCOVERIES OF MOLYBDENITE

Before the war the production of molybdenite in Norway was small and irregular. The first production of which I know took place from the Knaben mine at Flekkefjord, presumably at the end of the eighteenth century or the beginning of the nineteenth, as upon the resumption of work on these rich deposits in the 80's, old tools and other indications were found which pointed to previous activity here. This also agrees with the stories in those parts about mountain peasants bringing ore over the mountain to Kristiansand and Stavanger, where they exchanged a pound of molybdenite for a pound of butter. The molybdenite was used as a lubricant and a polish for stoves. In these long past times it was usual to call molybdenite "silver stone," later "lead-pencil stone," and one often finds names like "Pencil Mountain," and "Silver Deep," at the deposits.

In the 80's, at about the same time as the resumption of work in the Knaben mine, the Tjoerdalskamp, in Saltdal, was discovered, and work was started, but it was abandoned after a few years, probably because the deposit was exhausted. The activity from 1880 to 1900 was on the whole small and irregular, the price being only about two kroner per kilogram. The demand was also light, the product being used only in color factories and for certain special unimportant chemical uses. During the introduction of special steel in the period from 1900 to 1910, there was technical but no great amount of general interest in the metal. From 1910 to 1913 production was fairly steady, not exceeding Kr. 15,000 for any one year.

In 1913, the Kvina mine, the first to use modern concentrators (flotation), was started. In 1914, the Knaben mine was reopened, so that at the outbreak of the war two mines were producing, but by the close of the war a series of greater and smaller deposits were being worked, especially in the southern part of the country, where operation had been resumed, so that there are now at least fifteen Norwegian mines producing molybdenite. The prices must have, of course, the credit for this blossoming out of molybdenum mines. I must say the credit, and not the blame, despite the fact that there are many who have been "burnt" by molybdenum.

RAPID RISE IN PRICE OF MOLYBDENUM

The price rose for several reasons:

1. The demand was already steadily increasing from early in the year 1913 and the price was then 5s. per kg. pure MoS_2, and by the outbreak of the war the price had risen to about 13s. The English government, as known, set the maximum price at 105s. per unit, and this price was the usual maximum price in the Entente countries in the early part of the war.

2. Germany was cut off from its usual overseas supply of steel-alloying metals (manganese, nickel, wolfram, molybdenum, and vanadium) and had to obtain what it could by the few avenues still open, almost regardless of cost. Except for some nickel and chrome, it had to depend principally on molybdenum. Even if the Germans are clever in making substitutes, they could not get along without these metals, and that is a point that should not be forgotten in days of depression. They announced often enough that they now no longer needed our molybdenum, but still they paid the increasingly greater price demanded, on account of the constantly increasing cost of production. This again caused the price to rise gradually to Kr. 18 to 20 per kg., with a stop here for a while. Later, however, about Kr. 25 was obtained. One mine then made a contract at a price of Kr. 35, which came to be a standard price. Some ore sold as high as Kr. 40 per kg.

As is commonly known, in the summer of 1917 the British government entered into a contract with all of the Norwegian mines for the purchase of their produc-

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*Translated and abstracted from a lecture before the Norwegian Mining Industry Association, as published in *Teknisk Ukeblad*, Vol. 68, Jan. 7, 1921.

tion during 1917 and obtained an option from Jan. 1, 1918, on all molybdenite produced. By this arrangement the price was, if possible, still further stabilized. This, of course, was done only to prevent the product from going to Germany.

In this connection I want to express my regrets that the Norwegian mines at that time did not work together as closely as they have since done. With a combination behind them such as A/S Norske Molybdenprodukter much more satisfactory and safe contracts could have been obtained. The great and all-too-sudden rise in price led to speculating in molybdenum deposits, and all know where speculation leads. In the beginning it was called investment in stocks, and, as always, in prosperous times, caution was put on the shelf. It must be considered as somewhat hasty to start large companies on the basis of the report of some man with a "wishing twig" who claims to have discovered that unsuspected masses of molybdenum are found in a certain locality, where the professional man distinctly warns against anything more comprehensive than a moderate investigation.

MANY IMPORTANT PRODUCERS IN NORWAY

We in Norway, however, have shown sufficient molybdenite so that the steel producers of the world will have to consider it in their calculations for producing molybdenum steel. I shall now consider the various molybdenum mines in Norway, as there are so many new companies that it is here possible to treat of them only in general. Some of these mines have already stopped work or failed; others will, without doubt, never start operations. The capital invested, in proportion to the production of the mines, is disproportionately large, and, including the loans raised by the companies, can certainly be set at twenty million kroner.

Until the end of 1917 there were only three considerable producers, namely:

1. Knaben mines, in Tjotland, with a total production of about 275 metric tons pure MoS_2.
2. A/S Kvina mines, in Tjotland, with 150 metric tons pure MoS_2.
3. A/S Dalen mines, in Telemarken, with 100 metric tons pure MoS_2.

The quantity of concentrate delivered by other mines was small. The principal production outside of the three first-named mines came from three others:

4. Tjaerdalskampen, in Saltdalen, production in the 80's about 10 metric tons pure MoS_2.
5. Vatterfjord pr. Solvaer has probably also produced 10 metric tons pure MoS_2.
6. Haugholmen, in Telemarken, has produced 15 metric tons pure MoS_2.

Of the new mines which have produced the most important are: Ornehommen mine, total production about 15 metric tons MoS_2; Knaben mine No. 2, total production about 25 tons; Gursli mine, total production about 45 tons; Undalen mine, total production about 32 tons; [illegible] mine, total production about 3 tons; Lier Molybden A/S, total production about 4 tons.

This gives a total production of molybdenite in Norway up to date of about 800 tons pure MoS_2. These are the most important molybdenum mines now in operation. Besides this, it is reported that preliminary investigations in the Laksedals field, in Gildeskaal, in Nordland, have shown large quantities of relatively rich concentrating ore. It seems sure, therefore, that, considering the new, and, in part, rich deposits which were opened during the war, Norway will be able to furnish a production of at least 150 to 200 metric tons pure MoS_2 per year, provided that the price remains satisfactory.

SIMILARITY IN OCCURRENCE OF MOLYBDENUM DEPOSITS

Molybdenite is usually intimately connected with acid rocks, principally granite. This applies not only to the Norwegian but also to the Swedish, Australian, Canadian, and United States molybdenite deposits. In the last phase of the extrusion of the granite masses, the magma has given off a part of its molybdenum contents. At the same time there was a plentiful segregation of silica in the form of quartz, and the geologist constantly finds molybdenite associated with quartz, at some places in pure quartz veins, which are generally closely connected with a granitic magma. It is clear that all deposits cannot be ascribed to a "magmatic origin," for as in the formation of pegmatite veins, all the transition steps between pneumatolysis and crystallization from solutions are to be noted.

The downward continuation of the deposits is, of course, a question of the utmost interest. Experience seems to have shown that the extent of a molybdenite deposit is relatively limited, compared with deposits of iron ore, pyrite, and other ores which occur in great quantities, usually with 30 to 40 per cent and more iron and sulphur. The downward dimension seems also to be quite limited, and there is probably no molybdenum mine over 100 ft. deep. It is, therefore, important to investigate the deposits before tying up too much capital in them. As far as the Mineralselskapets property is concerned, and it holds good for about all the Norwegian deposits, there are found, besides molybdenite, copper and iron pyrite and vein materials, quartz (of varying colors), feldspar, hornblende, biotite, and sometimes muscovite. In some deposits, fluorspar (green and violet), tourmaline (black), calcite, augite, and epidote occasionally appear. At one deposit magnetite, granite and other gangue minerals occur. Wolframite and scheelite occur in Orsdals fields, and bismuthinite and some arsenopyrite at the Telemarken deposits, and apatite at the Resör deposits.

TWO GRADES OF PRODUCT OBTAINED

The method of concentrating the ore differs according to whether one is dealing with deposits of the vein type or of the impregnation type. With the vein type the ore is generally subjected to a separation whereby one or more other directly salable products are obtained, No. 1 concentrate with 80 to 90 per cent MoS_2, and No. 2 concentrate with 50 to 60 per cent MoS_2. The tailings from deposits of the vein type usually contain from one-half of 1 per cent to about 1 per cent MoS_2. In deposits of the impregnation type the ore generally carries considerably less than one-half of 1 per cent, but on the other hand considerably larger quantities can be broken and forwarded to the mills. A content of one-quarter of 1 per cent molybdenum will probably prove to be the average for the Norwegian deposits of this type. In preliminary calculations the great error is usually made of putting these figures much too high.

The concentration of molybdenite is, contrary to earlier statements from foreign sources, quite simple, and the course in the mills is usually according to the following flow sheet: Ore from mine to rock crusher, to picking belt, to ball mill, and thence to Elmore flotation machines.

The rock crusher is usually of the Blake type. The ball mill has calypsol or ball bearings. One concern has installed Hardinge mills with a Dorr classifier. The separation is always by flotation, and Elmore machines are most used. Lately Minerals Separation machines have come into use. In Canada, Callow machines are most used. The concentrate obtained in this way generally carries about 70 to 80 per cent MoS_2. In Canada a concentrate of from 85 to 90 per cent MoS_2 is obtained, but I do not believe the copper pyrite is so bothersome there as in Norway. If the concentrate contains too much copper it must be oxidized and separated magnetically to lower the copper contents sufficiently, preferably to 0.3 to 0.5 per cent Cu.

The uses of molybdenite in the technical industries are many, but as a rule only small quantities are required. The principal use of molybdenum is in the production of molybdenum steel.

STUDY OF MOLYBDENUM STEEL AND ITS USES IMPERATIVE

It cannot be denied that there is not yet even approximate agreement about the value of molybdenum steel. Norwegian metallurgists should not, however, be satisfied with the investigations of others, and it is part of A/S Norske Molybdenprodukters' program also to take up this question and attempt a solution. For this purpose the company should have the necessary assistance from the state. With the large deposits which exist in Norway, and with the capital which already is invested in Norwegian molybdenum, about Kr. 20,000,000, it is necessary to try to find a solution.

In regard to the prospects of the industry in Norway, it is difficult to make a prediction, but I am of the opinion that in the not distant future Norway will again have a "boom" in molybdenum.

Placer Gold in Indiana

State Geologist in 1902, on Strength of Occurrences in Morgan County, Forecast Discovery of Veins in Ontario

BY C. HAFER

Written for *Engineering and Mining Journal*

SOME MONTHS AGO, at a meeting of the Canadian Mining Institute, the question arose as to the whereabouts of the placers from erosion of the Ontario gold veins. Without knowing anything of Ontario gold deposits, either in place or fragmental, I am inclined to believe that they may have been removed during the glacial period, scattered over the drift-covered area of the interior northern states, and, in some places concentrated, forming placers of sufficient richness to suggest near-by gold veins and affording a field of effort to the inexperienced.

Among numerous localities where gold has been found in the drift-covered region, the most important is probably Indiana. Little known to miners throughout the world, this field has awakened considerable interest in the Middle West, and has been the scene of activity, at intervals, with little profitable result, as far as I know. In 1901-02 I spent part of the two summers there panning and testing the deposits with a sluice box. The counties of Brown and Morgan, lying forty to sixty miles southwest of Indianapolis, are the ones most prospected for gold, though there are a number of others from which gold has been reported.

In Morgan County, the surface features are typical of the Middle West, in general flat, with valleys carved by streams. No igneous or metamorphic rocks are known to exist here, and certainly none are visible in place. The placers have been satisfactorily determined to be of glacial origin, as a result of the investigation of a number of geologists, among them glacial specialists in the Government employ.

It is evident to the miner that the debris he finds below his boxes is not all of local origin, as there are fragments of granite, gneiss, amygdaloid, greenstone and iron ore, and in the riffles one finds pieces of corundum, garnets, and, in addition, an abundance of black sand.

According to the state geologist of Indiana, Blatchley, in his report of 1902, gold was discovered in Morgan County by returned Californian miners in 1850, who observed the characteristic black sand in the ravines and began prospecting. They found gold in the tributaries of Sycamore and Lambs creeks, and some were able to recover two to three dollars per day for several weeks. Numerous fortune hunters were attracted, and the pay dirt was washed out in a short time, when the boom subsided. Since that time washing has been carried on by a few workers, with pan and rocker, in Brown and Morgan counties, with a total production, estimated in 1874, at $10,000 and since then probably doubled. The largest nugget recorded is of 132 grains, valued at $5.50. The silver content is small, a mint report of July 12, 1901, making return of 61c. for silver in 14.05 oz., $250.07 being the total amount of the return.

In 1902 we washed only ten yards of dirt, with a recovery of $2.50 in the boxes, when the water supply gave out, and with the gold pan we tested the little valley in which the work was carried on, finding nothing more to attract us. The gravel stratum above bed rock here was largely of the country rock, with little of the foreign wash. On Gold Creek, to the northeast, there were more foreign boulders, and apparently better and heavier values. All of the gold found was flat and well polished, indicating the long journey to its present resting place.

It is interesting to note that several diamonds of value have been found in this gold field. Mr. Blatchley mentions having seen eight, ranging in weight from one-eighth of a carat to four and seven-eighths carats.

The conclusion of Mr. Blatchley, in his 1902 report, was that the original home of the gold and diamonds was in the neighborhood of James Bay, in Canada, and he ends with the following, suggestive of prophecy: "It is not improbable that within the next quarter century, a new Eldorado will be discovered among the igneous rocks of this Far Northern region, which will be as rich in gold and precious stones as any heretofore known to man." The discoveries made in Ontario since that report was made seem in a measure a fulfillment of that forecast.

Alsatian Potash Production During 1920

The total production of Alsatian potash during 1920 reached 1,061,197 tons, according to statistics received from the office of the commercial attaché, Paris, and published in *Commerce Reports*. Of this amount, 450,000 tons was sold in France, 327,000 tons was exported to the United States, 117,000 tons to Belgium, and 92,000 tons to the United Kingdom.

The Copper Implements of the Copper Eskimo

Natives of Coppermine River Region, in Coronation Gulf District of Northwestern Canada, Use Copper Found Locally for Making Primitive Weapons and Tools—Fort Norman Nearest Point of Activity

BY DONALD A. CADZOW
Written for *Engineering and Mining Journal*

PREVIOUS to the advent of white men in the Western Hemisphere, gold, silver, meteoric iron, and copper were in use by certain of the aborigines for making ornaments and implements. These metals were too soft to supersede stone wholly as material for the manufacture of tools which required keen edges, but they were used extensively for ornaments, and in certain districts, particularly in Mexico, Central America, and Peru, art in metal had reached a remarkable stage.[1]

In prehistoric times copper was used more extensively than the other metals, both because of its accessibility and for the reason that neither smelting nor even melting was necessary. The supply used by the Indians in the eastern part of the United States came mainly from the Lake Superior region, although small quantities were found in some of the Southern States. Archeologists have found many implements of native copper on ancient sites about the Great Lakes, but south of the Ohio River there are comparatively few, for in this region copper was generally considered too valuable to be used for utilitarian purposes; hence it was applied chiefly to the manufacture of ornaments.

COPPER ESKIMO IN SUMMER COSTUME. LEFT TO RIGHT, KOL, GIN, AK, KAT

ANCIENTS DID NOT TEMPER COPPER

A popular belief prevails that primitive man possessed the knowledge of tempering copper, but there is no foundation for this conclusion, as no specimens of pure copper have been found to possess greater hardness than can be produced by hammering, and there is no evidence whatever that the Indians had any knowledge of alloys. Heat, however, was sometimes employed to facilitate hammering and annealing.[2]

Many examples of beautifully worked copper have been found in South America. Copper bells have been dug up in Mexico, Honduras, and as far north as Arizona and New Mexico, but these are evidently of Mexican origin. Axes and ornaments are found in Peru and Ecuador, and displayed in our museums are many specimens made by the clever copper workers of ancient Mexico.

On the northwest coast of North America the natives used copper extensively, and in this region the possession of the metal, particularly fashioned in the form of large plates, indicated wealth or distinction.

CORONATION GULF DISTRICT RICH IN COPPER

Though most of the deposits of copper from which the North American aborigines once obtained their raw materials have been commercialized, there is still one district in which copper is known to occur in quantity, but which is so inaccessible that some time will elapse before it will be possible to transport and market the metal. This is the Coronation Gulf district of northwestern Canada. Deposits of copper were first reported in this region in 1776, when Moses Horton, the Hudson's Bay Company's governor at Fort Prince of Wales, on Hudson Bay, obtained specimens of the metal from Indians living on the northwest coast of the bay, who had received it from natives farther west, together with information that there were deposits on a large river in their country. Horton, hoping the metal could be commercialized, commissioned Samuel Hearne, a young Englishman, to explore the district in which the copper had been discovered, for the purpose of determining whether the locality could be reached by ships from Hudson Bay, and if the copper existed in sufficient quantities to pay the company to mine it and ship to England.

COPPER ESKIMO WOMAN USING A ULU

After two unsuccessful attempts, Hearne finally, with much difficulty and almost endless hardship, reached

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[1] See M. H. Saville, "The Goldsmith's Art in Ancient Mexico," Indian Notes and Monographs, Museum of the American Indian, Heye Foundation, New York, 1920.

[2] See the article "Copper" in Handbook of American Indians, pt. I, Washington, 1907.

[3] See Hearne, Samuel, "Journey From Prince of Wales Fort in Hudson's Bay to Northern Ocean," London, 1795.

TWO COPPER ESKIMO BELLES

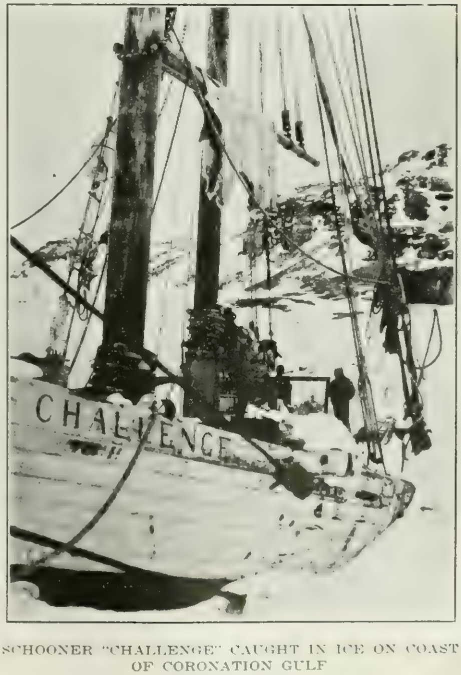
the shore of the river where the deposits were reported. Although he was not a geologist, he verified the statements of the Indians, but proved that the district where the copper occurred was too remote and difficult of access to permit profitable mining, even if ore should be found in abundance. Hearne surveyed the river and named it the Coppermine. While thus employed, the northern Indians who had accompanied him discovered and massacred a small party of Eskimo camped on the shore of the stream. These natives were undoubtedly the forefathers of the people who are now called the Copper Eskimo, or Kidnelik (Qidneliq). Hearne reported that native copper was used extensively by them in making utensils and weapons, and brought back a few specimens of their handiwork to Fort Prince of Wales, whence they were shipped to England and all trace of them was lost.

Since the time of Samuel Hearne, Coppermine River has been visited by several explorers, and the district, then sparsely occupied by northern Athabascan Indians, was later taken over by the Eskimo, who hunt far inland during the summer for caribou and return to the coast for seal in winter. They no longer fear their hereditary enemies, the Indians, who, on the advent of white traders, moved from the barrens to the timberland, where the climate is less severe and the trading stores are more accessible.

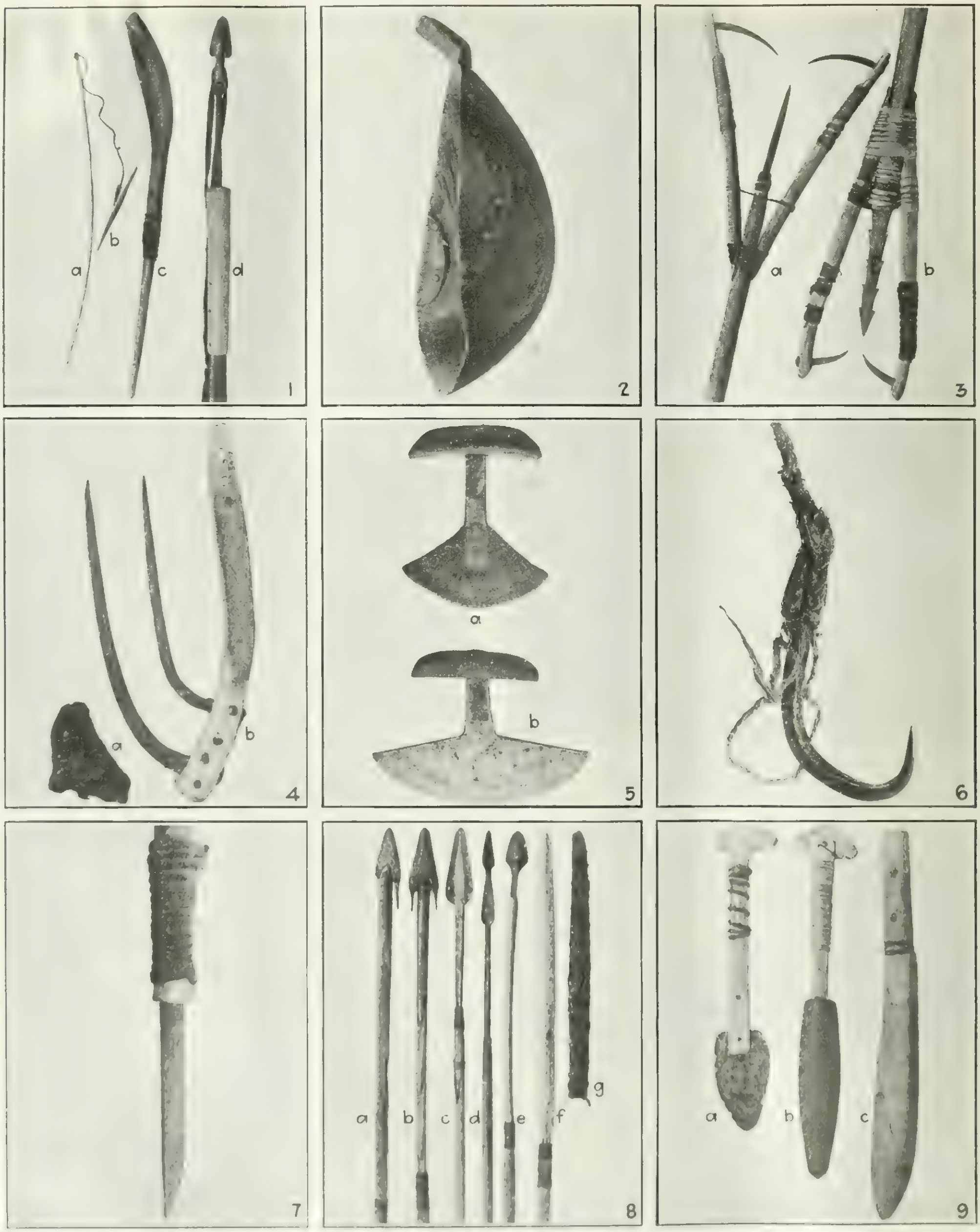
It was my good fortune while conducting an expedition into the Mackenzie River district of northwestern Canada in the interest of the Museum of the American Indian, Heye Foundation, New York City, to meet a small party of Copper Eskimo. These people were many miles from their usual summer hunting ground, and in the center of what a few years before had been hostile territory. But through the influence of two white men, prospectors and traders, who have spent several years in their country, these Eskimo were persuaded to come to Fort Norman, on the Mackenzie River, protection from the Indians being assured them by the white men. It was when this party was at Fort Norman that I met them and collected ethnological specimens, among which are numerous pieces of worked native copper.

One of the men, Katiuck by name, said he was a Pallirmuit, and that he made his home near the mouth of the Coppermine River in winter and hunted inland toward Bear Lake in summer. He stated that the native copper used in making utensils and weapons was usually picked up in the form of float, both on the western side of Victoria Island and along Coppermine River. He also said that on the island there were boulders of copper that were larger than an *iglu*, or snow house. From his description, it may be judged that some of them would weigh many tons. Katiuck also described the primitive method of copper-working. Following is a description of the more noteworthy objects gathered from the Copper Eskimo as illustrated on page 1026:

Gaff Hook (Fig. 4). The manufacture and use of the copper-pronged gaff hook was described as follows: First, a rough prong is hammered out of a small mass of float copper (Fig. 4a) with a beach pebble held in the hand. Next it is smoothed and finished by rubbing



SCHOONER "CHALLENGE" CAUGHT IN ICE ON COAST OF CORONATION GULF



NATIVE-COPPER OBJECTS OF THE COPPER ESKIMO

[illegible]

against a large boulder. A piece of caribou antler is shaped into a head (Fig. 4b), holes are cut through it, and each prong is attached by passing one end through a hole and hammering it to a flat rivet head. The prongs are then securely wedged in place with small pieces of copper. The head is fastened to a wooden shaft which is from 15 ft. to 20 ft. long and about 1½ in. in diameter.

The gaff hook is used generally for catching the so-called trout in the streams flowing into the Arctic. These fish, which in reality are a species of salmon, weighing from three to ten pounds, enter fresh water only during the spawning season. In using the gaff the fisherman finds a shallow place in a stream where the trout are running. Standing in a cleared space, usually a gravel bar, he cautiously slips the hook into the water, prongs upward, and allows the pole to float with the current until the hook is directly behind a fish, then with a quick jerk he transfixes it, and, running up the bank, drags it out of the water. With a forward thrust he loosens his catch, kills it with a club and is ready for another.

Copper Fish Hook (Fig. 6). This represents another type of fishing tackle used by the Copper Eskimo for fishing through the ice in winter. A piece of dried fish is tied to the copper hook for bait, and the fisherman bobs it up and down in the water to attract the fish. The proximal end of the copper hook is beaten out flat to facilitate the attachment of the line, which is spliced around the shank and stitched in place with a small piece of sinew. The line is made of four strands of sinew, braided and spliced, and is kept well greased with seal-oil to make it more pliable and to prevent freezing while out of the water.

Ulus, or Woman's Knives (Fig. 5). The copper-bladed *ulu* is essentially a woman's knife, used in cutting skin for clothing. The hide is placed on a board, an incision is made with one end of the blade, and the skin cut with a forward motion of the wrist. The *ulu* is also used for carving and chopping meat and fish.

Sealing Equipment (Fig. 1). In Coronation Gulf the seal is the main source of winter food supply, and therefore the sealing harpoon (Fig. 1d) is an essential part of the equipment of every hunter among the Copper Eskimo. There are two methods of locating a seal's breathing hole in the ice: In the first, dogs are trained for the purpose, and the seal hole finder is used; this is a long slender piece of bone shaped like a walking stick, and is poked through the snow until a breathing hole is found, when the hunter places the slender bone seal indicator (Fig. 1a) in the opening, one end just below the surface of the water; the other is fastened to the edge of the hole with a pointed bone peg (Fig. 1b), attached to a sinew cord that extends from the end of the indicator to the center of the peg.

The hunter sits beside the hole with his harpoon poised ready to strike, the shaft being held in the right hand and the retrieving line in the left. When the indicator moves upward, the animal is nearing the surface of the water, and the hunter quickly drives the harpoon toggle head into the seal, at the same time throwing the shaft over his shoulder and grasping the line firmly with both hands. When the seal stops struggling the hole is rimmed with a bone pick on the proximal end of the harpoon shaft, or with a musk ox horn spoon (Fig. 1c). The seal is then dragged to the ice and killed by pushing the pointed handle of the spoon into its eye. The wound is skewered with a bone peg to prevent the loss of blood, which is used in making soup.

Arrowheads. The Copper Eskimo use three varieties of arrowheads—copper, bone, and antler. Those of copper, made either of a single piece of metal or having an antler foreshaft tipped with a copper point, are the more popular and practical. They are "rankling" heads, and are used for killing big game. The pointed dowel inserted into the shaft of the arrow is made smaller than the socket, so that when the animal is struck, the head will easily slip out of the socket and remain in the victim's flesh, where with every movement it works further toward the vitals. The bone or antler-pointed heads are usually of the same type (Fig. 8), and are employed at close quarters for dispatching wounded game, the heavy, sharp-edged, broad blade tearing a large wound in the victim, killing it instantly.

The Copper Eskimo are at present rapidly becoming semi-civilized. The Imperial Oil Co., of Canada, has brought in an oil well a short distance below Fort Norman, on the Mackenzie River. With the opening of this district, engineers will undoubtedly find some means of transporting the copper from the Coronation Gulf region. Within a few years the utilization of native copper by the Copper Eskimo for making weapons and utensils will have ceased, the white man's handy and practical materials having taken its place.

Small Tungsten Production in 1920

Not since 1902 has the United States produced so small a quantity of tungsten concentrates as in 1920, according to Frank L. Hess, of the U. S. Geological Survey. The Wolf Tongue Mining Co. and the Vasco Mining Co., of Boulder, Col., were the only American tungsten miners. They produced an equivalent of 216 short tons of ferberite ore carrying 60 per cent tungsten trioxide (WO_3).

Tungsten is most used for making high-speed tools for cutting steel, so that the demand for tungsten ore rises and falls with the steel business. In 1920 the steel business was dull, and the demand for tungsten correspondingly small. At the same time, despite the small demand, the imports were rather large for peace times, and consisted in part of cheap ore from the shallow placers of China.

Much ore was apparently shipped to this country with the expectation that a heavy duty would be imposed on it and that ores in stock would accordingly increase in value. The imports for 1920 were 1,740 long tons of ore, probably averaging 65 per cent or more tungsten trioxide (WO_3) and were equivalent to about 2,111 short tons of concentrates carrying 60 per cent WO_3. Of this quantity 1,386 short tons of 60 per cent concentrates was shipped from China and most of the rest from South America.

Besides the ore 1,997,719 lb. of tungsten and ferro-tungsten was imported, equivalent to about 2,250 short tons of 60 per cent ore, and probably more than enough to supply the needs of the high-speed tool industry, so that there was added to the already large stocks in this country somewhat more than the quantity of tungsten represented by the imports of ore.

Exact figures are not at hand, but a large quantity of tungsten ore is in stock in this country, probably more than a three years' supply at the average rate of consumption before the World War.

BY THE WAY

A New Star on the Financial Horizon

We have received a hand-written business proposition, from which we make certain extracts *verbatim et literatim.* Would it interest any of our readers?

A Reasonable Proposition

The ——— Mining, Milling, Prospecting and Developing and Investment Company Unincorporated. The principais and purposes of this Company are to get together a good team of capable men ambitious to make a success of the business in hand, men that are capable Prospectors, Millmen timbermen, and generally usefull to do a bit in opening up and developing likely prospects in a new and untried ventures. In short a limited number of practical picked men, no grumblers, trouble makers, knockers, but men that can do things, and not talk to much about nothing or misrepresent anything in or out of our business, only practical minded chiefly workers and owners of stock wanted only one vote to each owner regardless of amount invested or controled no freeze out game in this deal

OPPERATIONS.

To handle properties on agency business, or commission or contract to lease, Bond. buy stake, sell or develop on contract: to mill on percentage or shuch contract or investment as desided upon in a business way to take most any kind of a contract that is straight honest and profitable.

WAGES.

Wages are to be payed only to the men actually doing the hard work. Miners mechanics, millmen and these only that are giving their entire time of regular working hours a common wage of say $5 per day for boss as well as men. And only members and owners at work or in charges untill the business has an income to pay its labor. The working man must have some way of being supported. This is not intended as a wage proposition neather is it a stock proposition only as a means of dividing dividens and eather selling an interest or digging out ore and selling that or selling a property to finance the business and buy a one drill portable drilling outfit a small Gold mill a Cleavland or Forde 72 horsepower Tank type tractor of a Type 14 Ingersoll Rand or some other good portable drill all machinery Nessary costing somewhere around $15,000. (15 thousand dollars) More and possiable less an outfit than make low grade ore profitable can be handled by about 5 men taking small space can be easily and quickly set up and moved from place to place till we are shure of the prospect then we can install a perment plant. No transfers of stock out of our circle without the consent of two-thirds majority to keep out unwelcome members.

WHO WE WANT FOR MEMBERS.

Only men that agree to be honest workers, careful in expenditures, tending to their own and the company's business and are out and willing to make a success and overcome all obstacles to find a way or make one

STOCK.

The company is divided up into 500 shares of stock valued at one hundred dollars $100.00 each and each owner has one vote and 50 shares or 1/10 is the limit to each owner. 50 shares or 1/10 to ——— Zion City in trust for Zion Work this is the Bible Tithe of Net Proceeds. I am not attempting to incorporate Religion into this proposition but having indorsed the Zion work and agreed to pay my Tithe I simply make it plain here that I want my God to be an equal partner in this deal. Also being a seventh day believer I demand the privledge of observing the Sabbath (Saturday).

I might add so far I am the only one that indorses this deal and am putting my purse, efforts trying to make it go. It is tedious and very slow working one man alone so if I find a decent man or two or three of them I can divide up some work with them.

OPERTUNITIES.

The field of operations of shuch a company is particaly unlimited in Canada and especialy in this undeveloped Gold belt of the Ymir Camp for with a just division of profits we need fear no strike neather a money panic as one man operating alone also with an outfit like this if this camp does not turn out good simply hitch up the tractor and move. We can endever to get in touch with capital and sell some of our properties outright or work them with them on the Fifty Fifty basis under contract sell on commission or as best suits our purpose.

Another Letter to the Editor

Dear Ed,

Being an amateur gardener, I was immediately and passionately interested by this announcement of the *Oil, Paint and Drug Reporter:*

"An exportable surplus of copper, bauxite, opium and pyrethrum flowers is said to exist in Jugoslavia."

Whether to send it to you or to the rhodium botanists of *Chemical and Metallurgical Engineering* was hard to decide, but you were finally elected because of your well-known studies in connection with bauxite.

Please tell me where to get the seeds and how to plant 'em. I think a border of flowers of zinc between copper and bauxite flowers, set with ore-i-carias and edged with flowers of sulphur, would be lovely. ALICE.

[Dear Alice—We are writing our correspondents at Trn and Crb as to where to get them. Of course, "baux" should be "box," and that makes a lovely hedge.—Ed.]

A Cousin Jack Miner's Lament

"Chap by tha name o' h'Elsworth Bennett in Tonopah," says Cap'n Dick, "sends me this 'ere poem. 'Ere's w'ot 'ee sez: 'Dear Cap'n Dick: 'Ere's a bit o' crude rhyme that I've 'eard sung aroun' tha mines in Grass Valley, w'ere I wuz muckin'. Change un any bloody way you min' to, an' if you don't want for to use 'er, thraw tha bloody thing in tha sump'. Poetry, m'son, mus' be jus' like a set o' timber—snug an' fitty, so I've put in a wedge or two, squared 'er h'up a bit, an' 'ere gaws:

There be some minin' h'experts in tha states,
Oo've studied years 'pon years to fill their pates
Full o' dips an' spurs an' h'angles,
An' h'all such bookish tangles.
Not like you nor me worked h'out h'upon h'our slates
But min' you, there's some 'igh-toned h'engineers,
'Oo've took a course in these 'ere minin' schools,
May be tried to learn but couldn't,
For I naws well they wouldn't
Naw tha trammers from tha Sutro Tunnel mules.

They'll spen' h'all day a' geekin' h'at a rock,
Tha words they'll speak to 'ee would stop a clock.
They will say h'it's h'argentifrus,
Per'aps, a bit h'aurifrus,
H'also full o' 'ornblende, glance an' poppycock.
But they doesn't naw cut-'ole from a liffer,
Nor 'ow a set o' timber should be put,
An' never seems to 'ave tha time
For to study h'out tha mine,
Nor doesn't naw tha 'angin' from tha foot.

Couldn't tell a sollar from length o' rails.
Wouldn't naw bal-dag from a keg o' nails,
An' w'ot they naws o' shovelin',
Jus' comes o' this 'ere grovelin'
With a muck stick, shovelin' snaw, an' breakin' trails.
They mightn't naw a slick sheet from a sheave wheel.
Nor worked in runnin' groun' like you an' me,
But w'en thee take un forth an' back, thee'll h'admit
that h'it's a fac',
They're better h'educated chaps than we.

CONSULTATION

The Kata-Thermometer

"The student of mine ventilation and of atmospheric conditions surrounding mine workers is reading many references to 'Leonard Hill's Kata-Thermometer' as an instrument indicating these conditions. None of us have ever seen one or had its principles explained. I assume that it is some form of thermometer, and, therefore, address you with our request for a brief exposition of the present form of the instrument and of its indications."

The kata-thermometer is an instrument used to measure the cooling power of the atmosphere. It is somewhat similar to the ordinary wet and dry bulb thermometer, both in construction and operation, and has been practically applied to the ventilation problems of deep mines, particularly in South Africa. It is found in practice, according to Dr. J. A. Orenstein, that kata-thermometer readings afford a much better way of investigating actual atmospheric conditions in relation to practical problems than anything which one could possibly obtain with the anemometer or thermometer. The "kata" is easily used, and the calculations are simple.

It is best described in the words of its inventor and designer, Dr. Leonard Hill, who, writing in the *Monthly Weather Review* for December, 1920, states that:

"Wet-bulb temperatures in factories and mines are physiologically much more important than dry-bulb temperatures; so, too, the vapor-pressure reading is much more important than the relative humidity, and the velocity of movement of the air is most important of all, for on this chiefly depends cooling by convection and evaporation. The dry-bulb thermometer indicates the average effect of the temperature of the air and walls of the inclosure on itself; it does not show the cooling and evaporative power of the environment on the skin and respiratory membrane. It is a static instrument, whereas the body is dynamic, producing heat which must be lost at an equal rate.

"To measure cooling and evaporative powers I have introduced the kata-thermometer, a large-bulbed spirit thermometer of standard size and shape [British standards understood], graduated between 100 deg. and 95 deg. F.[1] The bulb is heated in hot water in a Thermos flask, until the meniscus rises into the small top of the bulb. It is then dried, suspended, and the time of cooling from 100 deg. to 95 deg. F. is taken with a stop watch in seconds. The number of seconds divided into a factor number (approximately 500, and determined for each instrument) gives the cooling power by convection and radiation on the surface of the 'kata' at approximately this temperature, in millicalories per square centimeter per second. The operation is repeated with a cotton muslin fingerstall on the bulb, and the wet 'kata' cooling power obtained, a cooling power due to evaporation, radiation, and convection.

"The difference between the two gives the evaporative cooling power. In Britain the mean dry 'kata' cooling power on the top of observatories is from 20 deg. to 25 deg. F. in July and August and about 40 deg. F. in December and January. Extensive observation shows that the dry 'kata' cooling power is about 6 in ordinary rooms occupied by sedentary workers. It certainly should not be less than 6 except under conditions of outside temperature which make it impossible to secure such a cooling power by means of fan ventilation. It is found to be as low as 4 and even 3 in factories and offices when proper attention to ventilation would easily secure readings of 6.

"When physical work is being done, the reading should be higher, say 7 or 8, or even more when labor is being performed. By keeping the cooling power in proper relation to the work done and the heat output of the worker—four times as much energy is spent by the body in heat as in doing external work—the latter can be kept from sweating, and, working with comfort and ease, he will be naturally stimulated to give greater output. . . .

"The 'kata' can be used as an anemometer, the formula connecting temperature and wind with the cooling of the dry 'kata' having been marked out in wind tunnels. . . . Renewed investigation at a low range of velocities gave the following as the more nearly correct form:

$$H/\theta = 0.12 + 0.54\sqrt{v};$$

and for velocities below 0.4 meter per second

$$H/\theta = 0.165 + 0.42\sqrt{v}.$$

(in which

H = Cooling power of air in millicalories per sq.cm. per second.

θ = Excess of 'kata' temperature over temperature of air = $36.5 - t$.

v = Velocity of wind in meters per second.)

"The wet 'kata' reading is found to be about 18 to 20 in rooms which do not feel close when sedentary work is being done. In warm moist spinning sheds and mines it may be as low as 10 to 12. The wet 'kata' reading is of great import when the temperatures approximate body temperatures, and cooling by convection and radiation becomes greatly reduced. . . .

"The 'kata' indicates cooling and evaporative power from its own surface, not from the human body. Its bulk is comparable with the body of a mouse, and is much smaller than the parts of a human body. The 'kata' readings give valuable measures of cooling and evaporating powers, but not directly measurements of the cooling and evaporative loss of the body. . . ."

To anyone interested in a more extended discussion of the kata-thermometer, an article published in the November, 1920, issue of *The Journal of the Chemical, Metallurgical & Mining Society of South Africa*, entitled, "The Kata-Thermometer and Its Practical Use in Mining," by H. J. Ireland, will be found valuable, as it gives an extended record of the experimental work leading up to the design of the instrument, and a discussion of the theoretical and practical considerations governing its use. A paper, "Scheme for Working the City Deep Mine at a Depth of 7,000 Ft.," by E. H. Clifford, published in the February, 1921, *Bulletin of the Institution of Mining and Metallurgy*, describes an application of the "kata" to mining operations at great depths, and, coupled with the discussion following in the March and April numbers of the *Bulletin*, presents an interesting and highly informative and instructive amount of data.

The consensus of opinion among those engineers and others who have made practical use of the device seems to be wholly commendatory. Mr. Clifford in his article pays tribute to Dr. Hill's work in stating that "It is to the recent researches of Dr. Leonard Hill and his associates that we owe an adequate statement of the physiological theory of ventilation."

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[1] Dr. Hill has stated that the mean of 100 deg. and 95 deg. F. was 36.5 deg. C., which could be taken as the skin temperature; hence the reason for taking the range indicated.

HANDY KNOWLEDGE

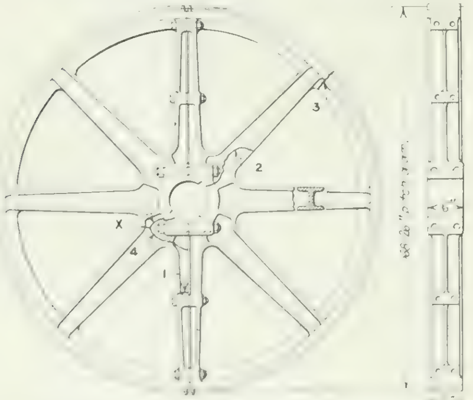
Repairing a Gold Dredge Bull Gear

By C. M. ROMANOWITZ

Written for *Engineering and Mining Journal*

On the night of April 5, 1921, at 10:45 o'clock, the Marysville dredge No. 5, operating at Marigold, Cal., was shut down, owing to a serious break of the bull gear on the starboard side. The cause of the trouble was a break of the intermediate shaft on the port side, which threw all the load on the starboard gear, which was weak because it had been poorly repaired previously. The gear apparently broke first in the old weld in the hub as shown at *x* in Fig. 1, then breaking at the other three points also designated.

The gear is of cast steel, approximately 14 ft. 2 in. in diameter, 15-in. face, 16 in. through the hub, with 192 cut teeth of 2¾-in. pitch. It is cast in halves and bolted together through the hub with four 2¾-in. rod bolts and eight 2¼-in. bolts through the split spokes, and weighs 18,190 lb.

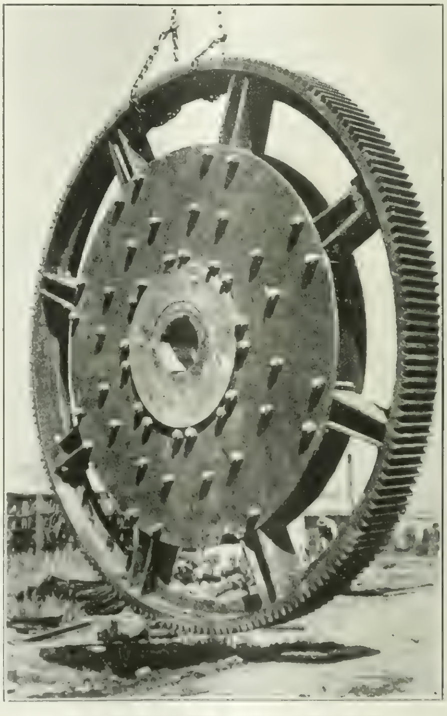


THE GEAR BROKE FIRST AT X, THEN AT OTHER POINTS AS SHOWN

As there was no spare gear on hand, and as the gear was not interchangeable with the gears on the other 18-cu.ft. dredges in operation, the situation was serious, owing to the probable shut-down of from six to eight weeks before a new gear could be supplied. It was therefore necessary to try to repair the broken gear, even though it looked almost impossible. It was without doubt the largest electric welding job ever tried on a gold dredge.

The four pieces of the broken gear were taken to the dredge repair shops at Marigold and there arranged for the welding. Owing to the fact that the gear had been electrically welded before, and had failed at the welded part, there was not much confidence that the electric welding would do the work properly. However, upon close examination of the break, it was easily seen that the original welding had been poorly done. This was owing to the fact that the repair had been made by a man who had had no experience in the heavy work and who was forced to work almost continuously until the job was completed. The weld clearly showed that the work had been slighted toward the end, and that the man had not had sufficient experience.

Through the kindness of the Natomas Company of California, that company's large welding apparatus, used on the dredges at Natoma, was taken to Marigold to do the work. Two welders having considerable experience in heavy welding were put on the work. The men worked twelve-hour shifts until the job was completed, taking approximately eight double shifts and using over 400 lb. of welding rods.

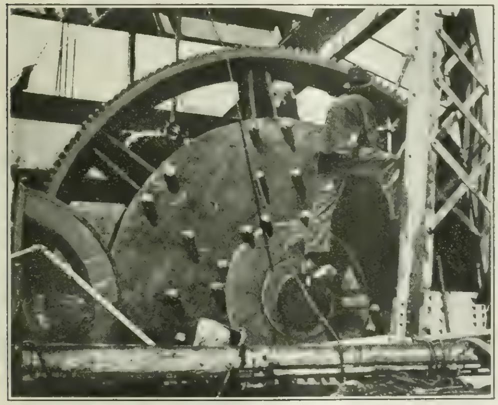


THE DREDGE BULL GEAR REPAIRED

In the meantime, on the morning of April 9, at 9 a.m., two plates, 1⅜ in thick by 126 in. wide and 272 in. long, were located at the Ralston Iron Works. These were ordered, cut in halves, 126 x 136 in., loaded on cars and left San Francisco at 3 p.m. the same day, arriving in Marysville April 10, and were hauled out to Marigold the morning of April 11. Two of the plates were cut to 10 ft. 6 in. outside diameter and 26 in. inside diameter and from the other two were cut two additional plates of 48 in. outside diameter and 26 in. inside diameter.

The welded gear and four plates were then hauled to the plant of the Yuba Manufacturing Co. at Marysville on April 14, arriving at 4 p.m. At 6 p.m. the gear was set on the mill and the machining started. It was necessary to machine the hubs to 26½ in. diameter in order to shrink the reinforcing plates on, and in doing this it was necessary also to machine through the boxes for the four 2¾-in. bolts, leaving the holes exposed, which were filled with rods and electrically welded. The hubs were first rough finished, and after the welding was done the machining was completed to the necessary diameter. Also, to permit the plates to be put on, it was necessary to turn the outside faces of the spokes about ¾ in. deep out to 10 ft. 6 in. diameter. As the spokes were made of tough steel, considerable time was saved in machining the second side by burning with an acetylene torch the excess material of the bosses on the hub and the spokes, leaving just a small amount of machining to be done. The bore of the gear was not true, and it was necessary to add metal and to re-bore to the proper diameter. The machining of one side and boring took until 3 p.m., April 17. Then by the method of cutting excess material just described there was saved about thirty-two working hours on the opposite side, so that the gear was taken off the mill on April 19.

The plates were next bored on this mill, which is capable of turning to a diameter of 16 ft. The finished plates were then heated, one at a time, and shrunk on the gear. In heating the large plates, care was taken so to heat them with the oil burners as to make them dish outward. One was shrunk on each side, so that the outside diameter of each plate was clear of the spokes. Both plates were afterward drawn together with forty-eight 2-in. rod bolts, which were so placed as to give good bearing against the spokes. As can be seen in the photographs, the plates of smaller diameter were not bolted, but were electrically welded to the larger ones at the outside diameter. The gear as repaired weighed 23,980 lb.



INSTALLING THE BULL GEAR

The work was finished at the Yuba plant at 1:30 p.m., April 20, and hauled to the dredge repair shop at Marigold and to the bank of the dredge about 10 p.m. that night. At 1 a.m., April 21, the gear was placed aboard the dredge. Considerable difficulty was encountered on the dredge owing to the gear being originally split so that it could be conveniently installed. To put the gear on, it was necessary to disconnect the bucket line, tear down part of the hopper, and lift the upper tumbler, shaft and port gear out of the bearings and slide them to one side to let the repaired gear clear the starboard truss until put on the shaft. Delay was also caused owing to limited head room on the crane. However, the crew overcame these hindrances and had the dredge ready to run at 1:30 p.m., April 21.

The lost time due to this break was 374 hours 45 minutes, or 15 days, 14 hours 45 minutes. The repairs were made under the direction of Gerald H. Hutton and Gregg Hanson, of the Marigold Store & Construction Co.

M. L. Summers, of the Yuba Consolidated Goldfields, and L. D. Hopfield, of the Natomas Company of California, greatly assisted Mr. Hutton in the welding job by their experience and advice. The close co-operation among the gold dredge superintendents of California is shown by Mr. Hopfield's loaning of the Natomas welding outfit for the job, which was too large for the welding equipment immediately available.

The interesting feature of this repair job is that it establishes a further limit to the possibilities of large repair work. This job appeared to be almost impracticable, and it required courage to undertake it. The question now is, what is the limit of electric welding in repair jobs on dredges? Electric welding has revolutionized dredge repair work, and the job just described is a record in such work.

A Two-Minute Qualitative Test for Lead

By E. C. D. Marriage

Written for Engineering and Mining Journal

A rapid and reliable test for the presence of lead in an ore should be a part of the handy knowledge of everyone who may have contact with the ores of this metal. A method that is more or less in common use in the West is as follows:

Place a portion of the finely ground ore, approximately 0.5 gram, in a small beaker, drop one or two drops of concentrated nitric acid directly upon the ore, allow to act for a moment, then dilute with about 20 c.c. of cold water, and to the resultant solution add about 0.1 gram of finely powdered potassium iodide. A brilliant yellow precipitate of lead iodide will indicate the presence of lead.

Other minerals may be present in the sample which have the power to liberate iodine, masking the color of the precipitate if the lead content be less than one-tenth of 1 per cent. Copper and a high percentage of iron are the chief source of interference. An excess of nitric acid will have the same effect, and for this reason not more than two drops should be added. The dull yellowish-brown color of the iodine is not likely to be confused with the brilliancy of the lead precipitate.

The test is distinctly reliable, and in the hands of a skilled operator will indicate the presence of the metal when as low as two-tenths of 1 per cent.

Mine Locomotive Haulage

According to Gerard B. Rosenblatt, the lightest permissible weight of rail that can be used in the operation of electrical locomotives underground is as follows: 4-ton locomotive, 12-lb. rail; 6-ton locomotive, 16-lb. rail; 8-ton locomotive, 20-lb. rail; 10-ton locomotive, 25-lb. rail; 15-ton locomotive, 40-lb. rail.

The mine-track gage with respect to the heaviest locomotive available for the gage of track is as follows: 18-in. gage, 4-ton locomotive; 24-in. gage, 8-ton locomotive; 36-in. gage, 20-ton locomotive.

THE PETROLEUM INDUSTRY

The Mesopotamian Oil Controversy

BY HENRY C. MORRIS

Written for *Engineering and Mining Journal*

THE MESOPOTAMIAN oil controversy between the United States and Great Britain has reached the point at which the liquid might be almost said to belie its nature and to have become an irritant instead of a lubricant. This is so contrary to the nature of the fluid itself, that the good faith and good sense of the governments and the people of the two countries should unite, to restore oil to one of its proper functions of lubrication, and as suggested by Sydney Brooks in the March number of the *Fortnightly Review*, the two governments should take counsel together, lay their cards on the table, and by a timely discussion and the widest publication of their oil policies and requirements do everything possible to moderate feeling and to restore perspective.

Ignorance concerning the facts, or concealment of them, inadvertent or willful misunderstanding of opposing statements, or unwarranted animus, only prolongs the dispute, confuses the argument, and adds bitterness to what should be a friendly and businesslike discussion.

DIPLOMATIC EXCHANGES NOT PRODUCTIVE OF RESULTS

The present divergence of opinion regarding Mesopotamian oil concessions, particularly as between the United States and Great Britain, has been argued publicly for months by official correspondence and by the interested nationals of both countries, without, so far as the public can learn, any approach to a definitive settlement. The rational, statesmanlike method of adjustment necessitates a free, frank, and open discussion between representatives of the two countries, with full authority to agree on a plan of co-operation that will prevent further controversy and complications. Substantial progress has been made by the exchange of official notes, but this process is painfully slow and unnecessarily delays arriving at an amicable adjustment of the controversy. It is appropriate, in view of the present misunderstanding of the facts, to detail the basis of the respective claims and to submit the brief to the bar of public opinion, particularly in the two countries chiefly concerned.

HISTORY OF CONCESSIONS

The British claims to petroleum concessions have the following history:

In 1888 a representative of the Deutsche Bank obtained a concession, by imperial firman, to build a railroad from Ismid east to Angora, which was completed in 1892. This is known as the Anatolian Railway Concession. Subsequent concessions extended the right of the Anatolian railway company from Eskishera southeast to Konia, and in 1903 another concession, for ninety-nine years, covered a right of way from Konia to Bagdad and Basra, via Adana and Mosul. Article XX of the Anatolian Railway Convention of 1888 provided, in its opening paragraph, that the concessionaire could exploit mines which it might discover in a zone extending for twenty kilometers on each side of the center of the right of way if it conformed to the laws and regulations relating to such concessions. It was expressly stated, however, that this permit was not to be construed as a monopoly. Article XXII of the Bagdad Convention, or concession, granted similar privileges for the Konia-Bagdad right of way, but for twice the lateral extent of the former concession; that is, for forty kilometers on each side of the center of the right of way.

RIGHTS ACQUIRED BY ANATOLIAN RAILWAY

In 1904, the Anatolian Railway obtained, from the Ministry of the Civil List, the right to explore for oil wells in the vilayets of Mosul and Bagdad, which rights were granted to the civil list by the Sultan in firmans of 1889, 1898, and 1902. These firmans granted all oil wells discovered or to be discovered in the whole territory of the two vilayets.

The rights granted to the Anatolian Railway under its convention of 1904 with the Ministry of the civil list expressly stipulated that preliminary borings or explorations must be carried out within one year. These preliminary investigations were not made, and the Anatolian Railway was therefore officially notified of the forfeiture of its rights because of non-compliance with the provisions of the convention.

The petroleum rights in the vilayets of Mosul and Bagdad were transferred, in 1908, from the Ministry of the Civil List to the Ministry of Finance. In 1912 the Turkish Petroleum Co. was formed, as the result of a British-German diplomatic agreement, to take over the oil rights alleged to be held by the Deutsche Bank and its subsidiaries. It should be remembered, in this connection, that the Anatolian Railway had already forfeited its rights because of non-compliance with the terms of its concession and had been officially notified of the fact.

TURKISH PROMISES NOT HONORED

The Turkish Petroleum Co. evidently did not consider its acquisition of rights any too secure, for in 1914 it alleges that the Turkish Minister of Finance promised the company a contract, or concession, covering the oil rights in Mosul and Bagdad. Whatever the Grand Vizier is alleged to have promised or did promise in 1914 was never sanctioned by the Turkish Parliament, which sanction was necessary under the Turkish law; nor were the conditions of the alleged concession definitely settled. In other words, the alleged contract was merely the personal statement of a Turkish official which was not legally binding on the Turkish government or on the successor of the Turkish government in Mesopotamia.

The ambassadors of Great Britain, Germany, and Turkey were engaged in negotiations regarding this concession or contract at the outbreak of the World War, at which time the railway was in operation from Konia, with one or two breaks, to somewhat beyond the crossing of the Euphrates River east of Birejik, or east to the Gulf of Alexandretta. Such, in brief, is the history of the so-called Turkish Concessions, on which more detailed light is shed by an article in the *Quarterly Review* (London, 1917), in Volume 228, under the title of "The Bagdad Railway Negotiations."

BRITISH PRIME MINISTER DECLINES TO DISCLOSE FACTS AND PAPERS

Requests were made in the British House of Commons in June and July, 1920, for all facts and papers covering the petroleum claims in Mesopotamia. On June 28, 1920, the Prime Minister stated that his reasons for refusing to honor these requests were that "It is not possible to say what claims, based on grants by the Turkish government, may be put forward in the various mandated territories." If the alleged contracts were valid, or were in full legal force and effect at the outbreak of the war, why not produce them?

On Dec. 15, 1920, the Prime Minister, addressing the House of Commons, said:

> We have shown perfectly clearly that if there is a rich deposit of that kind (oil) which requires to be examined —and it has not been examined up to the present time— we have made it quite clear that if there is a rich deposit of that kind, it is for the benefit, not merely of the British Empire, but for the whole world, and that we shall hold the balance merely between the nations of the world. But the mandate means that it is under British advice.

Lord Robert Cecil, in a letter to the London *Times* under date of June 24, 1920, went even further, saying:

> Unless the mandates effectively entitle the natives to protection and forbid improper employment of the resources of the mandated territory, the advisory powers of the League will be a farce, and we shall be back in the bad old days of conquest and exploitation which it was the chief object of the mandate system to destroy.

When the Turkish treaty was being drafted by the representatives of the Allied powers, the President of the United States made public certain statements contained in a note to the Allied governments, to which the Supreme Council at San Remo replied in part as follows:

> The economic provisions of the Turkish treaty are in general harmony with those approved in the treaty with the enemy powers with particular regard to concessions in the former Turkish Empire. These were, as is well known, not infrequently obtained by dubious means and under conditions inconsistent with the best development of the areas where they were located. The eventual right to cancel concessions has only been provided for in territories which are to be placed under the tutelage of the principal Allied forces. It has been felt unfair to saddle these new states with burdens which they had no voice in incurring.
>
> Finally, the Allied governments take this opportunity of assuring the United States Government that the Allied governments have in no way sought by the territorial changes and arrangements provided for in the Turkish treaty to place their corporations or citizens in a privileged position as compared with American citizens and corporations.

Secretary Colby's note to Lord Curzon under date of Nov. 20, 1920, said in part:

> This Government welcomes your pledges to the effect that the natural resources of Mesopotamia are to be secured to the people of Mesopotamia and to the future Arab state to be established in that region, and that it is the purpose of the British government, fully alive to its obligations as a temporary occupant, not only to secure those resources to the Mesopotamia state, but also its absolute freedom of action in control thereof, and in particular that it is far from the intention of the mandatory power to establish any kind of monopoly or preferred position in its own interests.

Another significant paragraph of the Colby note says:

> I need hardly refer again to the fact that the Government of the United States has consistently urged that it is of the utmost importance to the future peace of the world that alien territory transferred as a result of the war with the Central Powers should be held and administered in such a way as to assure equal treatment to the commerce and to the citizens of all nations.

And again our Secretary of State says:

> . . . I might observe that such information as this Government has received indicates that, prior to the war, the Turkish Petroleum Co., to make specific reference, possessed in Mesopotamia no rights to petroleum concessions or to the exploitation of oil; and in view of your assurance that it is not the intention of the mandatory power to establish on its own behalf any kind of monopoly, I am at some loss to understand how to construe the provisions of the San Remo Agreement that any private petroleum company which may develop the Mesopotamian oil fields "shall be under permanent British control."

In a communication to the London *Times* under date of Oct. 21, 1920, A. Berriedale Keith, an eminent British authority on constitutional law, of the University of Edinburgh, said in part:

> The report that the State Department at Washington is far from favorably impressed with the British and French attitude on the question of Mesopotamian oil suggests an interesting point as to the meaning of Article XXII of the Covenant of the League of Nations. . . . I am wholly unable to understand how the obligations imposed by the League Covenant are to be reconciled with the agreement regarding petroleum concluded on April 25 at San Remo between Mr. Lloyd George and M. Millerand, which appears to me to be open to all the criticisms adduced in the case of Nauru, while the reply made by Lord Milner is inapplicable. For the British government itself to develop the Mesopotamian oil field appears to be wholly incompatible with the obligations of a mandatory state, as opposed to a state exercising a veiled annexation, and the manifest duty of the mandatory appears to be to advise the Mesopotamian administration that in the grant of concessions for oil strict impartiality must be observed by the nationals of the state and members of the League. If it is contended that the British and French governments are entitled to make use of the rights flowing to them from former Turkish concessions, the reply is simple; by agreeing to the terms of the League Covenant they have precluded themselves from exercising in specie these rights when in conflict with the principles and terms of the Covenant, and have only a right to be reimbursed by the Mesopotamian state the amount of any expenditures actually incurred by them heretofore under the terms of the concessions.
>
> The question is one of far more than theoretic interest; the deplorable waste of British and Indian lives, apart from the enormous expenditures involved in the pacification of Mesopotamia, is more unjustifiable if it is incurred in the pursuit of a policy which persisted in will endanger

Anglo-American relations and ruin all belief in the honesty of the mandatory system.

In explanation of the above quotation, particularly the reference to the British government itself developing Mesopotamian oil fields, it must be understood that the British government really controls the Turkish Petroleum Co., through the Anglo-Persian interest in the latter. It is known of course that the British government holds two-thirds of the capital stock of the Anglo-Persian Oil Co., and that the government representative on the board of directors of this company can negative any action of the board.

I submit therefore that the Mesopotamian petroleum concessions were forfeited ten years before the war, and that if any partial rights which it is claimed were acquired prior to the World War are regarded by Great Britain as a monopoly which, ". . . shall be under permanent British control," they are a violation of the statement of the Supreme Council of the League of Nations that the Allied governments have in no way sought to place the corporations or citizens in a privileged condition as compared with American citizens or corporations.

To quote Dr. John H. Latané, professor of diplomacy at John Hopkins University:

> The San Remo Agreement should not be permitted to stand, and if Great Britain wishes to remain on cordial terms with the United States she must back down from a position which is wholly untenable.

Further to prolong the arguments, and thus endanger the friendship between Britain and America in order to sustain a ministry before its people and its commercial interests, or, for the sake of an economic advantage based on dubious antecedents, to uphold an invalid claim, constitutes an unforgivable reversion to the short-sighted, selfish, economic imperialism which was the principal cause of the World War.

Let us show our mutual good faith by our mutual willingness to come speedily to a just and amicable settlement of this unnatural cause of international irritation.

Petroleum in the Salta-Jujuy District, Argentina*

By Arthur H. Redfield

The Salta-Jujuy district of northern Argentina is a triangular area, with sides about 100 miles long, lying 800 to 900 miles northwest of Buenos Aires, adjoining the frontier of Bolivia, with whose fields it is continuous. Its area contains about 5,000 square miles, of which 250 square miles contain evidences of petroleum, but of which less than one square mile has been tested with varying results.

Oil occurs in the red shales and sandstones of the petroliferous formation, placed by Brackebusch and Steinmann in the Lower Cretaceous, but considered by Bonarelli to extend into the Tertiary. The latter divides the petroliferous formation into four groups: (a) The lower sandstones, 6,600-7,200 ft thick; (b) the limestone-dolomite horizon, 131 ft. thick; (c) the upper sandstones, 970 ft. thick; and (d) the Sub-Andine Tertiary (?), 8,200 ft. in thickness. All are probably of marine origin. The oil, occurring principally in the lower sandstones and the limestones, is believed to exist here in secondary deposits, formed in the underlying Devonian. Moderate folding and overthrust faulting are discernible in the Salta-Jujuy district. Eight anticlines are observed in the petroliferous formation.

Numerous oil seepages occur, as at Loma de Ipaguazu, Aguas Calientes, Quebrada de Iquira, Zanga Honda, Sierra del Alto, Rio Chico, Vado Hondo, and Rio Colorado. The Lower Traissic (?) limestones of the Upper Salado River are charged with petroleum. Sulphur springs are numerous.

The Salta-Jujuy district was studied in 1882 by Brackebusch, and in 1888 by Dr. über, for the Companiá Mendocina de Petróleo. This company in 1910-11 drilled foùr wells at El Garrapatal, without result. The Companiá "El Petróleo Argentino" drilled at the same time Laguna de la Brea, Jujuy, without commercial success. Senor Tobar drilled four shallow wells at Quebrada de Galarce without obtaining oil in any quantity. A well drilled by the Argentine government at Capiazuti was abandoned in 1916 "for economic reasons."

Concessions, as granting exclusive mining rights or special privileges over large areas, do not exist in the Mendoza-Neuquén district. The term concession is applied to the permission granted by the national or a provincial government to prospect or develop a given area. A concession may be granted to anyone, citizen or alien, who complies with the official formalities. The discoverer of a mineral deposit has prior rights over all other applicants. All mines are owned by the provincial governments, or, in national territories, by the national government.

Foreigners in Argentina enjoy all the civil rights of the citizen, and may do business or trade without adopting Argentine citizenship or paying special taxes. Citizenship may be acquired after two years' residence. Neither the mining code nor the law and regulations of mining make any distinction between nationals and foreigners for obtaining or developing concessions. A bill has been submitted to the Argentine Congress, however, declaring all petroleum wells to be national property, to be prospected or exploited by the national government.

The Dover Oil Field, Ontario

Special Correspondence

Work by several companies in the Dover oil field, in western Ontario, is making steady progress. The Petrol Oil & Gas Co. has seven tank cars of oil ready for shipment, and its production of both oil and gas is reported to be satisfactory. The Vacuum Gas & Oil Co.'s well is being connected with the Southern Pipe Line Co.'s gas mains. The Ajax Oil & Gas Co. is holding oil for shipment, pumping from five completed wells, and will test the different oil horizons penetrated in the shallow drilling.

The Eureka company is planning exploration of the Niagara and Guelph geological sands between 1,300 and 1,400 ft. deep. The Universal experienced some trouble with that company's first well in setting the 2,900 ft. of 6½-in. casing on the top of the oil and gas sands, but is now making satisfactory progress. The Peninsular, a new operator in the shallow field, adjoining the Ajax, has two producing wells and is drilling three adjacent leases.

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*[illegible] of Foreign Mineral Resources

Book Reviews

Geology of the British Empire. By F. R. C. Reed. Cloth; 5½ x 8½; pp. 480. Edward Arnold, London; 1921. Longmans, Green & Co., New York. Price, $14.

This is a rather curious development of the "political and commercial geology" trend. It is political geology divorced from the commercial geology. The treatment is purely from the geologic point of view, and although economic geology has its place in the presentation, it is a very subordinate one. The emphasis is mainly on the stratigraphic structure, volcanic and tectonic features, and even paleontology occupies a not unimportant place. Yet only British territory is included. For example, the book begins by describing the geology of the Rock of Gibraltar, passes thence to the Maltese Islands, thence to Cyprus, and from there to Egypt and the Anglo-Egyptian Sudan.

Such Mediterranean lands as do not lie under the British flag are geologically non-existent to the reader who voyages in fancy along with this book. Under "The West Indies" we read about the British islands, British Honduras, and British Guiana, and it is curious to find that the only geology of China is that of Hongkong. The treatment is consistent to its plan, and quite up to date. The geology of the "Mandatory Regions" receives due consideration, including Mesopotamia and Palestine.

We are used to seeing pure geology treated from the viewpoint of natural geological divisions, or at the most of natural geographical divisions, although, to be sure, the study of the geology of the United States is confined to our borders, and our numerous state surveys have similarly respected political boundaries. But hitherto we have had, for example, only the geological surveys of Canada, or of Australia, and so on, and they represent in each case single geographic provinces. To pick the rocks in the oceans of the world that are British for special description of their geology is somewhat startling, and indicates plainly the nationalistic or imperialistic idea. Therefore, the underlying idea is economic; for science knows no political boundaries. And this furnishes some strength to one definition that has been given of economic geology — "All geology is economic geology." In this book the underlying elements of pure geology are plainly put forward as a basis for an understanding of the necessary treatment and development of British territory, although no deductions to that effect are drawn.

As a textbook or reference book the volume seems admirable, showing thorough reading, great power of concentration, and clear presentation. For any one region it will simply provide an outline of the most salient features, for which the reader desirous of more precise information will proceed to the local authorities listed in the copious bibliographies. J. E. S.

Handbook of Metallurgy. Vol. 1 (Copper, Lead. Silver, Gold). By Dr. Carl Schnabel; translated by Henry Louis. Third edition. Cloth; 6 x 9; pp. 1,171. Macmillan & Co., London: The Macmillan Co., New York. Price, $13.50.

Since 1894, when the first edition of Dr. Schnabel's treatise on metallurgy was published, this book has rightly been considered a classic. Successive editions appeared in English in 1898, in German in 1902, and in English in 1904. The present volume is a revision of the second English edition by Dr. Louis, the translator, Dr. Schnabel having died, and retains the form of the earlier book with some of the older matter replaced with descriptions of more recent processes and equipment. The subject of copper occupies 387 pages; lead, 216; silver, 331; and gold, 198. It was the intention of Dr. Louis to publish this book six or seven years ago; most of the material was ready for the printer in 1914 and much of it was in type at that time. When the war broke out, publication had to be delayed, and not until this year did the book finally appear.

No book on metallurgy covers the ground so thoroughly as this volume. Most of us in America are accustomed to reading chiefly of American practice as presented by Hofman, Peters, Ingalls, and others, but here processes used all over the world are described in considerable detail, though European practice is given most prominence. The book will be particularly valuable in our own library for replying to inquirers about equipment and processes known only to us by name or not at all. Metallurgists may find the information given about foreign operations suggestive as a solution of some of their own difficulties. For example, at one American copper smelter, a method of selective converting was recently devised to segregate the small percentage of precious metals which occurred in the white metal produced at that plant. The process developed was practically the same as that used in some other parts of the world, and no doubt much helpful information could have been gained had such a reference book as the one under review been handy.

To American metallurgists who are looking for a good treatise on current practice, the book will be a big disappointment, for practically nothing which has happened in the last eight or ten years—and a great deal has happened—is mentioned. As a consequence many of the statements made are no longer true. The section devoted to copper, for example, states that water-jacketed blast furnaces are usually constructed with movable forehearths; that "where an ample water supply is available it is best to granulate the slag. . . as is done at Great Falls, and at the Parrot smelter at Butte"; that at Anaconda there is a reverberatory furnace which smelts 253 tons in twenty-four hours, using 1 ton of coal for 4.25 tons of charge; that at Dollar Bay, Michigan, "mineral containing about 60 per cent of copper is treated, over 41,000 tons having been treated in the year 1905-6." Practically nothing is said about the hydrometallurgy of copper; electrical precipitation of solutions of copper derived from ores is not mentioned as a commercial process; basic converting receives a brief paragraph; and three lines are devoted to pulverized-coal firing. Pyritic smelting is divided into two types, one being the "true" type in which no fuel whatever is used and which has come into use in only a "few instances," such as at "Tilt Cove in Newfoundland, Mount Lyell in Tasmania, at the Mammoth Copper Co., Kenneth, Cal., and at Ducktown, Tenn." Chalcopyrite is said to be the mineral source of most of the world's copper, although native copper "occurs in large quantities on Lake Superior in the State of Michigan, and at Santa Rita in New Mexico."

In discussing the metallurgy of lead, nothing is said of the Newnam ore hearth, and those parts devoted to roasting in shaft furnaces, to the charging of blast furnaces, and to a description of blast roasting equipment are decidedly incomplete when judged by present day practice. The only reference to the Cottrell process is the sentence, "Electrical methods of fume precipitation have also been tried, but have not yet passed into current practice." The sections on gold and silver contain fewer omissions and inaccuracies due to tardy publication, for improvements in practice have not been so radical. Also, those sections were apparently prepared a year or two later than the other matter in the book. Omission of such improvements as the Crowe process, is, however, noticeable.

The advisability of publishing this book without bringing it up to date is open to question, as is also the enthusiasm of the publishers, who, in circularizing us for an order, stated, "It includes every important new process that has been developed in the English-speaking world in the past dozen years." It is to be hoped that the second volume will have the benefit of a complete revision in the light of present practice. This second volume is to be devoted to the other metals not covered in the first, chiefly zinc, tin, quicksilver, nickel, and antimony presumably, and provides an opportunity to issue a most valuable treatise which will stand practically alone in the field. E. H. R.

Petroleum—A "Summary of Report of the Federal Trade Commission on the Pacific Coast Petroleum Industry, Part I," has been issued. This report was prepared in response to a resolution introduced by Senator Poindexter and passed July 29, 1919, and covers production, ownership, and profits of the Pacific Coast petroleum industry. Copies may be obtained on request to the Federal Trade Commission, Washington, D. C.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Report on Industrial Waste Blames Capital and Labor

Plan for National Leadership in Eliminating Waste Outlined and Public Support Invoked

Waste in industrial processes is causing enormous annual losses to the nation, declares the report of the American Engineering Council's Committee on Elimination of Waste in Industry, made public at the recent meeting of the council's executive board in St. Louis, Mo. "Over 50 per cent of the responsibility for these wastes," the report says, "can be placed at the door of management and less than 25 per cent at the door of labor."

The investigation found that the margin of unemployment mounts to more than a million men, that billions of dollars are tied up in idle equipment, that high labor turnover is a rough index of one of the commonest wastes, and that the waste of time and energy and money through duplications in estimates and bids in the building trades runs into millions annually.

Both employer and employee restrict output, it was found. Both capital and labor are blamed for existing abuses, but the annual losses through waste by conflicts between them is much less than popularly supposed. An elaborate plan of nation-wide co-operation of the Government, the public, trade associations, the industries, labor, bankers and engineers is outlined.

The full report of the committee comprises 125,000 words and deals with the deep-seated causes of waste. It does not consider "the present business crises, due in part to world-wide waste and extravagance caused by the war," as an excuse for transitory experiments, but as an opportunity to point out the need for permanent reform.

The findings are characterized as not exceptional, and American industry as a whole is said to suffer from the same defects as those found in the industries studied. The report states further, in part:

"The average method of management is far behind standards which have demonstrated their practical value; billions of dollars are tied up in idle equipment and there is a large additional waste through maintenance and depreciation charges. Both employers and employees restrict output, the former usually by limiting the total output of an industry, the latter by limiting the rate of speed of output of individual workmen.

"Preventable diseases, accidents, and death cause an annual economic loss in this country of over $3,000,000,000. It is possible, by using methods already perfected, to reduce deaths and serious accidents in American industry by at least 75 per cent."

The committee offers recommendations for the elimination of waste in production and outlines the following proposed program of governmental assistance:

"A National Industrial Information Service should be established to furnish more timely, regular, and complete information covering current production and consumption and stocks of commodity; a National Statistical Service should be established covering employment requirements; a national policy regarding public health should be fostered and encouraged; the material program for industrial rehabilitation should be encouraged and should offer opportunities for education and placement to those having physical defects as well as those handicapped because of industrial accidents; a nation-wide program of industrial standardization should be encouraged in conjunction with industrial interests; the Government should recognize the necessity for a revision of such Federal laws as interfere with stabilization of industry; a body of principles should be accepted which could be developed for the adjustment and settlement of labor disputes."

The report also says:

"Public support for the movement to wipe out waste in industry should be had. Managements should improve organization, reduce high labor turnover; improve relationship with employees; maintain inspection control-maintenance of plant and equipment; coordinate quantity and quality requirements.

"Organized labor should develop a policy for increasing output; the attitude of opposition or indifference to proper standards for production should be changed and labor should show a frank and aggressive insistence on proper standards for production; give a common-sense scrutiny to the bases for wages, and modify certain union rules; individual workers should realize their responsibilities for waste resulting from ill health and disregard of safety measures.

"The banking interests should specially encourage the stabilization of industry."

The waste of idle material in large inventories of raw and finished materials is very large. Unbalanced production also results in a very large material idleness. Very large waste is said to exist through plant idleness

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The new joint home of the **Institution of Mining and Metallurgy** and the **Institution of Mining Engineers** is Cleveland House, 225 City Road, London, E. C.

John Fritz Medal for 1921 Taken to Hadfield by American Delegation

To express the obligation which the world owes to the engineers of Great Britain for the part they played in winning the war, the organized engineers of America are sending a mission to London this summer. This mission of engineers representing the so-called Founder Societies will deliver the John Fritz Medal to Sir Robert Hadfield at the opening meeting of the British Institution of Civil Engineers on June 29.

The inability of Sir Robert to come to the United States to receive the medal which was awarded him in January, 1921, moved the trustees of the board to make the ceremony of presentation in England the occasion for an international expression of appreciation by the engineers of the United States to the engineers of Great Britain.

The deputation to England will consist of a representative of each of the four Founder Societies represented on the John Fritz Medal Board of Award as follows:

Charles T. Main, of Boston, the American Society of Civil Engineers; Colonel Arthur S. Dwight, of New York, the American Institute of Mining and Metallurgical Engineers; Ambrose Swasey, of Cleveland, the John Fritz Medal Board of Award and the American Society of Mechanical Engineers; Dr. F. B. Jewett, of New York, the American Institute of Electrical Engineers.

Dr. Ira N. Hollis, president of Worcester Polytechnic Institute and a past president of the American Society of Mechanical Engineers, will accompany the deputation and bear the message from the American engineers.

The John Fritz Medal is a gold medal presented for achievement in applied science as a memorial to the engineer whose name it bears. Previous recipients of the medal have been John Fritz, Lord Kelvin, George Westinghouse, Alexander Graham Bell, Thomas Alva Edison, Charles Talbot Porter, Alfred Noble, Sir William Henry White, Robert Woolston Hunt, John Edson Sweet, James Douglas, Elihu Thomson, and Henry Marion Howe. The medal is awarded to Sir Robert Hadfield this year because of his invention of manganese steel.

The medal was established by the professional associates and friends of John Fritz, of Bethlehem, Pa., on Aug. 21, 1902, his eightieth birthday, to perpetuate the memory of his achievements in industrial progress. There are no restrictions on its bestowal because of either nationality or sex. The trust funds supporting the medal are held and administered by a board of sixteen directors, consisting of four from each of the four national engineering societies whose representatives make up the mission now on its way to England.

The members of the mission are widely known in the engineering profession. Mr. Main is a past president of the American Society of Mechanical Engineers, past president of the Boston Society of Civil Engineers, and a life member of the corporation of the Massachusetts Institute of Technology. Colonel Dwight is vice-president of the American Institute of Mining and Metallurgical Engineers, a member of the British Institution of Mining and Metallurgy, and a trustee of Columbia University, where he is a leading figure, both in the college administration and among the growing body of its progressive alumni.

Ambrose Swasey is a Cleveland manufacturer, past president and honorary member of the American Society of Mechanical Engineers, member of the Institution of Mechanical Engineers, and president of the Board of Trustees of Dennison University, Granville, Ohio. Mr. Swasey is one of the foremost exponents of industrial research in this country and is internationally known as the original sponsor of Engineering Foundation, to which he has contributed $500,000 for the promotion of research. His latest gift was $200,000.

Dr. Jewett is vice-president of the American Institute of Electrical Engineers, past president of the New York Telephone Society, and chief engineer of the Western Electric Company. He is a vice-chairman of Engineering Foundation for 1921.

The admiration felt by the American engineer for his British fellow worker has been expressed by Calvin W. Rice, secretary of the American Society of Mechanical Engineers, in a communication to Dr. J. H. T. Tudsbery, secretary of the Institution of Civil Engineers, London. In response to cabled greetings, Mr. Rice sent the following message:

"There is a very deep sense of gratitude and obligation on the part of the engineering societies of the United States for the part played by the engineers of Great Britain in the war, and it has been a great deprivation to us that we could not have sooner expressed this in an adequate manner. It is the desire of the engineers of the United States that the presentation be as simple as possible and yet be sincere."

In response to this communication the British Institution of Civil Engineers cabled that it would "welcome and appreciate very highly greetings from the engineers of America at the opening meeting on June 29," and that they "found the occasion very suitable for the presentation of the John Fritz Medal to Sir Robert Hadfield." The delegation which will present the medal sailed from New York by the "Mauretania" on June 15.

Eugène Schneider Awarded the John Fritz Medal for 1922

The John Fritz Medal Board of Award, at a special session last month, awarded its gold medal and diploma to Charles Prosper Eugène Schneider, French engineer, scientist, and man of affairs. The following cable was recently sent to his home in Paris:

"John Fritz Medal Board of Award, representing national societies of civil, mining and metallurgical, mechanical, and electrical engineers, has awarded you the John Fritz Gold Medal for achievement in metallurgy of iron and steel; for development of ordnance, especially the 75-mm. gun, and for notable patriotic contribution to the winning of the war. Letter follows."

Mr. Schneider heads the great Creusot engineering and steel works and shipbuilding plants of France, which, with their subsidiaries, have 100,000 employees. No industrial establishment in the whole world made a greater contribution to the defense of liberty or showed more wonderful resourcefulness under the stress of war from 1914 to 1918.

The German invasion of 1914 reduced almost instantaneously the French output of pig iron about 81 per cent and of steel by 63 per cent. Nevertheless, within two and one-half years, France nearly tripled the number of her blast furnaces and increased the number of her open-hearth furnaces by 60 per cent. During the war she increased her production of rifles 290 fold, of machine guns 70 fold, of 155-cm. shells 225 fold, and of 75 cm. shells beyond reckoning. These achievements were due largely to the genius and energy of Eugène Schneider and his associates.

Mr. Schneider has led not only in the technical and commercial development of the great and varied steel and other engineering industries of France, but he has also given effective attention to the wellbeing of his men and their families. His schools for workmen, foremen, and engineers are among the best in the world. As early as 1877 his company introduced a pension system, antedating similar action by the French government. A very large proportion of his men own their houses and gardens. He has successfully done much to raise the standards, broaden the outlook, and bind the loyalty of his men.

Born on Oct. 29, 1868, at Le Creusot, Eugène Schneider has devoted his life to the development of the great industries which his forefathers founded. Upon the death of his father in 1898, he became the head of the company when only thirty years of age. He was a member of the Chamber of Deputies of the French Parliament from 1898 to 1910. He has received many honors in his own and other countries for his noteworthy achievements. While in the United States in November, 1919, he was presented the gold medal of the Mining and Metallurgical Society of America. His noble and lovable personality has won many friends.

The medal and diploma will be presented to Mr. Schneider in France by the party of American engineers led by Ambrose Swasey, chairman of the Board of Award, which left for France on June 15.

Inaccessible Books and Papers Copied for Students

Many scientists lack the library facilities which their work demands. They are compelled either to journey to distant libraries or to try to borrow books by mail. Often it is difficult for them to locate something that is badly needed.

The Research Information Service of the National Research Council is prepared to assist investigators by locating scientific publications which are not generally or readily accessible. It will also, as is desired, have manuscripts, printed matter, or illustrations copied by photostat or typewriter. The cost of copying varies from 10c. to 25c. per page. No charge is made for this service unless an advance estimate of cost has been submitted and approved by correspondent.

Requests for assistance should be addressed: National Research Council, Information Service, 1701 Massachusetts Avenue, N. W., Washington, D. C.

Ordnance Men Form Manhattan Local

In connection with the organization, under the direction of General Pershing, of the reserve armies of the United States, it was recently proposed to informally associate members of the Army Ordnance Association and the ordnance officers of the Reserve Corps.

The membership of the Army Ordnance Association, of which Benedict Crowell is president, includes about twenty-four hundred technical and business experts who, during the war, served either as officers of the Ordnance Department or as executives of industries engaged in ordnance manufacture.

For the purpose of offering assistance in the organization of the reserve armies and in the solution of local war plans, it was proposed to form in the metropolitan district of Greater New York, a local organization of the Army Ordnance Association which shall include as members all ordnance officers of the Officers' Reserve Corps.

In furtherance of the preceding suggestions a meeting was held at the Engineering Societies' Building, 29 West 39th St., at 8 p.m., Wednesday, June 15. Mr. Guy E. Tripp presided. Short addresses were made by Major General C. C. Williams, Chief of Ordnance; Major General Robert L. Bullard, Commanding General of Second Corps Area; Brigadier General William Weigel, Chief of Staff, Second Corps Area; Colonel Samuel G. Shartle, Assistant Chief of Staff, Second Corps Area; Major M. L. Brett, office of Assistant Secretary of War, and others.

MEN YOU SHOULD KNOW ABOUT

Arthur Keith, of the U. S. Geological Survey, is visiting the marble deposits near Knoxville, Tenn.

William Kelly, of Vulcan, Mich., general manager of the mines of the Penn Iron Mining Co., has sailed for a several months' visit in Europe.

Dr. Henry Mace Payne, consulting mining engineer of 300 Madison Ave., New York City, goes to Mexico next week to examine some silver-lead properties in Jalisco.

J. Morgan Clements, mining engineer, of New York City, who went to Hinan, China, in March on professional business, is expected to return to the United States during June.

Fred P. Williams, formerly with the U. S. Bureau of Mines, arrived June 1, from Colombia, South America, where he had been for the last year engaged in oil explorations for the Colombia Syndicate.

Joseph Irving, specialist in ore leaching processes, is at present testing the amenability of the Dundee-Arizona Copper Co.'s ores to such treatments. His present address is: P. O. box 73, Jerome, Ariz.

O. S. Finnie, acting secretary of the Canadian Northwest Territories, has gone to Peace River and will visit all districts of importance within the oil areas of the North.

H. A. Wheeler, consulting engineer, of St. Louis, Mo., has completed an examination of gas fields in Kansas, and has returned to complete studies previously started in the new Waterloo oil field near St. Louis.

W. L. Whitehead, mining geologist, after more than a year of geologic exploration and mining investigations in Chile, Argentina, Bolivia, and Peru, is now at the Massachusetts Institute of Technology, Cambridge, Mass.

S. C. Ellis, of the Canadian Geological Survey; **Professor Wallace**, of Manitoba, and **W. Webster**, of Saskatchewan, have gone to investigate the Pasquai oil fields west of The Pas, Manitoba.

Victor C. Symonoff, engineer, formerly of the University of Pittsburgh, returned recently from the Baku oil fields, where he had been in charge of the "Molot" interests for the last eight years. [illegible] months ago he [illegible] from the [illegible] and [illegible] a [illegible] address at [illegible] West [illegible], New York City.

George S. Rice, chief mining engineer of the Bureau of Mines, and **Dorsey A. Lyon**, supervisor of experiment stations, will sail from Seattle July 2 for Alaska, where they will gather first-hand information as to the mining situation in that territory, with the idea of devising means whereby the Bureau may be of additional assistance in encouraging mining activities.

Dr. F. G. Cottrell, chairman of the division of chemistry and chemical technology of the National Research Council, sailed on June 11 for Europe to make a survey of the applications being made of helium in European countries. He also will make a special study of oxygen separation and concentration. In this work he is representing the U. S. Bureau of Mines as well the National Research Council.

EUGÈNE SCHNEIDER

Eugène Schneider, Creusot, France, is John Fritz medallist for 1922.

Mining engineers recently in New York City included: **Theodore Chapin**, of Tampico, Mexico; **E. P. Dargin**, recently returned from Ecuador; **H. S. Mulliken**, of the U. S. Bureau of Mines; **L. A. Friedman**, of Lovelock, Nev.; **Allan D. M. Rain**, of the Braden Copper Co., Sewell, Chile; **Hallet R. Robbins**, Fierro, N. M.; and **E. H. Nutter**, of Minerals Separation, San Francisco, Cal.

SOCIETY MEETINGS ANNOUNCED

The Regional Meeting of American Society of Mechanical Engineers scheduled to be held at Cleveland, Ohio, on June 13, has been postponed to October.

American Society for Testing Materials holds its twenty-fourth annual meeting at the New Monterey Hotel, Asbury Park, N. J., June 20 to June 24. The "North Asbury Park" station is the nearest one to the hotel.

The Rocky Mountain Coal Mining Institute holds its summer meeting this year in Salt Lake City, Utah, beginning Tuesday, June 28. Headquarters will be at Hotel Utah. Among the speakers will be E. Dawson Hall, editor of *Coal Age*; A. C. Watts, chief engineer of the Utah Fuel Co.; D. C. McKeehan, of the Union Pacific Coal Co.; Benedict Shubart, of Lindroth & Shubart Co., and E. R. Gibson, of the U. S. Fuel Co.

OBITUARY

William H. Williams, general manager of the American-Mexico Mining & Development Co., Velardeña, Durango, Mexico, died at Corpus Christi, Tex., on May 29, after ten days' illness. Mr. Williams went to Mexico a number of years ago, and had carried on mining at Sombrerte, El Tigre, Mapimi, and elsewhere.

Frank A. Keith, mining engineer of Los Angeles, Cal., formerly president and late vice-president of United Eastern Mining Co., of Arizona, died at Los Angeles on June 2 after a prolonged period of ill health. Mr. Keith was born in 1870 at Detroit, Mich., and received his education in the schools of that city, graduating from St. Paul's Academy there.

Immediately after concluding his studies Mr. Keith went west and located in Colorado, where he became surveyor for the Iron Silver Mining Co. at Leadville. This was the beginning of a life that was spent in mining and engineering work in Colorado, Utah, Nevada, and California. After leaving the Leadville company he held successively the following positions: engineer of the Eureka Hill Mining Co., Tintic, Utah; ore purchaser for the Arkansas Valley Smelting Co., Leadville, Col.; assistant manager, Union Smelting Co., Leadville; engineer, De Lamar Nevada Mines Co., in Nevada; general superintendent of the Bamberger De Lamar Mines Co.; engineer, Guggenheim Exploration Co.; general manager, Tonopah Mining Co., of Nevada. These firms are among the most important in the mining industry of America, and the offices Mr. Keith occupied were among the most responsible. He remained in Nevada until 1908, when he moved to San Francisco and opened offices as a general mining engineer. After two years he moved to Los Angeles. One of his first mining ventures thereafter was the organization of the Pacific Mines, which company he managed successfully for a number of years until its sale to others. A short time later he became interested in Oatman, Ariz., and through his activity the United Eastern mine was developed and brought to satisfactory production. He resigned the presidency of this company on account of ill health. He was never able to resume his full business activities, and during the last few months had been confined to his home. Mr. Keith was of a nature that inevitably makes a large circle of friends, and his professional associates will miss his ability and judgment.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

WEEKLY RÉSUMÉ

At Washington a second bill has been introduced providing for the creation of a Federal Department of Mines. Senator Shortridge, of California, is the sponsor of this measure, which differs in various respects from that introduced by Senator Nicholson last week. The bill providing for liberalizing the war minerals relief act came before the Senate for consideration on June 10. Early passage is expected. Ira E. Robinson, of West Virginia, has consented to serve as commissioner to administer the relief act, without associates.

In Nevada the strike conditions at Tonopah and Divide are reported unchanged. The wage cut that was made June 1 on the Comstock has been accepted by the men without demonstration. Lower rates on copper and lead bullion are expected to become effective soon between various western points and the East. In Utah it is reported that the Silver King Coalition Mines Co., of Park City, has reached an agreement with the American Smelting & Refining Co. over the matter of its smelting contract.

Iron-Ore Shipments Fall Off Greatly

The marked decrease in iron-ore shipments from the Lake Superior district so far this season, compared with those for the same period last year, is shown by the following figures: Up to June 1, 1921, a total of 2,770,238 tons has been shipped as compared with 7,206,939 tons for the same period in 1920. During May, this year, 2,594.028 tons was forwarded, as compared with 6,976,085 tons in May, 1920.

Aluminum Co. of America Makes Large Sale of Metal to Australia

Approximately 2,000,000 lb. of aluminum conductor was sold recently to the government of Victoria, Australia, by the Aluminum Company of America. This was in the form of 700 miles of the company's standard 336,400 circular mils steel-reinforced aluminum cable. This is to be used on the Morwell brown-coal power project by which it is proposed to generate sufficient electrical energy to supply the requirements of Melbourne and environs as well as other important industrial centers there.

The Katherine-Union Pass District in Arizona

Small Boom Developed in This Section of Mohave County—Katherine, Katherine Extension, Roadside, Gold Chain, and Other Properties Under Development

By S. Ford Eaton

IN VIEW of the disturbed conditions of the base-metal markets, and the perhaps questionable future position of silver, it is logical that the interest of mining men should turn to the gold-producing sections. The gradual recession of various costs has aided in bringing the metal into prominence. These factors are responsible for the present activity in the old Union Pass district of Mohave County, Ariz. Owing to the Katherine mine being the center of attraction, the district is becoming known as the Katherine-Union Pass district. Roughly, the district covers an area about ten miles square and lies on the western slope of the River Range. It is bounded on the west by the Colorado River. The center of the area is about fifteen miles west of the half-way point on the Kingman-Chloride rail and auto roads. The camp of Oatman lies nearly twenty miles south in the same range.

Pre-Cambrian granites are the predominating rocks. In the southeastern portion, at higher elevations, andesites, porphyries and rhyolites similar to those of the Oatman district are in evidence. In the western half of the Katherine-Union Pass section, erosion has removed all signs of these flows. The veins, for the most part, are intrusive fissures in the granite in which calcite has been replaced by quartz. Pronounced faulting is a general characteristic. At the Katherine the replacement is complete, though in the more easterly properties it exists in varying stages. The values are practically entirely in gold, which is free milling and, though finely divided, horns quite readily. For from three to five miles back from the river the surface is covered by a deep gravel wash. Present shafts show this wash to be from 75 to 100 ft. deep, but undoubtedly portions exceed these figures. At various points the enormous quartz ledges, having resisted erosion, outcrop above the gravel.

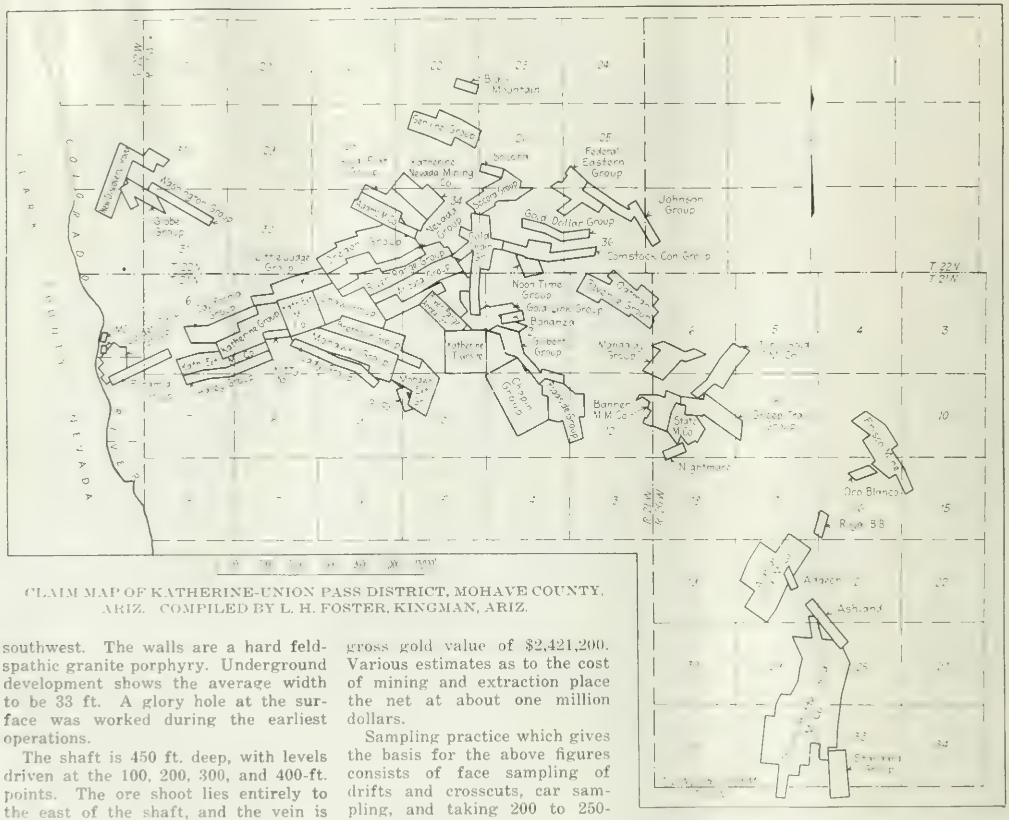
Preliminary symptoms of the present activity began to make their appearance soon after the first of the year (1921). Before long the interest shown by a few outside mining men roused local people, and in March there was a rush for locations. As is usual in this sort of thing, there is today scarcely the equivalent of a claim left in unlocated form. About April 1 the need of accommodations expressed itself in the locating of the Katherine Townsite on the sloping wash about equally distant from the more active properties. By the middle of May there were about two dozen buildings up or in process of construction. These range from simple tent houses to substantially floored structures of corrugated iron. Flivvers with lean-to canvas quarters are still much in evidence. Telephone communication has been established with Kingman and Chloride. There is a daily stage service from Kingman, on the main line of the Santa Fe. A store, a restaurant and a soft-drink establishment seem to be doing a good business, but about June 1 hotel accommodations were still somewhat limited. It is reported that a postoffice has been promised.

THE KATHERINE MINE

The New Comstock Mining Co., financed by Charles Sutro and associates, of San Francisco, has held the property known as the Katherine mine for a number of years. Prior to 1916 development work was carried on in a rather indifferent manner. For a time the property was operated by others under lease and bond. The years 1916 and 1917 saw the work completely shut down. Early in 1918 the company resumed, and the present showing has practically been developed during the last three years.

The Katherine group embraces eight full claims, and these lie along the strike of the Katherine ledge for a distance of 4,500 ft. The property is in the extreme western portion of the district. Buildings and shaft are about two miles from the river at about 500 ft. higher elevation. The present equipment is well housed in large corrugated-iron buildings. Hoist, compressor, and pumping unit total 100 hp. in gasoline engines.

The vein outcrops for a short distance near the shaft. It shows a width of 60 ft. and strikes roughly northeast and



CLAIM MAP OF KATHERINE-UNION PASS DISTRICT, MOHAVE COUNTY, ARIZ. COMPILED BY L. H. FOSTER, KINGMAN, ARIZ.

southwest. The walls are a hard feldspathic granite porphyry. Underground development shows the average width to be 33 ft. A glory hole at the surface was worked during the earliest operations.

The shaft is 450 ft. deep, with levels driven at the 100, 200, 300, and 400-ft. points. The ore shoot lies entirely to the east of the shaft, and the vein is cut up by an interesting series of longitudinal and side step faultings. On all levels crosscuts have been driven through the vein at regular 50-ft. intervals.

Although all estimates are based on the average value of the large low-grade tonnage, a number of high-grade lenses have been found. It is stated that on the 100 level there are several lenses 5 to 6 ft. thick running $100 in gold per ton; on the 200 level, 16 ft. of the vein assays $122, and on the 300 level one 21-ft. section carries $80 and a 6-ft. lens reaches the high mark of $293 per ton.

The ore shoot varies in length on the different levels. On the 100 level it is 287 ft. long, with a width of 15 to 35 ft., the average value being given as $11 per ton. At the 200 level the length is [illegible] ft., breadth 30 to 65 ft. and the average value $14.45. On the 300 level, the length is 483 ft., the average width 32 ft., and the value $11 per ton. On the 100 level several hundred feet of drifting has been done, but as the crosscuts have not been completed no figures have been given out.

The management estimates the ore blocked out at 190,000 tons. Of this 17,000 tons average $11, 96,000 tons $14.45, and 77,000 tons $11, making a gross gold value of $2,421,200. Various estimates as to the cost of mining and extraction place the net at about one million dollars.

Sampling practice which gives the basis for the above figures consists of face sampling of drifts and crosscuts, car sampling, and taking 200 to 250-lb. samples across the vein sections in the crosscuts.

Plans have been worked out for a large mill and complete new equipment. It is reported that work will be started on this before 1922. Ray Dimmick is in charge at the mine.

THE KATHERINE EXTENSION

Immediately adjoining the Katherine on the northeast is the Katherine Extension. This group consists of four claims and four half claims located on the strike of the Katherine ledge. C. N. Miller and associates are operating this property. Between April 15 and May 21 these operators installed a hoisting plant in a concrete-floored building, put up a blacksmith shop and change room, erected a 40-ft. headframe, and sank and timbered their shaft 90 ft. through the gravel to bedrock. The first crosscutting for the vein will be done at the 200 level. Sherman & Brethour are doing this work on contract.

THE ROADSIDE PROPERTY

The Arizona Rand Gold Mine, Inc., with Thad M. Boggs as president and John Sherman Bagg as consulting engineer, has leased the Roadside property, three and one half miles east of the Katherine. The Roadside shaft is 300 ft. deep, with crosscut levels at the 50, 100, and 300-ft. points. The vein at the 50-ft. level is about 50 ft. wide. A 25-ft. section in the center is reported as having an average value of $8 gold per ton. The lower levels at present are under water, the flow of which is 1,600 gal. daily at the 100 level and 6,000 gal. daily at the 300 level. Former operators claim that the vein holds strong in these lower workings, being 50 ft. wide at the 100 level and 86 ft. wide at the 300 level. Unwatering and retimbering of the shaft is going forward rapidly. A contract has been let for 250 ft. of drifting on the 100 level. The equipment consists of a gasoline-driven hoist and compressor.

THE GOLD CHAIN

Probably the most striking showing in the district is that at the Gold Chain property, two and one half miles northeast of the Katherine. The enormous brecciated quartz ledge, 100 ft. wide and striking east and west, outcrops and towers 200 ft. above the wash for a length of many hundred feet. The ledge dips rather flatly to the north and forms a landmark visible for many miles in all directions. A beautiful example of cross faulting shows in the outcrop, where a 100-ft. section of the vein has been moved north about its own length.

1—TOWNSITE OF KATHERINE, MOHAVE COUNTY, ARIZ., FACETIOUSLY DUBBED KATHERINE CITY. 2—GOLD CHAIN PROPERTY FROM NORTH. 3—ROADSIDE MINE. 4—KATHERINE EXTENSION HEADFRAME AND BUILDINGS

(Views of Katherine and Arabian properties were published in *Engineering and Mining Journal*, April 16, 1921, p. 685.)

Work under F. C. Nourse was started last September. A crosscutting adit was driven into the vein. At the same time a thorough sampling and measuring of the huge outcrop was undertaken. Results from these last give ground for the statement that there are 100,000 tons of $6 gold ore above the adit level. Owing to the extremely favorable physical conditions, the management claims that this tonnage can be mined for about 30c. per ton. One viewing the near toppling mass can readily believe this.

A shaft has been started on the hanging-wall side of the outcrop. A gasoline-driven compressor is ready to operate in a concrete-floored building, and the foundation for a new hoist has been laid.

OTHER PROPERTIES

Development work is proceeding at the Arabian property, as reported in *Engineering and Mining Journal*, April 16, p. 685. It is reported that W. J. Loring has taken over the Sunbeam group. The Adams Mining Co. has opened an office at the townsite preparatory to beginning work. The Sheep Trail, Oatman Revenue, and Thumb Butte are active. In addition to these there are a number of other properties on which the owners are doing location and development work.

The National Lead Co. has purchased and is offering to all its employees common stock in the company at the cost price of $75 a share, payable in sixty monthly payments, deferred payments to draw 6 per cent interest. A similar transaction three years ago sulted in a large oversubscription.

Copper Radiator, Made at Ajo, Being Tested

Manufactured Electrolytically at New Cornelia Plant—Expected to Cost Less, When Perfected, Than Present Kind

Much interest has been aroused in Bisbee, Ariz., by the appearance of the new copper radiator which is being tried out on a Dodge car owned by J. M. Johnson, engineer, and A. G. McGregor, of Warren. The radiator was made electrolytically and is the result of experiments conducted at the plant of the New Cornelia Copper Co., at Ajo, Ariz. Much remains to be done to perfect this radiator so that it will compete with the present types generally in use. It is said that the cost will be considerably less than those now used. It is made entirely of copper, and if it proves successful will mean an important new use for this metal.

Canadian Mining Institute Has Organized Nanaimo Branch

A branch of the Canadian Institute of Mining and Metallurgy has been formed at Nanaimo, B. C., as a result of a recent visit paid to Vancouver Island by George C. Mackenzie, secretary of the institute. Representatives were present from Cumberland, Extension, Ladysmith, Cassidy, and East Wellington, as well as from Nanaimo. Officers were elected as follows: Chairman, George O'Brien, Cumberland; vice-chairman, F. A. Spruston, Ladysmith; secretary-treasurer, W. H. Moore, Nanaimo; local council, John John, Nanaimo; C. M. Campbell, Cassidy; C. Graham and James Strang.

Steel Corporation Files Answer to Trade Commission

Expected That Date for New Trial Will Be Fixed Later

The U. S. Steel Corporation and its eleven subsidiaries filed on June 4 with the Federal Trade Commission an answer to the commission's complaint of last April in which unfair competition in interstate commerce was alleged. The case will now go to trial on its merits before the commission which will determine whether an order should be entered requiring the companies to desist from the practices complained of. The date for the trial will be fixed later.

Smelter at Sumpter, Ore., To Be Operated by New Company

Will Handle Gold and Silver Ores From Nearby District

Organization of a Washington corporation to take over and operate the smelter at Sumpter, Ore., which has been idle for some time, has been practically completed, and head offices of the company are being established in Spokane. The plant will do a general customs smelting business, and it is hoped will afford a profitable outlet for the gold- and silver-bearing ores of parts of Oregon and Idaho, close to Sumpter, but which have been handicapped by long freight hauls to Tacoma, San Francisco, and Salt Lake. No definite date has been set as to when the plant will be put in operation, but officials of the new company are hopeful of having everything ready for starting up by fall or the early part of the winter.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Second Mines Department Bill To Be Introduced

Shortridge Follows Nicholson in Presenting New Measure—Assistant Secretary Provided For

The proposal to establish a department of mines as one of the major subdivisions of the executive branch of the Federal Government has met an enthusiastic reception throughout the country, as is witnessed by the communications reaching Senator Nicholson, of Colorado, who introduced the initial bill at this session providing for the creation of such a department. Many members of the House and Senate have expressed themselves as favoring the project. The representatives of the mining states are practically a unit in their belief that this step is necessary to unify the mining activities of the Federal Government and to prevent the increasing tendency to scatter them among several departments and many bureaus.

Though thoroughly in accord with the general purport of Senator Nicholson's bill, Senator Shortridge, of California, has some different ideas as to the details of carrying out the plan, and before this appears in print he probably will have introduced a bill of his own.

In its present form, Senator Shortridge's bill provides that the name of the department shall be "Mines and Mineral Resources." His measure is somewhat more comprehensive than that of Senator Nicholson, in that it would bring into the new department the Federal Power Commission and the Alaskan Engineering Commission. The Shortridge bill will specify that, in addition to the taking over of the U. S. Geological Survey, the Bureau of Mines, the Federal Power Commission and the Alaskan Engineering Commission, it will include the California Debris Commission of the War Department; the Bureau of Explosives of the Interstate Commerce Commission, and such portion of the work of the General Land Office, of the Bureau of Standards and of the Indian office as relate to the inspection and regulation of mines or mineral industries. The administration of the War Minerals Relief Act also is vested in the new department.

The bill provides for the amending of the existing statute so as to permit the addition of one member to the Cabinet. It also provides for an assistant secretary of mines, who is to be "technically qualified by experience and education," at a salary of $10,000 per year. The measure transfers to the new department the records of the Fuel Administration and those sections of the War Industries Board, the War Trade Board, and the Shipping Board which relate to the mineral industries.

Under the Shortridge bill, the department would be divided into the following subdivisions: Bureau of mineral industry, mine and explosives inspection service, and bureau of power development.

McFadden Gold Bonus Bill Ignored

Ways and Means Committee Too Busy With Tariff Bill To Consider Measure

Owing to the pressure incident to the writing of the new tariff bill the Committee on Ways and Means has not found an opportunity at this session to consider the McFadden gold premium bill. A subcommittee of the Committee on Ways and Means at the last session of Congress reported favorably to the full commission on the bill. No subcommittee has been assigned at this session to consider the measure. This action will be taken as soon as work on the tariff will permit.

I. E. Robinson Accepts Position as War Minerals Commissioner

Enters Upon Duties Promptly—H. G. Pomeroy To Remain Until June 30

Ira E. Robinson, of Grafton, W. Va., has accepted the appointment to be war minerals relief commissioner. He already has entered upon his duties and is making a thorough review of the status of war minerals relief. Horace G. Pomeroy, a member of the commission under the preceding administration, has consented to remain in the service, that he may be of any possible help to Mr. Robinson in making him acquainted with the status of various matters pertaining to the commission's affairs. His resignation, however, will become effective on June 30.

A. H. Fay in Income Tax Unit

Appointed Acting Chief of Natural Resources Subdivision

A. H. Fay has been appointed acting chief of the natural resources subdivision of the income tax unit of the Bureau of Internal Revenue. Mr. Fay is a mining engineer who, for many years, had charge of the statistical division of the Bureau of Mines.

Government's Silver Purchases

Purchases of silver under the Pittman Act during the week ended June 11 totaled [illegible],000 fine ounces. This brings the total purchases under this act to [illegible] fine ounces.

War Minerals Liberalization Bill Before Senate

Expected To Pass—Fall Asks Delay Until New Commissioner Has Studied Situation

The Committee on Mines and Mining of the Senate reported favorably on June 8 a bill providing for the liberalization of the War Minerals Relief Act. The bill went to the calendar and was reached June 10. Objection was made by Senator King, of Utah, on the ground that more time should be given to look into the measure to see if "the bars are let down and the Government subjected to enormous demands and vexatious claims." He expressed the fear that it might afford a precedent for similar claims from those who sustained losses upon the farm or in the factory. After an extended explanation by Senator Ashurst, of Arizona, Senator King withdrew his objection, but further objection was raised by Senator Jones, of Washington.

"I think something ought to be done along these lines," Senator Jones told the Senate, "but in our anxiety to take care of just claims, we ought not to go so far in the language of the proposed legislation as to cover all sorts of claims which might be made against the Government." This action will make for some delay in the consideration of the measure, but Senator Ashurst expects to secure a vote on the bill in the near future. It is certain that it will pass the Senate, as it is almost identical with a bill which passed the upper house at the last session of Congress.

The Committee on Mines and Mining reached the conclusion that a "strict and narrow" construction has been given to the request or demand feature of the existing act. The committee points out that 572 claims were rejected under that construction of the statute. These claims amount to $3,464,023.05. As nearly $5,000,000 of the appropriation for war minerals relief remains unexpended, it is argued that the alteration of the law will not call for the voting of more money. On the other hand, it is argued that the addition of "published request" will call for more money than remains to the credit of war minerals relief, in that it will reopen most of the claims which have been passed upon, because of the change in the date of stimulation. The Secretary of the Interior has asked that this legislation be held in abeyance until the new commissioner has had an opportunity to ascertain if it will not be possible to administer the existing law more liberally than it was administered by the Shafroth commission.

NEWS BY MINING DISTRICTS

London Letter

Rand Mines Must Cut Wages, Says Hugh F. Marriott; Favors Removal of "Color Bar"

By W. A. Doman

London, June 2—As the Central Mining & Investment Corporation group of Rand companies accounts for 47 per cent of the tonnage of ore milled in this great field the remarks of the consulting engineer, Hugh F. Marriott, on working conditions are worthy of attention. The group of mines ranges from the poorest to the richest, and as the properties are widely separated working conditions of the field generally are known to the controlling corporation. Mr. Marriott's report has both its unfavorable and favorable aspects. It is unfavorable in that it shows that the aggregate results of twenty companies, apart from the so-called gold "premium," marked a loss of 2/- per ton milled, and the quantity milled last year was no less than 11,327,312 tons. The average return was 28.04-, and the average working profit 1.71/- per ton. But working profit is not identical with divisible profit, so that when other expenditure is allowed for the result works out at the loss mentioned above. The additional revenue from sales of gold above standard price was £4,913,764, or 8.67/- per ton crushed. This discloses one of the unfavorable aspects, for it is evident that without the premium several of the mines would have to be closed down. Thirteen of the twenty companies paid dividends out of the excess price of gold.

Mr. Marriott has carefully investigated the position to ascertain how costs are made up. From the twenty companies recorded he arrived at the truth, and he finds that, whereas in 1914 the average working costs were 17/2 per ton, they had risen to 25/11 last year, and for the final month the average was 27/4. Native wages have gone up from 3/11 to 4/9 per ton; materials from 5/8 to 9/2 per ton, and other costs from 3/2 to 4/2 per ton, and European wages from 4/9 to 9/2 per ton. The native labor cost increase calls for no comment; "other" costs are partly due to additional benefits having been given to European labor, and the increase of 61 per cent in the cost of materials Mr. Marriott regards as a temporary burden, and one likely to be lightened as old stocks bought at high prices are replaced at a lower figure.

It is to wages paid Europeans that Mr. Marriott devotes particular attention, and it is clear that he regards the increase as quite unjustifiable. European employees constitute one-eighth of the total labor force, and their work, which is mainly of a supervisory character, costs almost double the total expenditure upon the native laborers who carry out the work. It is time not only to call a halt but to bring about a reduction. The white employees in the Rand are the best paid of their class in the world, and palpably if the gold "premium" should vanish no reservoir of money would exist from which to draw funds for wages. Mr. Marriott therefore suggests that pay must be reduced to an economic level, and if this cannot be done there is the implication that some of the mines must cease operations; but he goes a step further and supports the removal of the "color bar" in order that native laborers may be afforded legitimate development to higher classes of work. It is the white miners themselves who are the obstacle to this development.

A matter is mentioned in the report which was not previously known. The mining regulations are "onerous and obsolete," and they "unduly restrict the hours of work of the native laborers to as little as five hours daily." The inference is that the officials who inspect the workings previous to the beginning of the day's work are slow, and that the inspection could be better done in other ways. Obviously, no mining or other industry can be conducted successfully if seven-eighths of the employees put in only five hours effective work daily.

It is fairly evident that Mr. Marriott is of opinion that reforms will be permitted by the Union Government, and it is to longer hours of work, reduced white pay, lower costs of materials and the promotion of the intelligent Kaffir that the favorable aspect of his report may be attributed.

CANADA

British Columbia

Hedley Gold Company To Resume July 1—Premier Strike Over

Ainsworth—It is possible that the Florence mill may resume soon in order to concentrate some milling ore stoped last winter by lessees.

Rossland—The men employed in the various Consolidated mining operations here now number about 250.

Kaslo—The mining depression, which has been most pronounced in this vicinity for several months, shows signs of beginning to lift. There is an indication of some activity up the South Fork of Kaslo Creek, and a possibility of some work being done by lessees of Utica mine.

Poplar—The Bullock Gold Mining Co. is purchasing a compressor and drilling equipment for more adequate development of eleven claims adjoining the Swede and Lucky Jack groups. About 350 ft. of drifting has been done recently. The values are in free milling gold.

Revelstoke—The Waverly Mines Co., of Spokane, is planning to build a wagon road from Albert Canyon, on the Canadian Pacific, to a property recently acquired on Downie Creek. A considerable tonnage of silver-lead ore is said to have been blocked out.

Slocan City—Work has been resumed on the mill at the Ottawa mine, Springer Creek, and it is anticipated that the plant will be ready for operation within a few weeks. The plant is of the selective flotation type and was designed by L. H. Biggar. Its capacity is fifty tons per day. Ore will be brought down from the mine over a 2,000-ft. two-bucket aërial tramway. The tonnage of milling grade in sight is estimated as sufficient for two years' operation.

Fort Steele—The Niagara company, operating the Victor mine, on Mause Creek, continues to keep a small crew, and it is planned to start shipments when the roads improve so as to permit ore hauling. The Gamble Mining Co. has begun the season's placer operations on Wild Horse Creek.

Cranbrook—Dr. S. Schofield, of the Dominion Geological Survey, with two assistants is now camped along St. Joseph's Creek. The party is engaged in connecting up the Cranbrook map area with the Windermere map area, a work which has been undertaken this season at the express desire of the East Kootenay's Prospectors' Association. Another matter receiving attention here by the local mining organization is a plan for the holding of the summer meeting of the Columbia Section of the A. I. M. E. in Cranbrook.

Grand Forks—C. M. Campbell, who has been in charge of dismantling operations at the Granby smelter, at Grand Forks, has gone to Cassidy, Vancouver Island, to become superintendent of the coal mines of Granby company. The entire Grand Forks machine plant equipment of the Granby has been taken over by the Boundary Iron Works. The plant is regarded as one of the most complete in interior British Columbia.

Alice Arm—The Dolly Varden mine, which closed down toward the end of last year, is to be reopened for development, according to a statement by Major G. B. North, the manager. Major North has returned to make a survey and a report on the properties. With market conditions as they are, shipping will not be resumed.

Stewart—Dale L. Pitt, manager of the Premier, has announced that the strike is over, and that all tramway workers, teamsters, tractor men, and part of the mine crew had returned to their jobs. The tramway construction will be pushed. Two new camps have been opened, and the company is sending out for fifty men, who are to receive $5 a day. The mill is nearly completed, all the tram line right of way has been cleared, and the construction towers have been built.

Several reports are current with respect to the future of the Big Missouri group in the Salmon River district. Pat Daly, who has been in New York for some weeks, is said to have bonded the property and to have received a substantial cash payment in this connection. The report has not been verified. Daly is said to have succeeded, while in New York, in bonding the Fraser group of claims, which are situated on Marmot River, in the Portland Canal district.

Hedley—The Hedley Gold Mining Co. will reopen the Nickel Plate mine on July 1.

Vancouver—The Bullion Mining Co. has once more been the subject of litigation. R. T. Ward, as manager of the syndicate and trustee of the claims, recently asked for an injunction restraining his partners from operating and developing the property along lines that do not meet with his approval. He asked that the thirty men employed be ordered to stop work. It was argued by the other side that Mr. Ward was nominal trustee of the mine only for the purpose of registration of title and that a majority interest was held by those favoring the present development policy, Mr. Ward's interest having been placed, in a previous action, at 3$\frac{4}{10}$ per cent. This view was accepted by the court, and Mr. Ward's application dismissed. At present a 500-ft. tunnel is being driven through rock, disused flumes and ditches are being repaired, and the management expects to make a cleanup this fall.

D. G. Marshall, one of the directors of the Britannia Mining & Smelting Co., has stated that the plans for the new concentrator, to replace the one recently burned, are being prepared and that work will be started within two months.

Victoria—Twenty tons of iron ore are being shipped from the Lake Hill mine of the Puget Sound company's group on the west coast of Texada Island for a test run in the electric furnace of the firm of Thomas Summerson & Sons, Ltd., Darlington, England.

Queen Charlotte Islands—A party of miners is engaged in another attempt to separate the fine gold from the black sand of the beach near Masset, Graham Island. They have taken in a machine involving a patented process for the purpose.

Hazelton — Preparations are being made by the Kleanza Milling, Mining & Development Co. for an exhaustive exploration of the mineralized zones of Kleanza Mountain.

Yukon Territory

Dawson—Navigation has opened and steamers are beginning to traverse the rivers. Miners, prospectors and freight are on their way to the Mayo silver camp. Some gold dredges already have started and others are ready to begin the season's operations. The first gold of the season has left Fairbanks for Dawson.

Ontario

North Crown Mines Shuts Down—Part of Keeley Plant Burned—Trethewey May Build Mill

Porcupine—The North Crown Mines in Porcupine has stopped operating, and all employees have been paid off. It is stated that this will be for only a month, but no definite information on this point is available.

The McIntyre has begun sinking the main shaft from the 1,500 level to the 2,000 level.

The Hollinger gave a contract some time ago for the building of 150 houses in Timmins for Hollinger employees, and has now given a further contract for a bunkhouse to accommodate fifty men. It is reported that it plans to install another 500-ton ball mill.

Dome directors are making a visit of inspection to the property.

The directors of the South Keora Mines will sell 100,000 shares of treasury stock at 15c. a share.

Kirkland Lake—Development work so far on the No. 1 and No. 2 veins on the 600 level of the Lake Shore has indicated a grade of ore as high as that on the upper levels. During March and April the average recovery was $11.35 and $11.94 per ton, respectively, which is much lower than for the previous months.

The Kirkland Gold has recently cut on the 900 level the vein which was found by diamond drilling. The drill core showed 7 ft. of $21 ore, and it is understood that development is satisfactory. The mill is treating 125 tons a day, but the mill heads are lower than for some time past.

Surface work has been started on the Comfort Kirkland, which adjoins the Ontario Kirkland to the west.

After an idleness of several years work has been started on the Goodfish Gold Mines.

The Wright Hargraves mill is now handling 140 tons a day, and it is understood that the management is looking for a production of approximately half a million dollars this year.

Cobalt—During May the O'Brien mine produced 312,000 oz. from mill heads averaging 51 oz. to the ton. This is approximately one quarter of the 1920 production and one half of the 1919 production.

The transformer house and transformers of the Keeley mine have been destroyed by fire, and this has entirely cripped mine operations.

The Trethewey Mines in Gowganda is sinking from the 165 to the 265 level. The company is considering the erection of a mill.

MEXICO

Power Shortage at El Oro Hampers Operations

El Oro—Alarm is being felt in the mining regions of this state over the diminishing electric power available. Some companies are manifesting their intention of suspending operations unless the deficiency is remedied. An appeal has been made to the federal government. The light and power companies are unable to secure sufficient oil and coal to keep their power plants at full capacity

Aguascalientes

A. S. & R. May Blow in Lead Furnace Soon

Aguascalientes — Governor R. Arellano Velle has been in Mexico City conferring with federal officials in an effort to relieve the silver mining industry in this state.

The American Smelting & Refining Co. is said to be operating two copper furnaces at its Aguas plant and expects to blow in one lead furnace soon. This smelter is receiving considerable copper ore from the Sombrerete district, in Zacatecas. As soon as the lead furnace is blown in the ores from the San Juan de Guadalupe district will be shipped to Aguascalientes instead of to Chihuahua.

Zacatecas

Installing Mine Sampling Unit at Fresnillo

Zacatecas—Charles E. Snider has taken up the Guarda group of gold-silver mines at La Noria, Sombrerete, and is preparing to develop them. This property is next to the lead-silver mines known as the Oscar, San Antonio, and Soledad. Shipment will be made to Aguascalientes.

John O. Emerson has applied for titles to fifty-four mining claims at San Miguel del Mezquital. These claims are to form the Santa Catarina group. The survey is to include the old Santa Catarina shaft, which has been abandoned for years. This shaft produced a large amount of high-grade gold, silver, and lead ore, and was worked some distance below the water level. It is claimed that there are yet some good orebodies to be found above the water with proper development work.

George H. Davis is developing the Purisima mine at La Noria.

Walter Palmer is operating the Noria mine, in this district, and is shipping to Chihuahua and Aguascalientes.

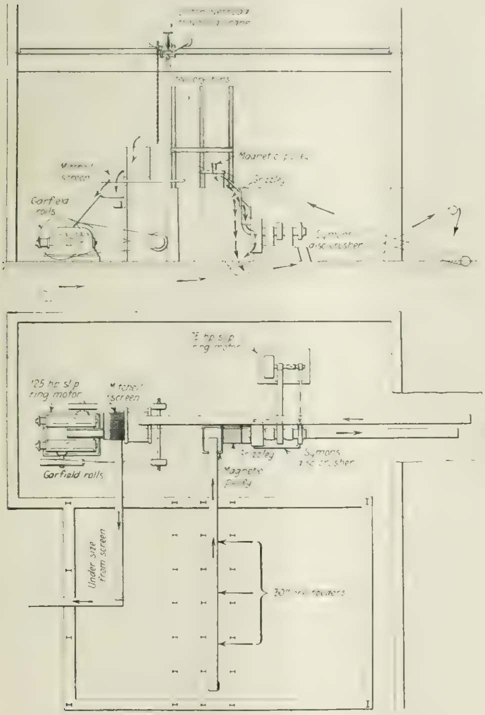
Gerald E. Norton, representing John Emerson, has filed on forty claims to be titled under the name of El Compromiso. The group is a short distance north of San Miguel del Mezquital. The denouncement includes some old workings, which will be cleaned out and redeveloped.

Fresnillo—G. W. Voelzel has accepted an eight-month engagement with the Mexican Corporation to install a complete mine sampling system at the company's Fresnillo unit.

Chihuahua

Alvarado Company Erects New Primary Crushing Plant

Parral—The Alvarado Mining & Milling Co. has constructed a primary crushing plant having a capacity of seventy-five tons of ore per hour. The ore is delivered to this plant in 4-in. size and is reduced to ¼ in. The equipment consists of one 48-in. Symons disk crusher and one set of 54 x 20-in. Garfield rolls working in closed circuit with a 72-in. Mitchell vibrating screen. The layout of this plant, which is an addition to the old mill, is shown in the accompanying illustration. A 5 x 16-ft. Ball-Peb mill, using 2-in. steel balls, has been added to the fine-grinding equipment. This is in closed circuit with a 10-ft. Dorr bowl classifier.



LAYOUT OF PRIMARY CRUSHING PLANT RECENTLY BUILT BY ALVARADO MINING & MILLING CO., PARRAL DISTRICT, CHIHUAHUA, MEXICO

The company has two three-compartment inclined shafts at the Perseña group of mines on the Red vein (Veta Colorado). Each shaft has been equipped with two 80-cu.ft. ore skips and with a Denver Engineering Works Co. double-drum electric hoist with a 150-hp. motor. Solenoid brakes are attached to the motor shafts and there is full magnetic control. Clutches and brakes are operated with oil pressure pumps. The brakes are of the post type. The hoist drums are grooved for 1-in. hoisting rope. The rope pull is 12,500 lb. and the hoisting speed 400 ft. per minute.

A Sullivan twin-angle compound compressor of a capacity of 2,000 cu.ft. of air per minute at 5,000-ft. altitude has been installed. This is direct connected to one 350-kva. synchronous motor.

ARIZONA

Shattuck Opens New Ore on 600 Level —Copper Queen's Boras Shaft To Be Sunk Under Contract

Bisbee—At the Shattuck a new orebody is being opened up on the 600 level. Development has not proceeded for enough to indicate its size. So far on the 600 level it is 100 ft. long and averages 6 per cent copper. Thus far it has not been opened on the 700 level. Raises from the 700 cut the ore a short distance above the level. Present indications point to the fact that this is an important discovery.

The Boras Leasing Co., which has a lease on the Boras claim, has taken a contract to enlarge and sink the Boras shaft for the Copper Queen. The shaft is down to the 700 level. It will be enlarged to two and one-half compartments and sunk an additional 400 ft. The leasing company has discontinued its development work and has begun to enlarge the shaft from the 400 level to the surface.

Jerome — Dundee-Arizona has started a one-ton experimental mill on its carbonate ores, of which a large tonnage, sampling from 3 to 7 per cent copper, awaits development of a satisfactory reduction process.

The Yavapai County Court has made permanent its injunction against the Mitchell-Frazier interests in the Jerome-Superior and has decided that the meeting was legal at which control was taken by the faction headed by George A. Kobold. The mine has been unwatered and will employ electric pumping. Further operations will depend upon the report of sampling and examination now being prepared.

Pearce — High-grade ore has been found in an old abandoned drift on the Rainbow claim of the Commonwealth Extension, which is being operated by Guy Emmons and associates under lease. The vein is 2 ft. wide.

CALIFORNIA

Broken Hills Before Public Again—To Cut Wages July 1 at Grass Valley—Southern Pacific To Publish New Rates East on Bullion

San Francisco—An advertisement appears in the *San Francisco Chronicle*, May 28, 1921, in which the president and two directors of the Broken Hills Silver Corporation advise the stockholders of the Broken Hills Silver Corporation not to be stampeded by "false reports" and to hold their stock. On good authority it is stated that a telegram by the Fidelity Finance & Funding Co. is being circulated in which it is alleged that the company owes about $9,000, and suits have been started by certain creditors. It is further alleged that the south drift on the 350 level has been abandoned because no ore was found; that no ore was found in the north drift after drifting more than 150 ft.; that developments on the 250 level were also disappointing; and that three of the directors have assumed control of the company.

The Southern Pacific Co. is arranging to publish a rate of $16.50 per ton on copper bullion, copper matte, blister copper, also lead bullion and speiss, carloads, minimum weight 60,000 lb., from Clifton, Globe, Hayden, Miami, Cananea, Ajo, and other points in Arizona and New Mexico to New York and Laurel Hill, N. Y., Chrome, Perth Amboy, Cartaret and Newark, N. J., via Southern Pacific to Galveston, thence via Southern Pacific Atlantic Steamship Lines. The present rate is $20 per ton.

Jackson—The Kennedy mine has been unwatered to a depth below the 3,800 level, and the shaft at this depth is below the intersection of the vein and in hard country rock. It is believed that no further shaft repairs will be necessary and that unwatering can proceed steadily until the lower levels are recovered.

The Argonaut is reported to have a full complement of men and to be operating thirty stamps.

Sutter Creek — According to the weekly report of A. S. Howe, supertendent of the Central Eureka, the vein in the south drift of the 3,350 level has widened to 2 ft.

Prospecting work on the Old Eureka has been definitely suspended. After deepening the shaft to the 3,500 level and crosscutting and diamond drilling, the results were stated to be negative and the work of about five years without satisfactory results.

Grass Valley—Wage reductions to take effect July 1 at the Empire, North Star, and Idaho-Maryland mines have been announced following a conference of W. B. Bourne, of San Francisco; George B. Agnew, of New York, and Bulkeley Wells, of Denver.

Assurances have been given locally that the deferred payroll of the Allison Ranch mine will be met and that operations will be suspended and the mine kept free from water pending negotiations for a sale of the property.

Keeler—The Cerro Gordo company has begun construction of a new mill to be completed early in July.

The Inyo Talc Co. anticipates a good season and will increase shipment despite high freight rates.

Operations have been resumed by the National Soda Products Co. and a number of good contracts insure continuation of operations.

NEVADA

Comstock Miners Accept Cut—Knox Divide, Unable To Ship, Engaged in Development Work

Virginia City—In accordance with an agreement between the labor organizations of Virginia City and Gold Hill and the operators, wages were reduced at both camps on June 1, the reduction being 50c. per shift for miners and 75c. for muckers, making their wages $5 and $4.50 per day, respectively, and making the pay of top labor $4.25 and that of mechanics $6. An unsuccessful attempt was made to cause a walkout and tie up operations. A. Bordsen, representing the executive council of the International Union of Mine, Mill and Smelter Workers, with which the Gold Hill miners union is affiliated, arrived in Gold Hill on June 1, presumably to support the agreement between miners and operators. Underground crews on that day were about 75 per cent complete, and top crews full. Conditions are expected soon to revert to normal on the Comstock.

Weepah—The Electric Gold Mines Co. is developing a large free-milling gold property at Weepah, about thirty miles southwest of Tonopah. The property is in the prospect stage, the deepest shaft being down 75 ft. The quartz vein is wide and has given good assays. A camp has been established, headframe built, gasoline hoisting plant and a small air compressor installed. Crosscutting is now being done on the 75 level.

Klondyke—The Knox Divide, being unable to ship any ore on account of the closing down of all custom mills in the Tonopah district, is doing necessary development work with satisfactory results. A winze on the vein has been sunk 30 ft. below the 60 level, above which practically all ore produced to date has been mined. The winze is in milling grade ore and the vein is said to be 12 ft. wide. Conditions are excellent in the east drift on the 60 level. An east drift has been started on the 130 level on the contact to cut the projection of the orebodies as developed on the 60 level at this depth.

Tonopah—The labor situation remains unchanged in the Tonopah and Divide districts. The Tonopah Extension and Belmont companies are still trying to build up crews by importing labor. [illegible] [illegible] pay of the imported men [illegible]. In a letter to stockholders, dated June 1, Clyde H. Heller, president of the Belmont company, [illegible] employees to accept a 12½ per cent reduction in wages and the consequent strike the directors have deemed it unwise to declare a dividend at this time.

Hornsilver—The option held by the Tonopah Mining Co. on the Orleans mine has been terminated on account of the refusal by J. W. Dunfee, the lessee, to consider any change in the original agreement between himself and the Tonopah Mining Co. Dunfee claims to have a drift face, 7½ x 10 ft., entirely in $40 ore.

Candelaria—According to a statement by Charles D. Kaeding, consulting engineer and manager for the Candelaria Silver Mines Co., construction will be begun at once on the first 150-ton unit of a cyanide plant. Crushing equipment capable of handling 400 tons per day will be installed. This first unit will probably be completed by September, by which time the power line extension from Hawthorne is expected to be completed also.

COLORADO

Powder Price Cut at Cripple Creek—Golden Cycle Only Dividend Payer

Cripple Creek—The price of powder has been reduced $1.75 per 100 lb., and caps have come down $1.25 per 1,000. Powder is now selling in the district at $18.50 per 100 lb., compared to the high price of $26.75 about two years ago.

Independence — The Golden Cycle Mining & Reduction Co. paid its quarterly dividend of 2 per cent on June 10. The amount was $30,000. Outside of certain leasing pools operating in the district the Golden Cycle is the only dividend payer in the camp at present.

UTAH

Silver King Coalition and A. S. & R. Co. Agree on Smelting Contracts—Daly West Still Opposed

Park City—Shipments for the week ended June 4 amount to 1,097 tons, as compared with 993 the preceding week. Shippers were: Judge allied companies, 611 tons; Ontario, 268; Silver King Coalition, 218.

It is announced that the controversy between the Silver King Coalition and the American Smelting & Refining Co. over smelting charges has been settled satisfactorily to both parties. As is evident from the above list, the Coalition is resuming shipments. As regards the Daly West in a similar controversy with the smelting company, which, as in the case of the Silver King, was seeking to increase smelting charges above those allowed in the smelting contracts, officials of the mining company announce that the differences have not been settled.

Eureka—Shipments for the week ended June 4 amounted to 119 cars as compared with 123 cars the week previous. Shippers were: Tintic Standard, 41 cars; Chief Consolidated, 38; Eagle & Blue Bell, 7; Iron Blossom, 6; Iron King, 6; Dragon, 6; Victoria, 1; Gemini, 2; Alaska, 2; Colorado and Swansea, 2.

Salt Lake City—The camp of Alta, in Little Cottonwood Canyon, Utah, is being made more accessible this season. Both the narrow-gage railroad from Wasatch to Alta and the wagon road to the camp are being improved, the latter so as to be passable to automobiles for the first time. It is hoped to have the narrow-gage opened by the middle of June, so that ore may be coming down soon. The South Hecla, Albion Consolidated, South Hecla Extension, and the Alta-Michigan, all under the same management, are preparing for an active summer. New ore is said to have been opened during the winter at the Sells and the Columbus-Rexall. The Michigan-Utah has finished repairing the aërial tramway.

MICHIGAN

Gogebic Range

Ironwood and Wakefield Companies Object to City Bonds Recently Voted

Wakefield—Some of the mining companies operating mines in the city of Wakefield are objecting to the issue of bonds which were voted at a recent election. The people of Ironwood also have voted to issue more bonds, and have practically granted the City Council the power to issue bonds for any purpose and in any amount they wish without referring the question to the people. The opinion is expressed that that city would soon be in the class of Hibbing, Buhl, and Chisholm, Minn., as regards taxation and amount of money spent per capita of population.

Gile, Wis.—The Cary mine, which has been working with a reduced force, has closed down, laying off about seventy-five or eighty men.

Marquette Range

Work Resumed at Mary Charlotte

Negaunee—Operations have been resumed at the Mary Charlotte mine. Two shifts are being worked full time, and it is the only mine in Negaunee being operated full time. Shipments are to be started soon.

Menominee Range

Work Stopped at Odgers Mine

Crystal Falls—The McKinney Steel Co. has stopped all work at the Odgers mine. It has also ceased mining at the Colby and Ironton mines at Bessemer. Very few of the Menominee Range properties are in operation, and most of those being worked are on a part-time basis.

MINNESOTA

Mesabi Range

Gilbert—The Pickands Mather Co. has stopped operations at all of its properties on the Mesabi Range. Those affected are the Corsica mine, at Gilbert, the Belgrade, at Biwabik, and the Mohawk mine, at Aurora.

Aurora—The St. James mine, operated by the McKinney Steel Co., has been closed down indefinitely.

THE MARKET REPORT

Daily Prices of Metals

June	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
9	12.75	28.375	29.25	4.50@4.65	4.40@4.50	4.45
10	12.75	27.875	28.875	4.50	4.25@4.50	4.45
11	12.75	27.875	28.875	4.45@4.50	4.25	4.40@4.45
13	12.60@12.75	27.875	28.875	4.40@4.50	4.20@4.25	4.40@4.45
14	12.60@12.75	28.25	29.25	4.40@4.50	4.20	4.40@4.45
15	12.60@12.75	28.75	30.00	4.35@4.40	4.20	4.40@4.45

*These prices correspond to the following quotations for copper, "delivered": 13c. for June 9, 10 and 11; 12.85@13c. for June 13, 14 and 15.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

June	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
9	73½	73⅝	77	168¾	170¾	23¼	22⅞	26¾	27¾
10	73	73¼	77	165¾	167¼	23⅛	22⅝	27	27⅞
11		..	...	....	....	...	...	..	...
13	73⅛	73⅜	77	167	169¼	22½	22	27¼	28
14	73⅜	73⅜	77	167½	169½	22⅛	21⅞	26¾	27½
15	73	73⅛	77	168¾	171½	22¼	22	26¾	27⅝

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

June	Sterling Exchange	Silver			June	Sterling Exchange	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York, Foreign Origin	London
9	370	99¼	57⅜	35	13	373½	99¼	59⅛	35¾
10	372½	99¼	58½	35½	14	375¼	99¼	59	35⅝
11	374¼	99¼	59⅛	35¾	15	376½	99¼	58⅜	35

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, June 15, 1921

Those who have followed the metal market for many years cannot remember any time when conditions were so dull as at present. Often a poor domestic demand has been offset by better markets abroad, but now the stagnation seems to be international. Little hope can be had from a survey of the stock market, which is supposed to reflect business conditions from six to eight months in the future, for current prices of securities are practically at the extreme lows reached last December. Conditions in England are demoralized by the continuance of the coal strike, and they are little better in France. Germany shows some signs of an industrial revival, but is laboring under obvious disadvantages. Metal producers are trying to be as optimistic as possible in view of the fact that present prices are below the cost of production and therefore cannot continue indefinitely. Labor costs are slowly becoming lower, but still have a considerable distance to go to reach the comparative levels of metal prices. It seems likely that before wages reach pre-war levels prices will have shown improvement.

Copper

The larger producers continue to quote 13.50c. delivered, and we heard of one carload sold at this price. Smaller interests have tried to sell a little copper at 13c. delivered, and possibly two million pounds has been marketed at this price; in other cases, however, consumers have informed would-be sellers that metal was obtainable for 12.75 and have turned down the higher offers. It is likely that June copper could be obtained today at 12.875c., with a premium of about one-eighth cent for each month in the future. Export demand continues almost non-existent.

Lead

Late Friday afternoon, June 10, the American Smelting & Refining Co. reduced its official price for lead from 4.75c. to 4.50c., New York and St. Louis. This was in accord with conditions obtaining in the open market.

Demand from consumers has been almost non-existent during the last week, even inquiries being scarce. The price is being depressed by continued weakness in London, accompanied by further declines in sterling exchange which would have made importations profitable had not domestic prices been reduced. Some producers are unwilling to sell lead for less than 4.50c. in the middle West, and if they persist in this attitude the price is likely to react to that figure, particularly for such brands as they control.

Today one interest is reported to be offering lead as low as 4.25c., New York, in an effort to market current production.

Zinc

The zinc market has been as quiet as that for the other metals, the exceedingly low prices current not tempting purchasers. Conditions were reported particularly weak on Monday, with a slight improvement in evidence today, though one producer reports that he is willing to sell at 4.35c.

Tin

Tin is somewhat stronger, in sympathy with London, and not because of any increase in demand here. Sellers of 99 per cent grade are not as anxious to find a market as formerly, for there may be some difficulty about getting future supplies. Tin for forward delivery is quoted at the same price as spot.

Arrivals of tin, in long tons: June 8, Buenos Aires, 32; 13th, London, 50; Rotterdam, 50; Straits, 15.

Gold

Gold in London: June 9, 110s. 4d.; 10th, 111s.; 13th, 110s. 5d.; 14th, 110s.; 15th, 109s. 2d.

Foreign Exchange

The weakness in sterling has continued, and at one time a low of $3.695 was reached. The cause is not clearly understood. On Tuesday, June 14, francs were 7.98c.; lire, 5.13c.; and marks, 1.4525c. New York funds in Montreal, 12½ per cent premium.

Silver

The London price for silver advanced sharply the last week owing to speculative buying, as well as a brisk demand for India bazaars. At the high level of 35¾d., re-sales of silver by India satisfied buyers, causing a reaction in price to 35d. on June 15.

There was a brisk demand from China buyers in both the New York and London markets on June 13, on the basis of 35¾d., due to improvement in China exchanges, but, buyers being satisfied, China exchanges have suffered a relapse and close weak with buyers holding off. The Continent has been selling silver more freely in London, and there have also been some further imports of German silver in the New York market in the last week.

The important factors affecting the price of silver are the course of sterling exchange, which is very uncertain; the decreased production of silver, which is quite marked; and the economic conditions in China and India, which still continue poor. The monsoon season is now due in India, and a great deal will depend on whether rains are plentiful enough to assure crops for the coming season, which will have a decided result in trade exports of India, and if the monsoon is favorable, the India demand should improve. The outlook for silver is uncertain and dependent on all the above noted factors, and the course of the market is likely to be sluggish until some new factor such as Government sales of demonetized metal or a revival of trade gives the price a decided impetus in one direction or the other.

Mexican Dollars—June 9, 43⅞c.; 10th, 44¾c.; 11th, 45¼c.; 13th, 45¼c.; 14th, 45¼c.; 15th, 44¾c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 22@23c. per lb.; 22½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 5¼@5½c.; market dull. W.C.C. brand, 5¾@6¼c. per lb. Cookson's "C" grade, spot, 9⅞c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb., 500 lb. lots.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $4 per lb.; black oxide, $3@$3.10 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, [illegible] per oz. Because of [illegible] in [illegible] trade very little iridium is going into [illegible] Manufacturing [illegible] are [illegible].

[1]**Molybdenum Metal in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.**

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—$75 per oz.

Quicksilver—Nominally, $46@$48 per 75-lb. flask. San Francisco wires $47.50.

[1]**Rhodium**—$150 per troy oz.

[1]**Selenium—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.**

[1]**Thallium Metal—Ingot, 99 per cent pure, $20 per lb.**

[1]**Tungsten Metal—Wire, $35@$60 per kilogram, according to purity and gage.**

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $30; ground, $35; f.o.b. Atlantic ports. Quotations are nominal. Market very dull.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $7.45; Mesabi bessemer, 55 per cent iron, $7.20; Old Range non-bessemer, 51½ per cent iron, $6.70; Mesabi non-bessemer, 51½ per cent iron, $6.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5.80; old bed concentrates, 63 per cent, $6.70; Harmony, cobbed, 63 per cent, $6.70; new bed low phosphorus, 65 per cent, $9.50.

Manganese Ore — 25c. per unit, seaport; chemical ore (MnO_2) $55@$60 per gross ton, lump; $70@$75 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores—Ilmenite, 52 per cent TiO_2, 1¾@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.**

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., June 11—Zinc blende, per ton, high, $28.40; basis 60 per cent zinc, premium $21.50; Prime Western, $21; fines and slimes, $20@$17.50; average settling price, all grades of zinc, $27.07.

Lead, high, $58.10; basis 80 per cent lead, $50@$45; average settling price, all grades of lead, $48.92 per ton.

Shipments for the week: Blende, 3,834; lead, 1,224 tons. Value, all ores the week, $163,680.

Owing to a bulk of the shipments being of highest-grade blende, some of which was bought several weeks ago, settling averages show a marked advance over those of last week. Demand was strong this week on $20 basis, with light transactions at that figure, most of the tonnage selling on $21 to $21.50 basis. Report, unverified, of $22 basis was made. Lead ore weakened to $45 basis after midweek, a considerable tonnage selling earlier on $50 basis.

Platteville, Wis., June 11—No sales of blende or lead ore. No shipments of finished blende. Shipments for the year: Blende, 11,461; lead, 910 tons. Shipped during the week to separating plants, 285 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,700@$3,000; No. 2, $1,200@$2,000; spinning fibres, $400@$1,000; **magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to** be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7 per long ton, f.o.b. Cartersville, Ga.

Bauxite—High-grade French bauxite, $8@$12 per ton, Atlantic ports. American quotations the same. Consumers generally well supplied. Prices vary according to grade. Crude, unground, $16.50 per ton; ground, $22; calcined, ground, $35; unground, $45, f.o.b. plant.

Chalk—English, extra light, 5@5½c. Domestic light, 4½@5c.; heavy, 4@4½c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $7@$9; washed, $9@$10; powdered, $13@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, [illegible], f.o.b. New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b. New England points.

Feldspar—Crude, $7@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $12.50, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $32, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 7@7½c. per lb.; chip, 5½@6c.; dust, 3¼@4c. No. 1 flake, 6½c.; amorphous crude, ¾@2¼c. Market quiet. Consumers ordering only small lots to cover immediate requirements.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$2 per net ton; 1½ in., $1.50@$2. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned — $33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $6.75; 68 per cent, $6.25; 68@66 per cent, $6.

Pumice Stone—Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 14c., c.i.f. Atlantic seaport; furnace size, 14c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 12 @ 14c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$40, talcum powder grade. Southern talc, powdered, carload lots, $10@$14 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic — White arsenic, 6½c. per lb. in carload lots.

Sodium Nitrate—$2.85@$3 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $18@$20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; $33@$35 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.50@$1.75 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 14c. per lb. of chromium contained; 4 to 6 per cent carbon, 15c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $75@$80, f.o.b. furnace; resale, $90, delivered; English, $75@$80, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $30@$32, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $42@$45; 50 per cent, $70@$75; 75 per cent, $140@$145.

Ferrotungsten—Domestic, 70 to 80 per cent W, 50@55c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$5@$6 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 21.50c. per lb.; wire, 15c.

Lead Sheets—Full lead sheets, 8.25c.; cut lead sheets, 8½c. in quantity, mill lots.

Nickel Silver — 31½c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets 17¾c.; sheathing, 16¾c.; rods, ⅝ to 3 in., 14¾c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina $35@$50 per ton, f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $60@$65 per net ton, shipping point; arches, keys, wedges, $66; splits, soaps, $84.

Fire Brick—First quality, 9-in. shapes $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $70@$75 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000: $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, June 14, 1921

The stagnation in demand for pig-iron and steel products has grown even more pronounced. Orders are few and are usually for single carloads. Production of steel is now at less than 25 per cent of capacity, yet the inflow of orders at the moment is not sufficient to promise maintenance even of this low rate. In May, steel production was at about 38 per cent by the Steel Corporation and 32 per cent by the independents, the latter having had a spell of good sales in April when they were withdrawing the lowest of their cut prices. Their average operation now is estimated at under 20 per cent. The Steel Corporation is operating at about 30 per cent.

There is no price issue now between the steel producers and their customers. Many steel consumers have large stocks of their finished wares, such as agricultural implements, and reductions in steel prices just now would not be to their advantage. Later the steel mills will doubtless endeavor to pick out a situation in which sharp price reductions would stimulate buying, so that by a larger operation costs would come down. Present prices represent losses to most producers, on account of low operating rates.

Pig Iron—Foundry iron has declined 50c. to $22.50, Valley, bessemer remaining at $23 and basic at $21.50.

Coke

Connellsville—Furnace, $3.25@$3.75; foundry, $4.50@$5.

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[1] Foote Mineral Co., Philadelphia, Pa.

World's Production of Copper, Lead, and Zinc, 1911-1920

Prepared by the American Bureau of Metal Statistics

World's Production of Copper

Statistics Based on Blister Copper Referred to Countries Wherein Ore Originated

(In Metric Tons—2,204 6 Lb.)

Country	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
North America:										
United States	491,600	563,300	557,400	525,529	646,212	881,237	872,065	879,026	548,677	576,450
Mexico	61,900	73,700	52,800	36,337	30,969	55,128	47,503	75,529	60,491	50,480
Canada	25,300	35,300	34,900	34,027	47,202	47,985	50,626	52,693	36,106	35,500
Cuba	3,800	4,400	3,400	6,251	8,836	7,816	10,313	12,337	9,974	6,485
Total North America	582,600	676,700	648,500	602,144	733,219	992,166	980,507	1,019,585	655,248	668,915
South America:										
Bolivia	2,600	3,700	3,700	3,874	5,868	5,150	6,400	6,000	7,000	9,900
Chile	36,420	41,647	42,263	44,665	52,341	71,288	102,527	96,565	63,930	94,531
Peru	27,735	26,969	27,776	27,090	34,727	43,078	45,176	44,414	39,470	31,276
Total South America	66,755	72,316	73,739	75,629	92,936	119,516	154,103	146,979	110,400	135,707
Europe:										
Austria-Hungary	2,600	4,000	4,100	3,500	3,500	3,500	3,500	2,500	1,000	1,000
Germany	22,400	25,600	25,300	25,000	25,539	24,796	28,632	15,101	15,775	17,255
Norway	1,565	2,130	2,741	2,859	2,826	1,614	1,810	2,856	1,800	1,400
Russia	25,700	33,500	33,900	31,938	25,881	20,887	16,000			
Spain and Portugal	51,800	59,900	54,700	37,099	46,200	42,000	42,000	41,000	40,000	25,000
Sweden	3,221	3,957	4,215	4,692	4,561	3,181	4,423	2,956	3,558	3,500
Serbia	7,000	7,400	6,400	4,443	3,200	5,000	11,200	6,000	1,209	2,436
Total Europe	114,286	136,487	131,356	109,531	111,707	100,978	107,565	70,413	63,342	50,591
Asia:										
Japan	53,402	62,423	66,500	70,463	75,416	100,635	108,038	90,323	81,865	65,554
Total Asia	53,402	62,423	66,500	70,463	75,416	100,635	108,038	90,323	81,865	65,554
Australasia	45,979	46,343	45,647	38,667	37,709	39,855	36,564	44,722	16,441	26,486
Africa	17,300	16,600	22,900	27,033	31,300	39,815	42,656	31,064	31,350	32,230
Other Countries	6,300	5,300	3,800	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Grand totals	886,622	1,016,169	992,442	928,467	1,087,287	1,397,965	1,434,433	1,408,086	963,646	984,483

World's Production of Lead

(In Metric Tons—2,204 6 Lb.)

Country	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
North America:										
United States	368,140	376,413	395,340	488,737	486,185	537,277	527,729	462,878	412,701	432,355
Canada	10,786	16,219	17,080	16,483	21,009	18,823	14,776	23,314	19,876	15,413
Mexico	124,600	108,000	62,000	23,598	31,384	19,966	46,612	88,503	78,645	84,200
Total North America	503,526	500,632	474,420	528,818	538,578	576,066	589,117	574,695	511,222	531,968
South America:										
Argentina				1,088	1,546	1,611	2,743	3,436	3,965	3,500
Other South America	2,535	2,295	2,476	1,766	2,689	2,261	1,405	1,345	2,600	1,500
Total South America	2,535	2,295	2,476	2,854	4,235	3,872	4,148	4,781	6,565	5,000
Europe:										
Austria-Hungary	19,600	21,400	24,100	32,000	34,500	36,500	34,400	33,000	1,764	1,800
[illegible]	44,300	51,200	53,590	70,980	16,770	15,560	22,745	20,630	4,225	8,000
[illegible]	[illegible]	31,100	28,817	29,601	14,539	24,276	21,235	12,778	10,928	12,000
[illegible]	164,300	176,700	188,000	180,250	121,700	106,807	86,228	70,000	51,500	54,400
[illegible]	14,300	14,500	18,309	20,684	11,595	9,426	1,422	4,093	3,841	4,000
[illegible]	16,700	21,500	21,674	20,464	21,812	24,362	16,237	18,332	16,530	15,915
[illegible]	1,000	1,000	1,523	1,000	1,000	1,000				
[illegible]	189,919	232,612	198,829	143,524	171,472	147,406	172,909	169,709	125,721	142,000
[illegible]	1,160	1,300	1,235	1,630	2,530	2,160	3,170	2,240	830	800
[illegible]	26,000	29,200	30,500	19,584	15,767	12,890	11,430	11,083	10,441	10,000
Total Europe	500,819	580,512	566,577	519,817	411,685	380,387	369,776	341,865	225,780	248,915
[illegible]										
Turkey	12,400	12,500	13,900	6,000	1,200	1,200	3,000	2,500	1,000	1,000
[illegible]			5,931	10,218	7,059	11,266	17,137	19,380	18,827	24,197
[illegible]	4,125	3,733	3,777	4,562	4,764	11,370	15,806	10,684	5,771	5,000
[illegible]	[illegible]	[illegible]	23,608	20,780	13,023	23,836	[illegible]	32,564	25,598	30,197
[illegible]	[illegible]	107,400	110,400	94,950	95,000	141,232	162,568	177,810	81,682	11,713
[illegible]					485	1,264	3,882	9,308	12,859	13,900
[illegible]	1,123,005	[illegible]	1,177,481	1,167,219	1,063,006	1,126,657	1,165,434	1,141,023	863,706	841,693

World's Production of Zinc

[illegible]

[illegible]	[illegible]	[illegible]	1913	1914	[illegible]	1916	[illegible]	[illegible]	1919	1920
[illegible]	[illegible]	[illegible]	320,283	[illegible]	[illegible]	616,908	619,079	[illegible]	[illegible]	[illegible]
[illegible]						2,698	[illegible]	[illegible]	11,182	16,795
[illegible]	[illegible]	[illegible]	204,220	[illegible]	51,660	22,930	[illegible]	[illegible]	[illegible]	83,046
[illegible]	[illegible]	[illegible]	67,890	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	19,655
[illegible]	[illegible]	[illegible]	278,800	236,000	185,357	178,015	[illegible]	[illegible]	85,000	97,465
[illegible]	66,956	[illegible]	[illegible]	[illegible]	52,426	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]						[illegible]	[illegible]	1,188	1,282	1,400
[illegible]	[illegible]	[illegible]	21,707	15,100	[illegible]	11,600	12,600	[illegible]		
[illegible]									4,010	6,000
[illegible]	[illegible]	23,932	[illegible]	[illegible]	11,130	12,101	4,059	[illegible]		2,031
[illegible]	[illegible]	[illegible]	9,287	[illegible]	[illegible]	[illegible]	1,752	[illegible]	3,386	1,837
[illegible]	[illegible]	8,763	7,610	[illegible]	5,480	[illegible]	[illegible]	[illegible]	2,477	2,785
[illegible]	[illegible]	[illegible]	3,312	[illegible]	[illegible]	6,500	7,500	[illegible]	10,000	[illegible]
[illegible]	[illegible]	[illegible]	2,000	2,300	[illegible]	10,000	[illegible]	[illegible]	[illegible]	1,450
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4,826	[illegible]	[illegible]	3,404	3,920
[illegible]							51	[illegible]	4,877	5,900
[illegible]			960	[illegible]	[illegible]	38,993	54,718	[illegible]	19,816	10,885
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	987,021	[illegible]	[illegible]	[illegible]	[illegible]

COMPANY REPORTS

Cerro de Pasco Earned 69c. a Share in 1920

A report of operations of Cerro de Pasco Copper Corp. for 1920 shows a balance of $618,433 after interest, depreciation, depletion and federal taxes, compared with $2,283,628 in 1919. Profit and loss account follows:

Inventory — Dec. 31, 1919	$7,518,035 82	Sales of copper, silver and gold	$11,463,572 25
Operating, smelting, refining and administration expenses.....	8,417,195.34	Dividends and interest	2,319,890 66
		Miscellaneous receipts.	35,174 91
Custom ores	2,043,287 93	Inventory, Dec. 31, 1920	9,042,612 37
United States and foreign taxes.	621,576 46		
Reserve:			
Depletion of mines...	2,781,663.42		
Depreciation of plant and machinery	791,058 16		
U. S. income tax, 1920	70,000 00		
Net earnings..........	618,433 06		
	$22,861,250.19		$22,861,250 19

SURPLUS ACCOUNT

Adjustment of reserves, capital:		Balance—Dec. 31, 1919	$10,273,493.58
Surplus, etc	$5,708,166 13	Profit—Jan. 1 to Dec. 31, 1920 (see net earnings above).....	618,433.06
Dividends paid.......	3,592,917.00		
Balance..............	1,590,843.51		
	$10,891,926 64		$10,891,926 64

Capitalization, 898,230 shares of no par value.

Jim Butler Tonopah Mining Co.

A report of operations of the Jim Butler Tonopah Mining Co. for 1920 shows that the gross value of production was $263,658.44, from 12,616 dry tons of ore. The total earnings from Tonopah operations were $38,921.32; from the lease to West End Consolidated, $21,025.59; from other leases and miscellaneous income, $10,285.91. Operating statement follows:

Balance of cash in banks Dec. 31, 1919.....			$3,331 22
Receipts:			
Shipments of ore, (including lessees' ore)...		$123,342.51	
Sale of Liberty Loan bonds—$55,000.....		48,708.53	
Interest received on Liberty Loans.......		637 50	
Interest received on bank deposits.........		136.07	
Other collections		8,291 67	181,116 28
			$184,447 50
Disbursements:			
Operation of mine and conduct of business, including payments to lessees for ore.....		$102,300 52	
Net disbursements, quarter interest in:			
Belmont Shawmut Mining Co.	$70,865 59		
Less one-quarter net proceeds of ore during 1920...	38,944 56	31,921 03	
Belmont Wagner Mining Co.	78,295 77		
Less one-quarter net proceeds of ore during 1920..	28,987 85	49,307 92	183,529 47
Balance of cash in banks Dec. 31, 1920............			(a) $918 03

(a) Due from ore shipped, $6,266 15

Hedley Gold Mining Co.

A report of operations of the Hedley Gold Mining Co. for 1920 states that $324,985.55 in gold and silver was produced. Balance sheet follows:

ASSETS

Fixed		
Mines and mining claims, buildings, plant.	$2,016,547 63	
Capital stock, the Similkameen Water Works Co., Ltd..............................	6,000 00	
Copper Flat property..................	200 000 00	$2,222,547 63
Deferred		
Supplies mdse., cyanide, etc		73,844 03
Current		
Accounts receivable	$22,682 57	
Cash in banks	119,921 55	$142,604 12
		$2,438,995 78

LIABILITIES

Capital stock authorized and issued............ (240,000 shares, par value $10 each.)		$2,400,000 00
Current accounts payable......................		716 48
Reserve for insurance, etc......................		31,899 98
Surplus, balance, Dec. 31, 1919	$8 319 91	
Less deficit, year ended Dec. 31, 1920	1 940 59	6,379 32
		$2,438,995 78

Greene Cananea Surplus Increases

A report of operations of Greene Cananea Copper Co. for 1920 states that 43,672,939 lb. of copper, 1,778,618 oz. of silver, and 10,090 oz. of gold were produced. The cost of copper production was 16.304c. per lb. (including all expenses and Federal taxes); the price received was 18.013c. per lb. Income account follows:

Income		
Sales of metals.		$7,142,208 17
Miscellaneous receipts		157,710 67
		$7,299,918 84
Expenses:		
Mining	$3,630,781 14	
Reduction.	3,120,492 79	
Refining and selling.............	1,096,198 80	
Administration and taxes.......	996,429.56	
Metals in process and on hand Jan. 1 1920	4,516,383.63	
	$13,360,285 92	
Metals in process and on hand Dec. 1, 1920.	6,979,941 25	6,380,344 67
		$919,574 17
Expenditures on buildings and equipment written off		311,081 59
		$608,492 58
Interest paid		48,414.08
Balance, net income for year..............................		$560,078.50

Surplus balance on Dec. 31, 1919, was $7,837,309.32. Adding net income of $560,078.50 and subtracting dividends totaling $500,000, leaves a balance Dec. 31, 1920, of $7,897,387.82.

United Eastern Dividends, $981,360

A report of operations of United Eastern Mining Co. for 1920 states that 104,222.5 oz. of gold and 78,011 oz. of silver were recovered in the period named, valued at $2,173,914.28. Income account follows:

Values recovered:			
Gold....................		$2,087,558.39	
Silver..................		80,463.87	$2,168,022.26
Miscellaneous income.			24,611.51
			$2,192,633 77
Deduct:			
Mining costs		$534,489 92	
Development...........		54,854.76	
Depletion		672,916.29	
Milling		208,267 54	
Depreciation on plant, etc		32,035 86	
Marketing..............		12,396 81	
Taxes			
State and county.............	$92,494 60		
Capital stock.................	3,812 97		
1919 Federal income and profit taxes.....................	32,560 92	128,868 49	
Casualty reserve.		29,603 81	
Superintendence...................		11,688.01	
Administrative and general expense		48,669 23	
Litigation expense.................		63,719 46	
Miscellaneous.....................		2,505 01	$1,800,015.19
Net income before providing for 1920 Federal income and profit taxes....................			$392,618 58

Capital surplus Dec. 31, 1919, after deducting depletion, was $1,576,271.22. Adding net income of $392,618.58 and deducting distributions to stockholders in 1920 of $981,360, leaves a surplus Dec. 31, 1920, of $987,529.80. Capitalization, 1,363,000 shares, of $1 each, outstanding.

Camp Bird Surplus Decreases

A report of operations of Camp Bird, Ltd. (British) for the fiscal year ended June 30, 1920, states that £50,320 16s. was realized on investments and £58,917 19s. was received in dividends from subsidiary companies. Profit-and-loss account shows a profit of £64,717 14s., to which has been added £53,462 2s., brought forward from last year, giving a total of £118,179 16s., from which preference dividends totaling £45,473 15s. and tunnel advances amounting to £35,265 16s. have been deducted, leaving a balance of £37,440 5s. No milling operations were carried on during the year in Colorado.

MINING STOCKS

Week Ended June 11, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Adventure	Boston	½	½	½		
Ahmeek	Boston	50¼	47¾	47¾	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	7/16	5/16	5/16		
Allouez	Boston	21	21	21	Mar. '19	1.00
Anaconda	New York	40	37¼	38¾	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2½	2	2		
Ariz. Com'l	Boston	8¾	8½	8½	Oct. '18,	.50
Big Ledge	N. Y. Curb	5/16	¼	5/16		
Bingham Mines	Boston	....		10	Sept. '19, Q	.25
Calumet & Arizona	Boston	49	45½	46¾	Mar. '21, Q	.50
Calumet & Hecla	Boston	245	240	240	June '20, Q	5.00
Canada Copper	N. Y. Curb	‡		13		
Centennial	Boston			7¾	Dec. '18, SA	1.00
Cerro de Pasco	New York	27½	25⅛	25½	Mar. '21, Q	.50
Chile Copper	New York	11⅜	10½	10½		
Chino	New York	24¼	23⅛	23⅝	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	‡		*26½		
Con. Arizona	N. Y. Curb			1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb			1¼		
Copper Range	Boston	34½	32⅛	32⅛	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*39	*29	*34		
Davis-Daly	Boston	6¾	6½	6½	Mar. '20, Q	.25
East Butte	Boston	9¼	8⅝	8⅝	Dec. '19, A	.50
First National	Boston Curb	*58	*51	*56	Feb. '1[illegible], SA	.15
Franklin	Boston	2⅛	2	2		
Gadsden Copper	N. Y. Curb			*25		
Granby Consol.	New York	21¼	20⅛	20⅛	May '19, Q	1.25
Greene-Cananea	New York	23½	22	22½	Nov. '20, Q	.50
Hancock	Boston	3	2⅞	2⅞		
Howe Sound	N. Y. Curb			2¼	Jan. '21, Q	.05
Inspiration Consol.	New York	34	32⅝	33¼	Oct. '20, Q	1.00
Iron Cap	Boston Curb	6⅞	6¾	6⅞	Sept. '20, K	.25
Isle Royale	Boston	21⅛	20	20	Sept. '19, SA	.50
Kennecott	New York	20¼	18¾	19¼	Dec. '20, Q	.50
Keweenaw	Boston			1¾		
Lake Copper	Boston	2¼	2¼	2¼		
La Salle	Boston			2		
Magma Chief	N. Y. Curb			*21		
Magma Copper	N. Y. Curb	19	18½	19	Jan. '19, Q	.50
Majestic	Boston Curb			*8		
[illegible]	Boston	1½	1¼	1¾		
[illegible]	Boston	2½	2	2½	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	4¼	3	3		
Miami Copper	New York	22½	20½	21	May '21, Q	.50
[illegible]	Boston	2	2	2		
[illegible]	Boston	50	48	49	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5¼	4¾	5		
[illegible]	New York	11	10½	10½	Sept. '20, Q	.25
[illegible]	Boston Curb			3		
[illegible]	Boston	15	14½	14½	Aug. '20, K	.25
[illegible]	N. Y. Curb			[illegible]		
[illegible]	Boston	10½	9½	9½	Oct. '18, Q	.25
[illegible]	Boston	½	½	½		
[illegible]	N. Y. Curb					
[illegible]	Boston			21	[illegible] '18, Q	1.00
[illegible]	Boston	28	27	28	June '20, Q	.50
[illegible]	Open Mar.	†160	160		[illegible] '21, Q	1.00
[illegible]	Boston	39	37	37	[illegible] '20, Q	1.00
[illegible]	New York	13½	12	12½	[illegible] '20, Q	.25
Ray Hercules	Boston Curb			[illegible]		
[illegible]	[illegible]	38	37	37	[illegible] '20, K	2.00
[illegible]	Boston	16½	15	15		
[illegible]	Boston			[illegible]	[illegible] '17, Q	.25
[illegible]	New York	7	[illegible]	[illegible]	[illegible] '20, Q	.25
[illegible]	Boston			1		
[illegible]	Boston			3½	Apr. '17,	1.00
[illegible]	Boston	1¼	1¼	1¼		
[illegible]	[illegible]	8½	8	8	May '18, I	1.00
[illegible]	Boston	*60	*60	*60	May '13,	.10
[illegible]	Boston Curb	26½	25	26	May '21, Q	.25
[illegible]	Boston	4	3½	3½	Sept. '18,	.25
[illegible]	New York	52½	47½	49½	Mar. '21, Q	1.00
[illegible]	Boston	1½	1¼	1 5/16	Dec. '17,	.30
[illegible]	Boston			1½		
[illegible]	Boston			*40		
[illegible]	Boston	10½	10½	10½		
		NICKEL-COPPER				
[illegible]	New York	14⅞	13⅞	14½	Mar. '19	.50
[illegible]	New York			82½	May '21, Q	1.50
		LEAD				
[illegible]	New York	76	73½	73½	Mar. '21, Q	1.50
[illegible] pfd	New York	102	102	102	Mar. '21, Q	1.75
[illegible]	New York	12	11	12	Mar. '21, Q	.25
[illegible]	Boston Curb			*6	[illegible] '15,	.05
		ZINC				
Am. Z. L. & S.	New York	9	8	8½	May '20	1.00
Am. Z. L. & S. pfd	New York	28¾	27½	27½	[illegible] '20, Q	1.50
Butte C. & Z.	New York	4¾	4½	4½	[illegible] '18	.50
Butte & Superior	New York	12¾	12½	12½	Sept. '20,	1.25
Callahan Zn-Ld	New York	5	4½	4½	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb	126	[illegible]	[illegible]	May '21, Q	2.00
[illegible]	N. Y. Curb	*3	*1½	2	[illegible] '16	.03
[illegible]	Los Angeles	*65	*53	*55	Sept. '20, Q	.03
		GOLD				
Alaska Gold	New York	⅝	½	⅝		
Alaska Juneau	New York	1⅜	1¼	1¼		
Carson Hill	N. Y. Curb	13½	13½	13½		
Cresson Consol. G.	N. Y. Curb	1⅞	1 11/16	1¾	June '20, Q	$0.10
Dome Extension	Toronto			*75		
Dome Mines	New York	18½	17	17	Apr. '21, Q	.25
Golden Cycle	Colo. Springs	*74	*71⅞	*71⅞	Dec. '20, Q	.02
Goldfield Consol.	N. Y. Curb	*7	*6	*7	Dec. '19,	.05
Hollinger Consol.	Toronto	7.25	7.00	7.00	Feb. '21, M	.05
Homestake Mining	New York	57¾	57	57	May '21,	.25
Kirkland Lake	Toronto	*47½	*45	*45		
Lake Shore	Toronto	1.22	1.20	1.20	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	1.92	1.89	1.89	Jan. '21, K	.05
Porcupine Crown	Toronto	*21	*14	*15	July '17,	.03
Portland	Colo. Springs			*59¼	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*4	*3	*3½	May '19,	.05
Silver Pick	N. Y. Curb	*5	*3	*3		
Teck Hughes	Toronto	*14½	*12¼	12½		
Tom Reed	Los Angeles	*87½	*73	*73	Dec. '19,	.02
United Eastern	N. Y. Curb	2 9/16	2 7/16	2½	Apr. '21, Q	.15
Vindicator Consol.	Colo. Springs	*37½	*36	*37½	Jan. '20, Q	.01
West Dome Consol.	Toronto	*6¼	*5¼	*5¾		
White Caps Mining	N. Y. Curb	*8	*6	*8		
Yukon Gold	N. Y. Curb	1⅛	1	1⅛	June '18,	.02½
		SILVER				
Arizona Silver	Boston Curb	*27	*19	*19	Apr. '20, M	.03
Batopilas Mining	New York	¾	¾	¾	Dec. '07, I	.12½
Beaver Consol.	Toronto	*32½	*31	*31	May '20, K	.03
Coniagas	Toronto	1.70	1.70	1.70	May '21, Q	.12½
Crown Reserve	Toronto	*12¼	*11	*11	Jan. '17,	.05
Kerr Lake	Boston	2¾	2⅞	2⅞	Apr. '21, Q	.12½
La Rose	Toronto	*20	*18½	*20	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*20	*20	20	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.26	1.15	1.15	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4½	4¼	4¼	Apr. '21, Q	.15
Ontario Silver	New York			5	Jan. '1[illegible], Q	.50
Ophir Silver	N. Y. Curb			2	Jan. '12,	.10
Peterson Lake	Toronto	*5	5	*5	Jan. '17,	.[illegible]
Temiskaming	Toronto			*18	Jan. '20, K	.04
Trethewey	Toronto	*16	*16	*16	Jan. '19,	.05
		GOLD AND SILVER				
Atlanta	N. Y. Curb	*1	*½	*1		
Barnes-King	Butte	‡		1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*62	54	*59		
Cashboy	N. Y. Curb	*5½	*4	*5		
El Salvador	N. Y. Curb			¼		
Jim Butler	N. Y. Curb	*10	7	*8	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	6½	*4½	*5	June '16,	.05
Louisiana Con.	N. Y. Curb			¼		
MacNamara M. & M.	N. Y. Curb	*17	*15	*16	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9		Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1 3/16	1⅛	1 3/16	Apr. '21, Q	.05
Tonopah Divide	N. Y. Curb	1½	1	1 1/16		
Tonopah-Extension	N. Y. Curb	1½	1⅜	1⅜	Apr. '21, Q	.05
Tonopah Mining	N. Y. Curb	1 3/16	1⅛	1⅛	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	1	⅞	15/16	Dec. '19, SA	.05
		SILVER-LEAD				
Caledonia	N. Y. Curb	*10	8	9	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	‡		1.10	Dec. '21,	.15
Chief Consol.	Boston Curb	2	2	2	May '21, Q	.05
Consol. M. & S.	Montreal	15¾	15¼	15½	Oct. '20, Q	.62½
Daly Mining	Salt Lake	‡		1.50	July '20, Q	.10
Daly-West	Boston			3	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb			2¼	Apr. '21, K	.05
Electric Point	Spokane	7	*7	7	May '20, SA	.03
Federal M. & S.	New York	6¼	6¼	6¼	Jan. '09,	1.50
Federal M. & S., pfd	New York	24¼	22¼	23	Mar. '21, Q	1.00
Florence Silver	Spokane			*12½	Apr. '19,	.01¼
Grand Central	Salt Lake	‡		*37½	June '20, K	.03
Hecla Mining	N. Y. Curb	4	3	4	Mar. '21, Q	.15
Iron Blossom	N. Y. Curb	*15	15	15	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	‡		3.00	Sept. '20, Q	.12½
Marsh Mine	N. Y. Curb			*6½		
Prince Consol.	N. Y. Curb	¼		¼	Nov. '17,	.02½
Rambler-Cariboo	Spokane	5	4	4	Feb. '19,	.01
Rex Consol.	N. Y. Curb	8	7	*7½		
South Hecla	Salt Lake	‡		*3	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	¼	¼	¼	Oct. '17,	.05
Tamarack-Custer	Spokane	1.95	1.85	1.90	Jan. '21, K	.04
Tintic Standard	Salt Lake	‡		2.40	June '20, Q	.10
Utah Apex	Boston	2	2¼	2½	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	3½	2	2	Nov. '17,	.01
		QUICKSILVER				
New Idria	Boston	†*50	†	*50	Jan. '19,	.25
		VANADIUM				
Vanadium Corp.	New York	29¼	27¼	27½	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal	58	57½	58	Apr. '21, Q	1.50
Asbestos Corp. pfd	Montreal	79	78	78	Apr. '21, Q	1.75
		MINING, SMELTING AND REFINING				
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Volume 111 June 25, 1921 *Number* 26

ENGINEERING AND MINING JOURNAL

JOSIAH EDWARD SPURR, *Editor*
TENTH AVENUE AT 36TH STREET, NEW YORK CITY

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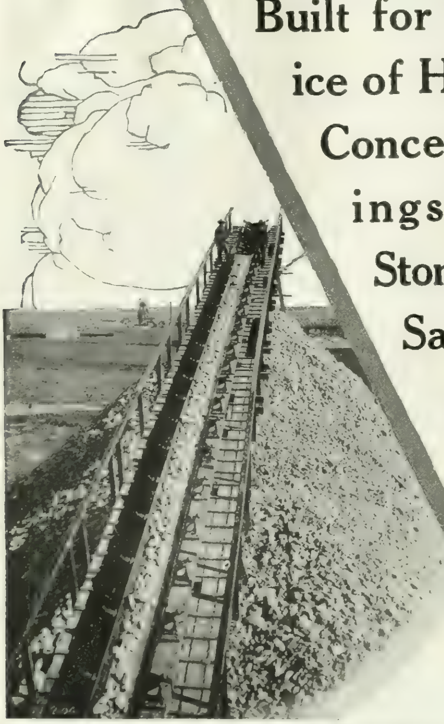

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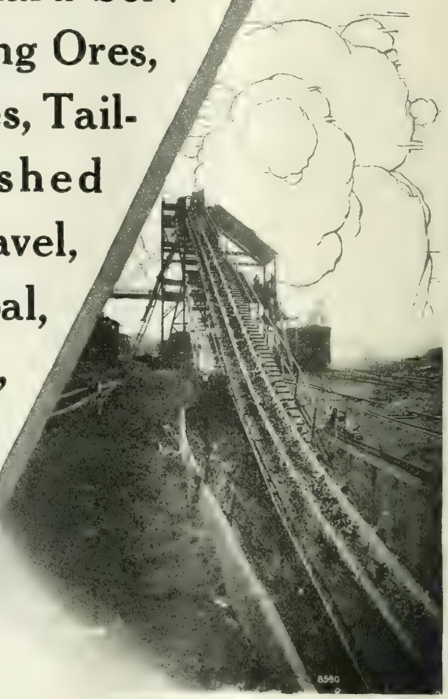

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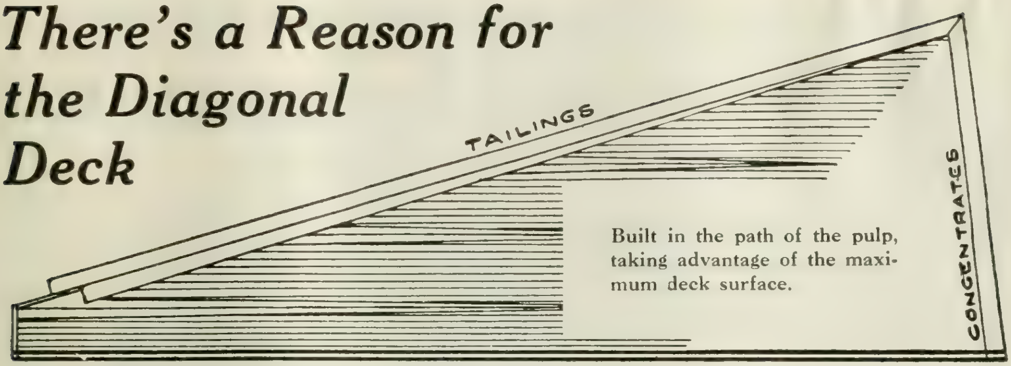

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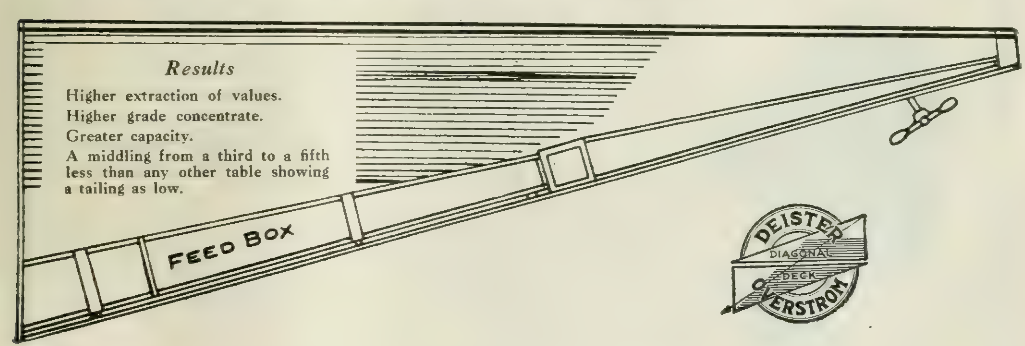

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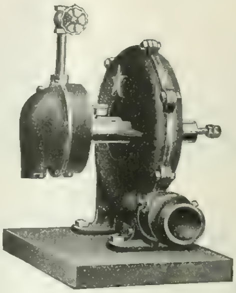

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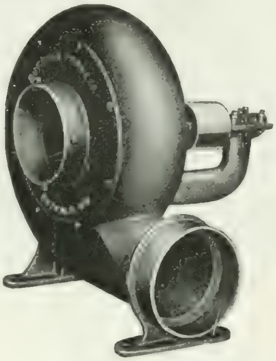

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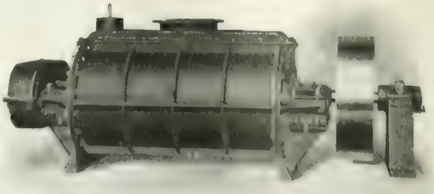

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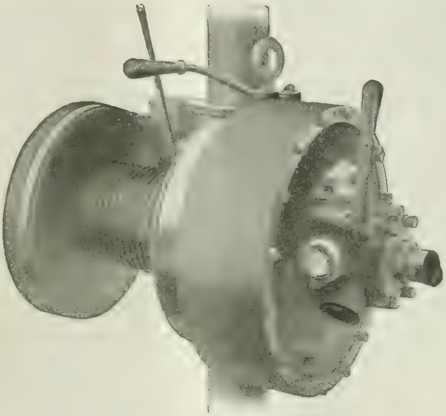

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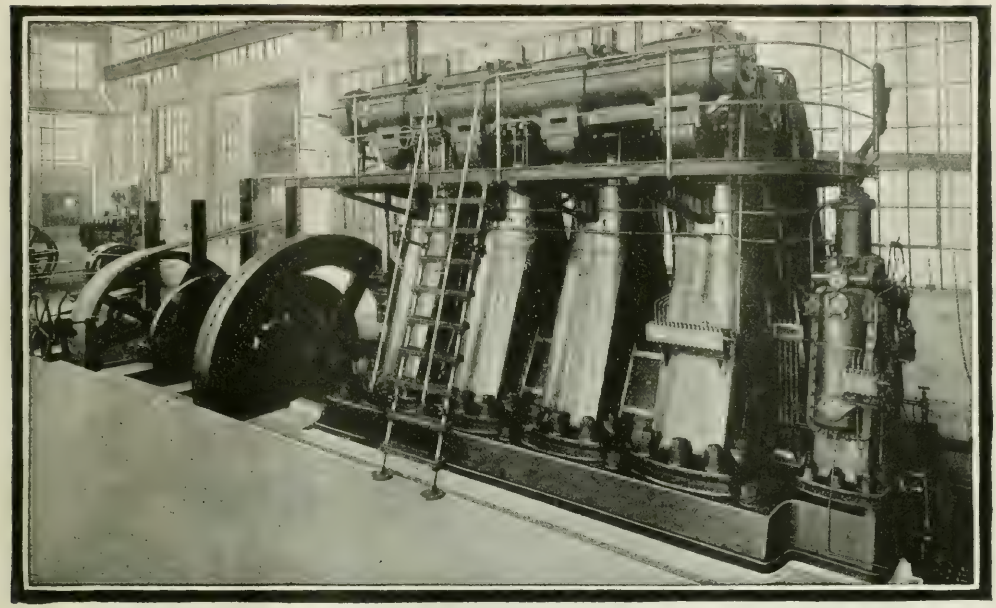

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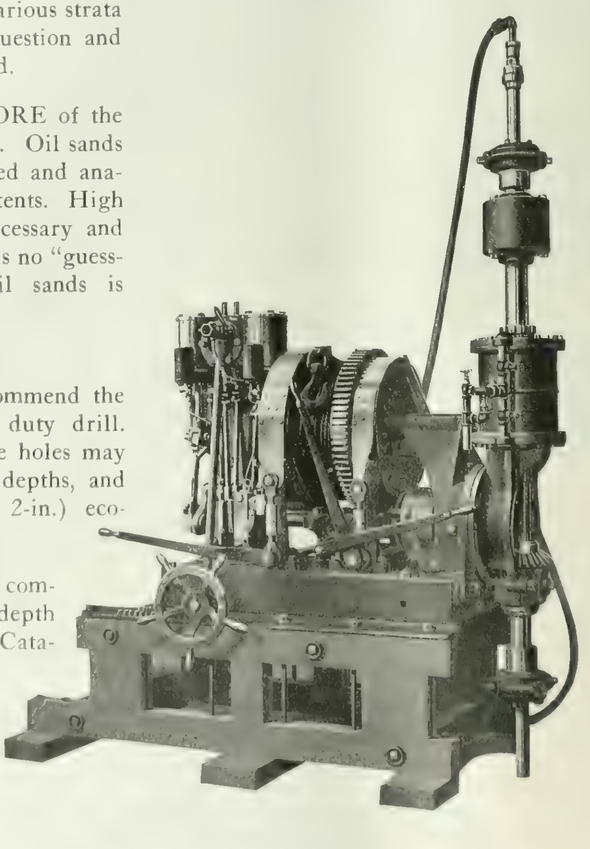

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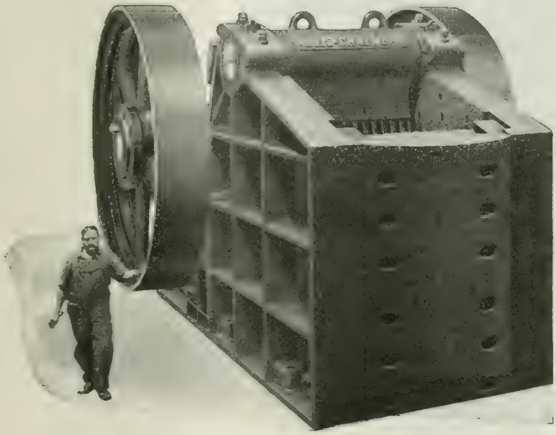
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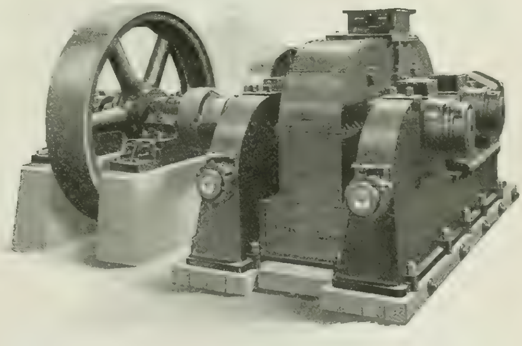
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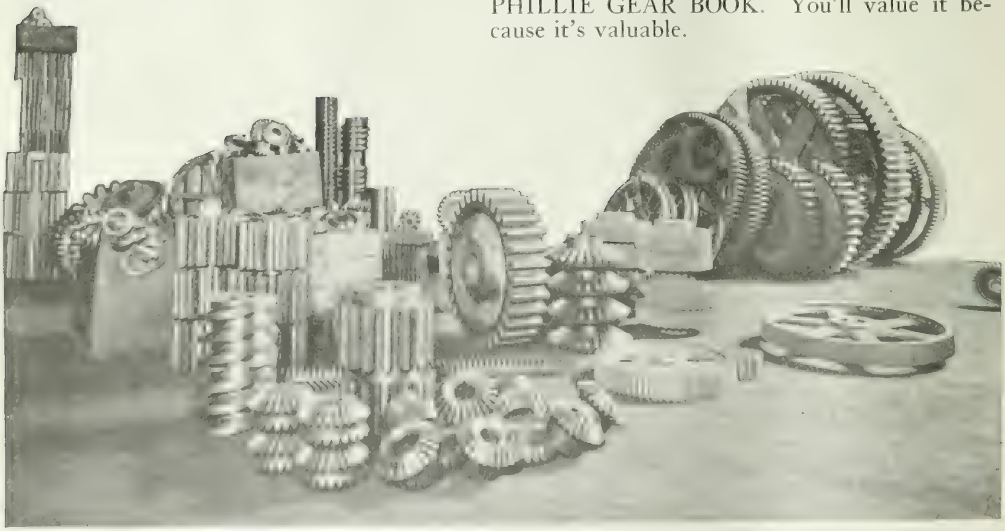

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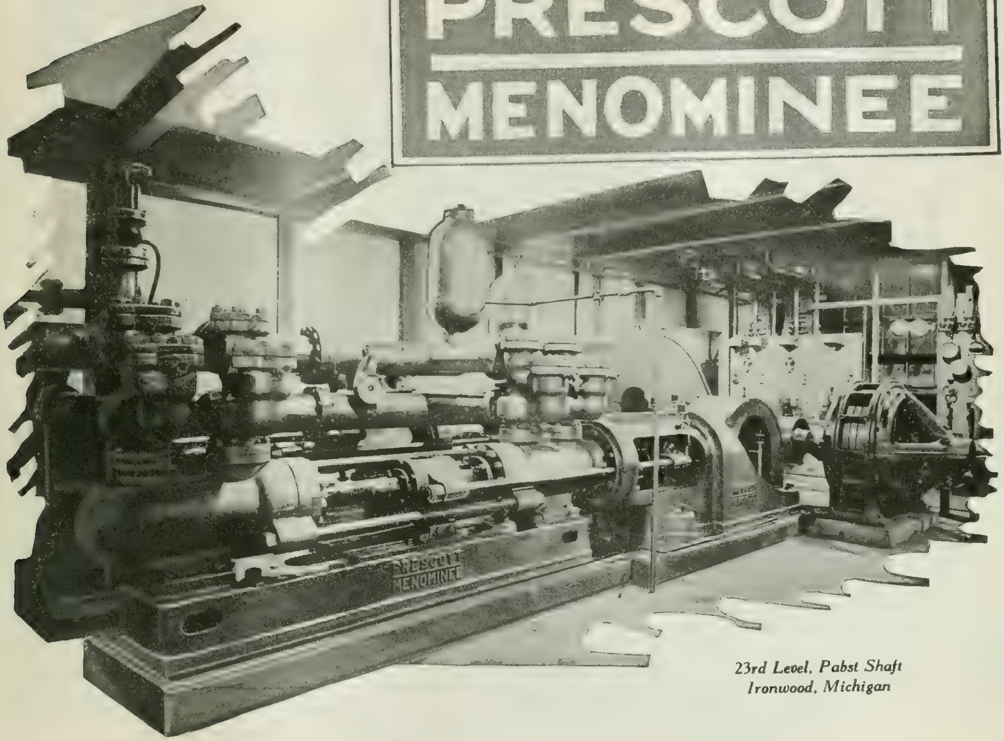

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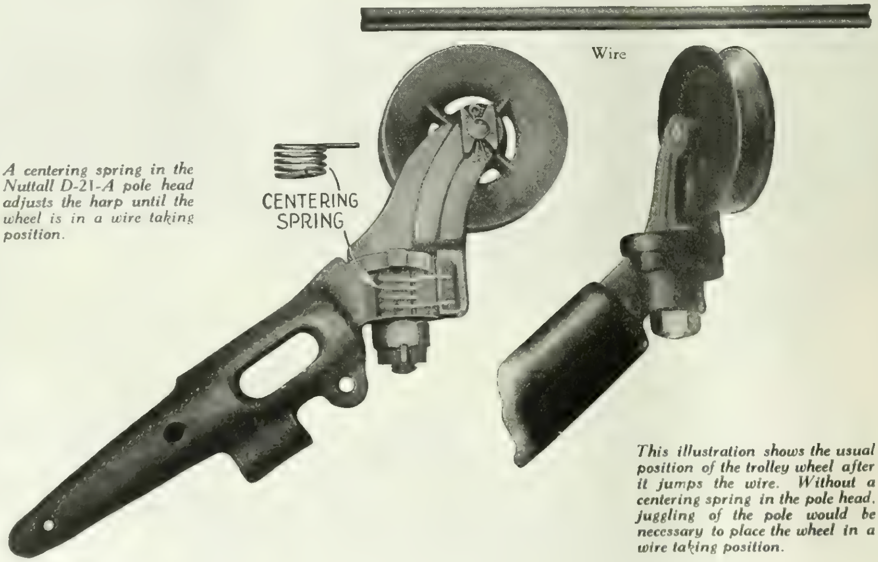
for Mine Trolleys



A centering spring in the Nuttall D-21-A pole head adjusts the harp until the wheel is in a wire taking position.

This illustration shows the usual position of the trolley wheel after it jumps the wire. Without a centering spring in the pole head, juggling of the pole would be necessary to place the wheel in a wire taking position.

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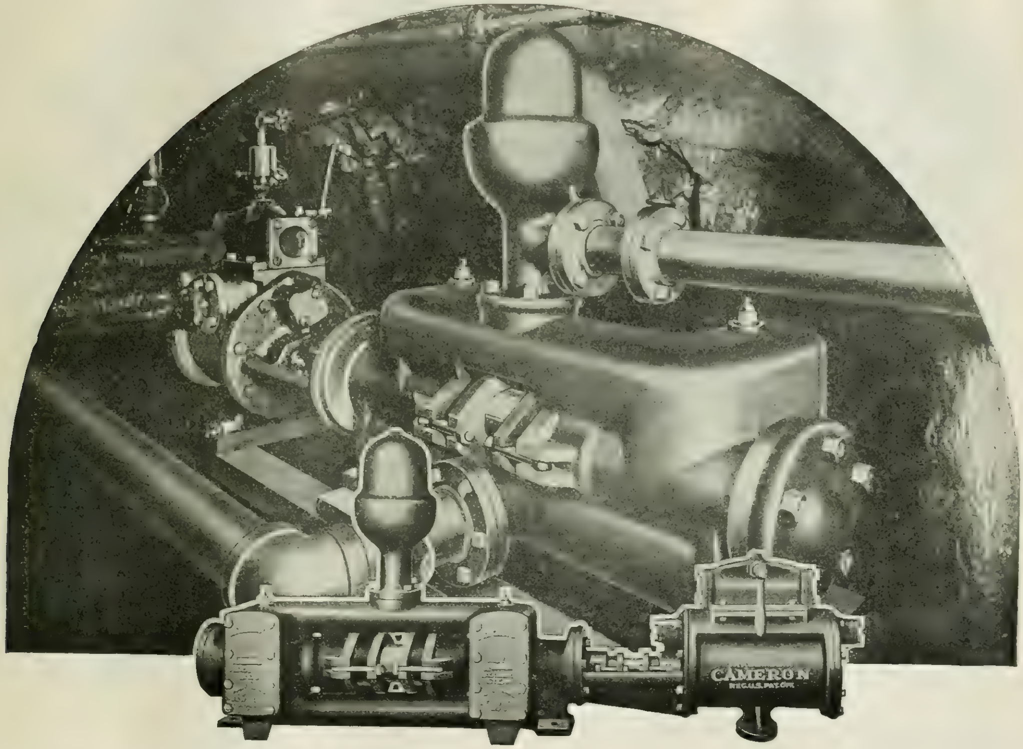

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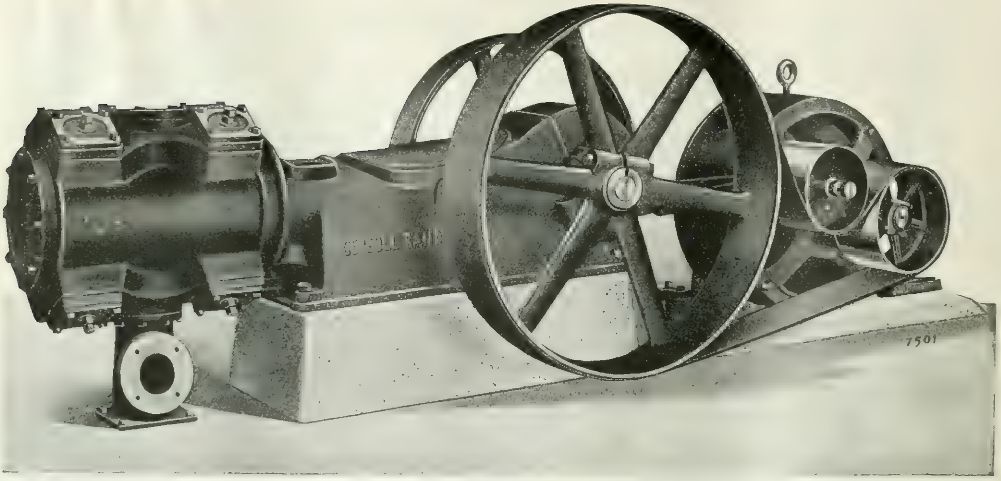

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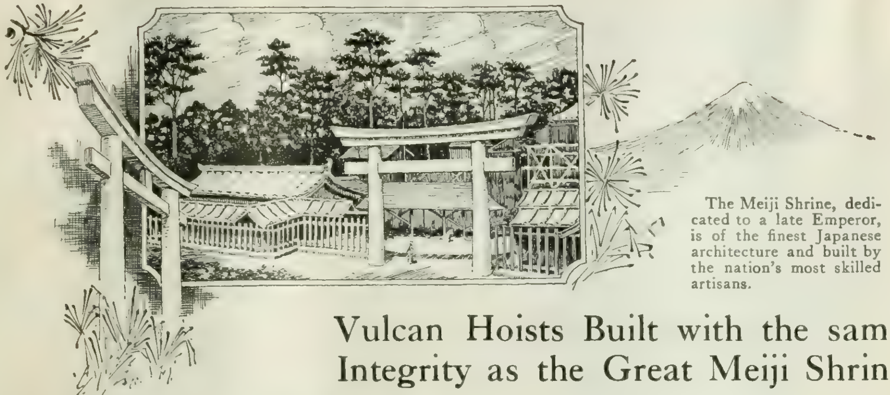

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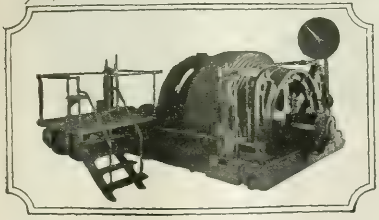
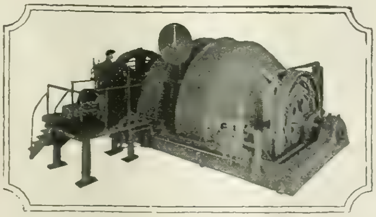


400 h. p. hoist with 7 ft. to 10 ft. diameter double cylindro-conical drum large enough to wind 1200 ft. of 1¼ in. rope in one layer. This hoist has a capacity of 500 tons of coal in 8 hours.



400 h. p. hoist with two cylindro-conical drums, 8 ft to 14 ft. diameter, one tight and one loose for hoisting in balance from different levels. Each drum is large enough to wind over 2000 ft. of 1¼ in. rope. Output, 400 tons in 8 hours from maximum depth.

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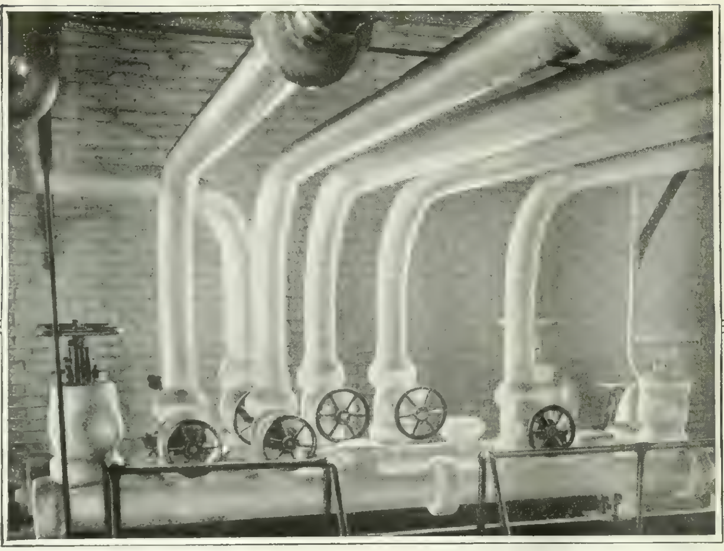

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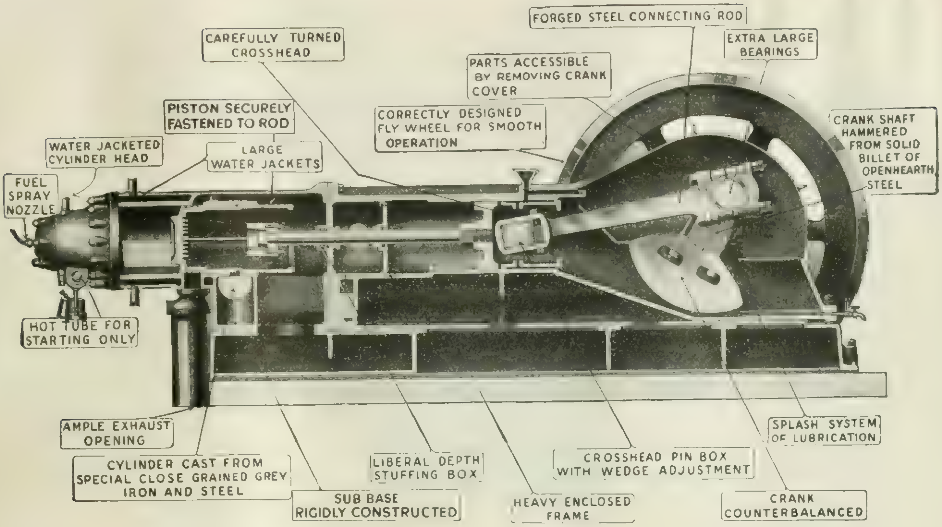
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EN 43

BOYER PNEUMATIC HAMMERS—LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
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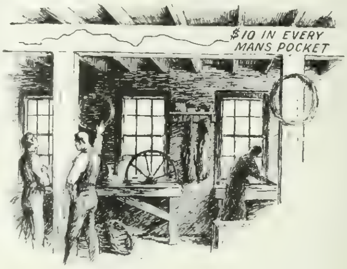

After Erskine Hazard and Josiah White had discovered how to burn anthracite coal in their wire mill, which was then located in Philadelphia, and thus established its use in 1814, they desired some way to get it down from the mines to the city more economically than in wagons. Anthracite coal at that time was selling at one dollar a bushel ($28 per ton).

They planned a canal system to be operated in conjunction with the Schuylkill River and to illustrate their project, drew a plan with chalk on one of the beams of their mill and wrote under it, "Ten dollars in every man's pocket," —meaning that that amount would be saved in the cost of coal to all users.

The scheme proved successful and the Schuylkill Navigation Company was organized in 1815. Three years later the Lehigh Navigation Company and the Lehigh Coal Company were formed to develop the Lehigh coal fields simultaneously. Two years later both companies were merged into the Lehigh Coal and Navigation Company.

So it was that these two men not only established the value of an unappreciated fuel, but lowered its cost and formed the "Old Lehigh" company which still mines and markets Lehigh anthracite.

This is one more indication of the vision that the founder of the Hazard Manufacturing Company had of the future. And the soundness of his basic, enduring principles still influences the making of HAZARD Wire Rope.

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Contrast with a lever-shaft breaker, averaging only ¼ in. to ⅜ in. movement at the top of the head; and it is readily seen why Telsmith takes bigger rock and crushes more of it. It is the big chunks that require the long pinch to prevent slippage, rocketing and bridging. Telsmith supplies this long pinch exactly where and when it is needed. Is it surprising, then, that Telsmith saves labor in block-holing, sledging and feeding or that Telsmith feeds and discharges more rapidly?

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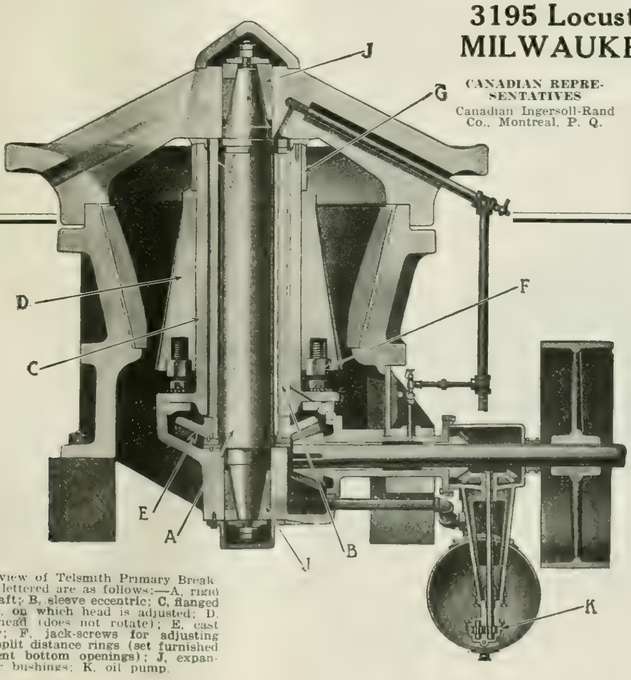

Sectional view of Telsmith Primary Breaker. Parts lettered are as follows:—A, rigid central shaft; B, sleeve eccentric; C, flanged head liner, on which head is adjusted; D, crushing head (does not rotate); E, cast steel gear; F, jack-screws for adjusting head; G, split distance rings (set furnished for different bottom openings); J, expansible taper bushings; K, oil pump.

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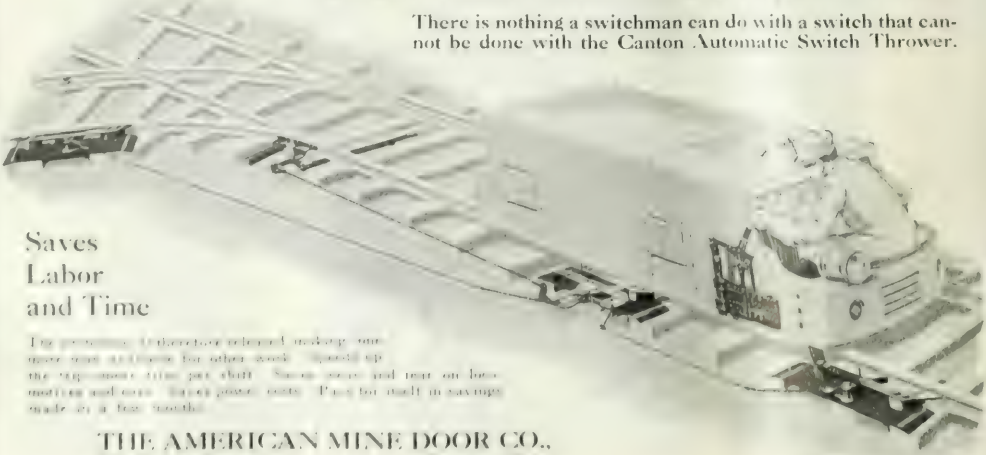

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Volume 111 New York, June 25, 1921 *Number* 26

Substitutes and Imitations

THOSE WHO PRODUCE commodities which sell at a low price have, in one way, somewhat less to worry about than those who handle expensive materials: they need have little fear that someone will come along with a low-priced substitute which will throw their business on the rocks. Among the metals, for example, it is beyond the realms of possibility that in our lifetime anything will displace iron to any marked degree. Lead and zinc, too, are so cheap that the tendency is to use them in place of other metals, rather than the reverse. Copper, even at its present moderate price, is three times as expensive as zinc and approximately ten times as much so as iron. Especially during war time was there a tendency to use substitutes for copper. Aluminum is by comparison expensive, but its increasing use is because it is so light that a given weight of this metal will go as far as more than three times the same weight of copper, for example. As we go up the scale we come to platinum, many substitutes for which have been devised and successfully used. Where its appearance is the chief desideration, as for jewelry, an alloy known as "white gold" has been put on the market.

Considering jewels, the future is somewhat more precarious, though here it is artificial production and not substitution which is feared. The diamond producers are nursing a monopoly most carefully, but the time is almost certain to come when imitation stones exactly like the kind we are accustomed to, and therefore no longer an imitation, will be on the market. Science has already pointed the way. And as for pearls, pearl plating has already been introduced in the oyster family, and the plated article cannot be distinguished from the solid except by breaking it, a procedure with obvious disadvantages. Pearls are ordinarily formed by a parasite working its way into the tissues of a mollusc, whereupon the outraged mollusc immerses the offending intruder in a fluid from which a pearly layer is deposited on the poor germ. The modern idea is to introduce within the shell of a vigorous looking mollusc a "starting sheet" considerably larger than the minute parasite heretofore employed by nature. This makes less work for the mollusc in producing pearls of a given size, and also a bigger profit for the middleman. It is an extension of the idea long practiced in the production of honey in which man takes upon himself certain details in the manufacture of the comb which he can perform more economically than the bee.

Every day takes us a little nearer to the cheapest way of doing things, and if someone devises a cheaper substitute for our favorite product, let *us* try to get the business of those who are making some even more expensive product for which our own can be substituted. And, also, we should never overlook the possibility of materially reducing costs through a radical change in our process.

The Exhaustion of Radium And Other Metals

A BALTIMORE PHYSICIAN, a "radiologist," Dr. Curtis F. Burnam, who is associated with the distinguished Dr. Howard A. Kelly in the radium treatment of cancer, is reported to be of the belief that the available supply of radium ore in the world will be exhausted in a short time, possibly in ten or fifteen years.

It is difficult properly to estimate the various current prophecies as to the exhaustion of certain rare and valuable metals; but it is certain that most important minerals except aluminum, iron and coal, and some others are being exhausted with varying degrees of rapidity. New discoveries will postpone the intense world shortage that will tend to show itself now in one mineral, now in another, from now on; but within a short space of time, certainly in less than one or two or three hundred years, the world will be very short of a number of metals of which we now have abundance. Aluminum and iron can always be had, for when the abundant supplies of the easily won oxides shall be low, new processes will utilize the silicates, and eventually the basic igneous rocks can be turned into these two metals and others. With the growing trend of the development of electricity, and the extension and perfection of electrometallurgical processes, it is easy to see that these developments will come when they are needed.

As to radium, there are two sides to the question, and no clear prophecy seems possible, because we do not as yet know the facts. It is argued that the amount of radium used for other than therapeutic purposes is trifling. Some geologists who have given special study to the problem are of the opinion that many additional finds of radium ore will be made in the world, and that the limits of our resources are difficult to predict; and in that case the fears of Dr. Burnam will not be realized.

We are, however, now near enough to the facts as to our metal reserves to begin to base an intelligent national policy on them. We have done an immense lot of prospecting, development, and mining, and are getting to the stage where we can constantly make closer and closer estimates of the earth's metal reserves—in sight, probable, and possible. Sound national policies of protection, development, alliance, or trade cannot be made without consideration of these fundamental facts: because they are not of the kind which apply solely a thousand years from now, but begin to be significant and controlling at once. We must substitute for the prophecies of physicians the best available estimates of geologists and mining engineers. This should be made the object of special studies; and these estimates should be revised from year to year, and constantly published. It will be easy, for example, to predict the rate of extraction of a considerable part of our copper reserves, for they have been largely measured.

Who will undertake this basic study, and be so situated as to be free from bias in the fact-finding? The Geological Survey has done splendid work in pointing out the situation in petroleum. If it had not been thus done, it is doubtful if any one would have done it. The whole job, indeed, is one for the Geological Survey. Will it undertake it? No one but a trained geologist is capable of estimating approximate ore reserves, unless it is drilled or developed ground, or ore in the bins or on the dump.

The Recovery in Gold Mining

THE McFADDEN gold bonus bill is still before the House Ways and Means Committee. Those engaged in mining gold are as desirous as ever for its passage, and from time to time some interested organization passes a resolution expressing this desire. In the meantime, here and there, the situation begins to look a little brighter for the gold miner. Recently at Porcupine, Ont., the Hollinger company increased its operations to full capacity, and conditions in that camp are said to be better than they have been in several years. In South Dakota, at another great camp, the Homestake Mining Co. has just paid a 25c. dividend for the month of May, the first dividend since September, 1919, a hopeful sign, even though it is less than half of the regular payment of 65c. per share. This property is also working at full capacity and has broken ground for an addition to its milling plant.

In California, on the Mother Lode, conditions are not so bad but that approximately 1,500 miners are employed, and, similarly, in the Grass Valley district from 900 to 1,000 are working. Compare this with the situation in the average copper camp. Two big properties, the Argonaut and Kennedy, at Jackson, on the Mother Lode, would probably be operating were it not for the conditions resulting from the fire that broke out in the Argonaut over two years ago.

In Cripple Creek, conditions are reported to be improving. Labor is cheaper, more plentiful and more efficient, and supplies cost a little less. In Arizona, the Katherine-Union Pass district, in Mohave County, has for some time been the scene of a gold "boom" of some dimensions, though to what extent it is justified is something for the future to determine.

Even when things looked darkest for the gold producer, great opposition developed to the McFadden bill. With the dawn of better times this opposition will not lessen. Furthermore, the record-breaking amount of gold in this country is steadily being added to from abroad.

The Advantages of Exercising the Microscope

HOW MANY FLOTATION PLANTS are equipped with microscopes? It is safe to say that the vast majority are not. Sometimes the mining department of a company is provided with one or more of these valuable instruments, but the flotation department usually either knows not of their existence or understands nothing of their applicability in the study of problems of concentration.

A thorough knowledge of the physical constitution of the substance we are handling is possibly not generally as important in metallurgical work as to know the chemical analysis, still it aids greatly in a proper conception of the problem to be solved. An example of such research is the work of Van Arsdale and Meier on the constitution and behavior of copper particles in slags, which has been made public in the last two or three years. Their experiments caused copper slag losses to be considered in a new light. Recently, the practicability of the microscope in the study of flotation phenomena has been demonstrated by the U. S. Bureau of Mines in its bulletin entitled "Flotation Tests of Idaho Ores."

The ore under examination visibly contained chalcopyrite, pyrrhotite, and pyrite. With the microscope it was discovered that the chalcopyrite was a replacement mineral, filling the pits and cracks of the pyrrhotite, and that the association of the minerals was so intimate and complex that no amount of crushing could set them free. Therefore, it was proved that the low recoveries obtained were not due to any error in manipulation or oils used, and further testing by a variation of these factors was shown to be without promise of tangible benefit.

Microscopical work does not require an unusual degree of skill. Neither does it take much time to polish a specimen and examine it. Even if it did, most copper metallurgists just now would not be deterred on this account, for they are in the position of the shiftless negro who remarked "Time is the onliest thing I aint got nothin' else but." So buy or borrow a microscope—it need not be the finest imported instrument—find out how to use it by reading some book, such as Davy and Farnham's "Microscopical Study and Determination of the Ore Materials," and the chances are that you will make discoveries which will set you to thinking. The expense of such experimental work is small, yet most practical metallurgists have done little in this field, so that the opportunities are all the greater.

Motion Pictures of Mining Industry

THOSE WHO ARE IN CHARGE of the entertainment at society meetings, at clubs, and at the various places at which men interested in mining occasionally gather, often find it difficult to arrange a program which will be instructive as well as entertaining. To such we wish to call attention to the motion picture films which the U. S. Bureau of Mines and the Canadian Department of Mines have gone to considerable expense to prepare. These pictures show in a most entertaining way, both to the technical and non-technical spectator, many of the leading features of interest in the industries which they cover. They could well be shown in many commercial moving picture theaters in mining towns to the exclusion of some of the eight-reel inanities which we sit through because we have paid our seventeen cents and have no better place to go. We cannot imagine any one who would not be interested in such a motion picture, for example, as "The Story of Petroleum."

The U. S. Bureau of Mines has so far prepared sixty-six such films, which it will loan free of charge for educational purposes in promoting safety, health, welfare, and efficiency in the mining industry. Applications for loans should be made to the Superintendent, Pittsburgh Station, Bureau of Mines, Pittsburgh, Pa., who will furnish a list of the subjects and give all desired information. Arrangements can also no doubt be made for securing the many interesting films which have been prepared by the Canadian dominion and provincial governments.

The Decrease in Wages

WAGES PAID "on company account" in mining camps throughout the United States have with some exceptions fallen below the scales in effect on Jan. 1, 1919, or, roughly speaking, at the time the Armistice was signed. This, however, was not the high point, for wages continued to rise after the Armistice, so that fourteen months later, at the beginning of 1920, the increase was marked. The late spring of 1920 saw still further increases in some instances, but by the fall of last year the tide had definitely turned and wages generally began to drop.

The contract system of paying miners is widespread, and a large part of the miners of the country are working under some form of wage contract, or would be if conditions were normal. The fall in straight day wages, however, is a fair criterion of the decrease in income today of the miner who is actually employed. "Actually employed" is to be stressed, for although a certain wage scale may obtain in a particular camp, a negligible number of men may be working.

In the news pages in this issue we tabulate the wages paid at fifty different camps in the United States as reported by sixty-one companies. In some cases, it will be noted, the decrease is slight and in others wages have not fallen at all. In particular, at Grass Valley and at Shafter, Tex., they appear to have risen. But in general the decrease is noticeable.

Domestic and Foreign Business Tactics

FOR MANY WEEKS the people of New York City have been able, through newspaper accounts, to scrutinize reports of shady and often criminal business practices, as the Lockwood committee, which was originally appointed by the state to investigate the local housing shortage, has, in its work, peered under the lid of many stupid and some adroit business methods of mulcting the public. The exposition of these methods has furnished many an interesting story of graft and criminality, and has clearly disclosed the fact that neither capital nor labor has entirely clean hands.

A few of the guilty have been imprisoned, many have been fined, and a large majority have been cautioned to alter their highly questionable business practices, the general rule being to imprison the labor leaders and to fine the business men. The scope of the inquiry has progressed further and deeper than was apparently originally its purpose and intent, and has shown that many artificial restrictions to trade, rather than the normal functioning of economic laws, have been responsible for hardship to the public in the building situation. Labor organizations, trade and price-fixing associations in building materials, insurance companies, and many other businesses have been dragged in the net—and a complete haul has not yet been made.

The exposure of these evil American business practices is a sad commentary upon our laws, upon our much-vaunted superiority in commerce, and our attempt to establish the nation firmly on the pinnacle of international trade. While responsible and comprehensive efforts are being made by far-sighted executives in government and business to intrench the foreign trade gained during the war, our internal commerce has been and no doubt still is being hampered and given a black eye by the greed of many business men and labor leaders. This is not exactly the sort of preparation one would expect from a country that intends to tune itself to international commerce and to occupy a dominant position in the world's finances, efforts that require a high order of business intelligence.

The important lesson that is apparent from the Lockwood exposures is the need for thorough reorganization and elimination of many sharp business practices, and for a moral regeneration, not only for the protection of the public, but for the better domestic organization of labor and capital to meet the intense effort that will be required to compete successfully in foreign trade.

Although we have great confidence in the integrity and undoubted honesty of by far the vast majority of American business men, it behooves them to see that their good name shall not be sullied by the tactics of reprobates among them. Tariffs, governmental loans, subsidies, and other palliatives can do little to bolster trading that is an offspring of sharp domestic business practices. Much good can come out of the Lockwood investigation, or any other similar investigation, if the lessons indicated are taken to heart, remedies instituted to remove the legal loopholes open to the law's evaders, and, above all, if an inward and conscientious attempt is made to improve the morality of American business.

The Institute Mining Methods Committee

THE American Institute of Mining and Metallurgical Engineers has formed a strong committee on mining methods, under the chairmanship of Mr. John C. Hodge, of Minneapolis. There is a great field of work for this committee, if certain proposed plans are carried out. There is much about up-to-date mining methods that is not to be gleaned from literature, although there are enough engineers who are expert in the special problems to make a systematic presentation and record easily possible. There is considerable talk, in this case, of the committee working on a definite plan, and this is a method which the Institute as a whole would do well to consider.

The papers of the Institute have always been practically spontaneous. Although committees on various subjects exist, the main or sole object of such committees has been to solicit papers—not papers on a certain subject, or so solicited that they would fit together, but just papers. But lately some of the most energetic and constructive of these committees have worked on a plan, and attracted much favorable attention thereby. The collection of papers on drill steel recently got together by Mr. B. F. Tillson is an example; another is the petroleum contributions brought out by the committee of which Mr. Ralph Arnold is chairman.

A carefully worked-out and assigned series of papers on mining methods would be very valuable. We do not recall any satisfactory treatment of stoping methods even, or of timbering methods, or of blasting methods, of methods of moving rock underground, or indeed of many other phases of mining, coupled with studies of the conditions under which each is to be applied. The men that are expert in these matters in too many cases are precisely the ones who will not volunteer papers on them; no man is anxious to write on matters which are so thoroughly known to him that they have no longer the charm of novelty. But an active working committee could put responsibility on such men, and induce them to contribute, for the making of a systematic and mutually related record.

WHAT OTHERS THINK

Selective Converting in South Australia

The article published in *Engineering and Mining Journal* of Feb. 5, "Selective Converting at Clifton, Arizona," by J. Owen Ambler, has been read with a good deal of interest here, as "bottoming" has been carried out at Wallaroo for a great number of years. Originally the method was practiced when the matte was roasted in reverberatory furnaces which were tapped on the regule stage after "coppering" for a short period. The beds for retaining the "bottoms" were made up near the tap hole so that the copper would be trapped in the first half dozen pigs. When the bed cooled, the impure copper was stripped from the regule and transferred to the electrolytic department to eliminate impurities and recover the gold and silver.

When the bessemerizing process was adopted at Wallaroo the "bottoming" was continued, with even better results than in the reverberatory roasters. In 1906 an engineer who had left the Wallaroo company's services and taken over the control of the O. K. mine, in Queensland, applied this method of selecting to the recovery of precious metals during the bessemerizing of matte.

There is no doubt the "bottoming" process in converting copper mattes is of considerable service where the precious metal values are low, as it also assists in removing small quantities of impurities and makes the bulk of the "blister" suitable for direct refining. As is well known, an appreciable amount of gold and some of the silver collect in the bottoms, which, at Wallaroo, are tapped through the side of the vessel opposite and directly above the tuyère line. The tap hole is drilled in the side of the shell and is continued by driving a 1½-in. bar through each new lining before it is dry, and this hole is kept free by allowing a bar to remain in it during blowing operations.

The matte charged is raised to the white-metal stage, and after removing the final slag, blowing is continued for twenty-five minutes, or whatever time is considered necessary to form a suitable "bottom," depending upon the quantity being treated. When sufficient copper has formed, the vessel is turned over, and a small quantity of matte shell is dumped into the charge. Blowing is resumed for about five minutes; this "tightens" up the regule and insures a minimum of metallic copper being held in the white metal. The converter is then turned over for about five minutes, when the bar is withdrawn and the copper allowed to run into sand moulds made up underneath the vessel.

As soon as the regule begins to show in the issuing stream, the vessel is returned to an upright position and the hole temporarily closed with a clay stopper. Subsequently the bar is again driven into the hole and the remainder of the metal blown to blister copper. The quantity of "bottoms" made varies according to requirements, but the usual practice is to run off about 16 per cent of the total copper, as under present working conditions this gives the most satisfactory result.

The recoveries of gold and silver average about 75 per cent and [illegible] per cent respectively. The silver recovery cannot be expected to be high, owing to its affinity for white metal being almost equal to that of metallic copper. During the last eleven years, 9,500 tons of "bottoms" have been produced in the converters, containing 2.5 oz. gold and 2 oz. silver per ton. The removal of impurities is the first consideration in making best select copper, and of course every attention is also paid to the recovery of the gold and silver which would otherwise be lost.

It may be stated that H. L. Collins[1] has published results of the same class of work which he introduced at the Huelva mine, Spain, in 1914. It is evident that in this instance the practice at Wallaroo had been followed in detail, with the exception that no raw matte was added to the charge on the eve of tapping the copper bottom.

H. LIPSON HANCOCK.

Wallaroo, South Australia.

The Chloride Volatilizing Process

In the *Engineering and Mining Journal* of Nov. 26, 1920, an article by Jay A. Carpenter is printed in which I am mentioned. Mr. Carpenter states in one paragraph: "Calcium and magnesium chlorides appear to react and volatilize faster and at a lower temperature than sodium chloride. I cannot, however, agree with Harai R. Layng that they are so much superior to sodium chloride as chloridizing and volatilizing agents. In fact, on oxidized silver ores I have been unable to make a high volatilization recovery of the silver with either of these chlorides or with sodium chloride, with a temperature of over 1,000 deg. C. for one hour, with rabbling and a fairly strong current of air."

His statement in the first sentence of that pararaph is in agreement with my published statements of an earlier date.[2] His attempt, however, to support his failure to agree with me, I consider weak. His failure to obtain high volatilization with calcium chloride on an ore which would not yield a high volatilization with sodium chloride is no proof that calcium chloride is not better than sodium chloride. He may have had an ore which could not be treated by chloridizing volatilization or he may have had an ore which would not yield good results by the methods of chloridizing volatilization which were used or known by him. The ore used may have required special treatment such as fine grinding, the presence of water, vapor, rapid heating, low oxidizing conditions, no rabbling or a different method of adding the chloridizer. It would be interesting to know whether the ore yielded better results by chloridizing cyanidation than those obtained by volatilization.

Each ore may require different treatment, and although I am willing to admit that chloridizing volatilization may fail on some ores of silver, I must say that of the many ores I have tested I have not tried one which did not give higher silver extractions by properly applied chloridizing volatilization methods than could be obtained by other methods excepting smelting.

In opposition to the main point of his article, I mention that I have been able to get high extractions by laboratory tests with chloridizing volatilization on samples of the tailings resulting from the cyanidation of Tonopah ores. I have recently done considerable work on an oxidized lead-silver ore which would not yield over 7 per cent extraction of the silver by concentration or flotation tests, and which would not yield any appreciable extraction by amalgamation or cyanidation even after chloridizing roasts, but which gave 60 per cent extraction by laboratory and over 70 per cent extraction by large-scale chloridizing volatilization tests. The lead extraction by concentration was about 70 per cent, and by volatilization the extraction was complete. The silver was not associated with the lead, but it was apparently combined with the silicate of alumina of the ore.

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[1] Trans. Inst. Mining and Metallurgy, Vol. XXIV, p. [illegible]

[2] Min. and Sci. Press, Jan. 17, 1920.

There are exceptional ores which, when mixed with a chloridizing agent like calcium chloride and placed in a muffle, will cause the calcium chloride to be rapidly decomposed, and the effective chloridizing agent will be volatilized before attracting most of the silver. With such ores sodium chloride may prove better than calcium chloride if the calcium chloride is not used as I use it in my processes.

Contrary to Mr. Carpenter's statement that the Cottrell method is the method relied upon to recover all of the silver, lead, and copper as volatile chlorides, I may mention that the Cottrell people do not claim that they can recover *all* of the silver, lead, and copper as volatile chlorides; furthermore, I do not depend upon the Cottrell system. In fact, I do not use it. I generally use absorption systems, and would use baghouses in the exceptional instances where absorption systems would not be suitable. My recovery systems are highly efficient.

My absorption system recovers in an available form practically all of the chlorine added to the ore except that which is combined with the volatilized metal chlorides, like lead chloride, which latter is recovered later in my processes in an available form. Experience with my processes has shown that most of the chlorine of the excess calcium chloride used is volatilized as hydrochloric acid and chlorine and that little is volatilized as calcium chloride; therefore, the amount of the excess chloridizer recoverable by the Cottrell system would be small indeed, unless use is made of absorbents. It will be advisable for me to mention here that I have covered the use of absorbents in patent applications and that I disclosed to Mr. Church, a Western Metallurgical Company's representative, upon his visit to my office some months prior to my publication on "Chloridizing Processes" the nature, description, application, and advantages of absorbents either with or without the Cottrell system, and that these points were news to Mr. Church.

Mr. Carpenter states that "the scope of the process depends principally upon the oil consumption per ton of ore, not only to chloridize the ore but also to maintain the necessary temperature at which the large stream of heated air gradually picks up and carries off the chlorides from the roasting furnace to the collectors." In another part of his article he states that the fuel required to heat "a ton of ore to 1,000 deg. C. and keep it there a sufficient time to volatilize the metals is variously estimated at from 15 to 25 gal." He states that for chlorination purposes only, the ore heated to 900 deg. C. for a short time, as thirty to forty-five minutes, would require less fuel than this.

My experience has been that the extractions by my chloridizing volatilization processes can be obtained in less than one-half of the time stated by Mr. Carpenter to be required for chlorination only. In trial with my processes a greater percentage of silver volatilization was accomplished in nine minutes in a large furnace than was obtained in laboratory tests in from ten to sixty minutes, and the indicated fuel consumption was considerably less than the lowest figure given by Mr. Carpenter. The amount of air required for volatilization is not nearly so great as the amount required for roasting. My experience has been that the fuel and chlorine consumption in chloridizing volatilization will be considerable less than in chlorination roasting and less than Mr. Carpenter states.

Chlorination roasting followed by cyanidation may sometimes prove advantageous under peculiar and unusual conditions, but I doubt whether it will prove more advantageous in the majority of cases of oxidized silver ores than will chloridizing volatilization.

San Francisco. **Harai R. Layng.**

Chloridizing Practice in Sweden

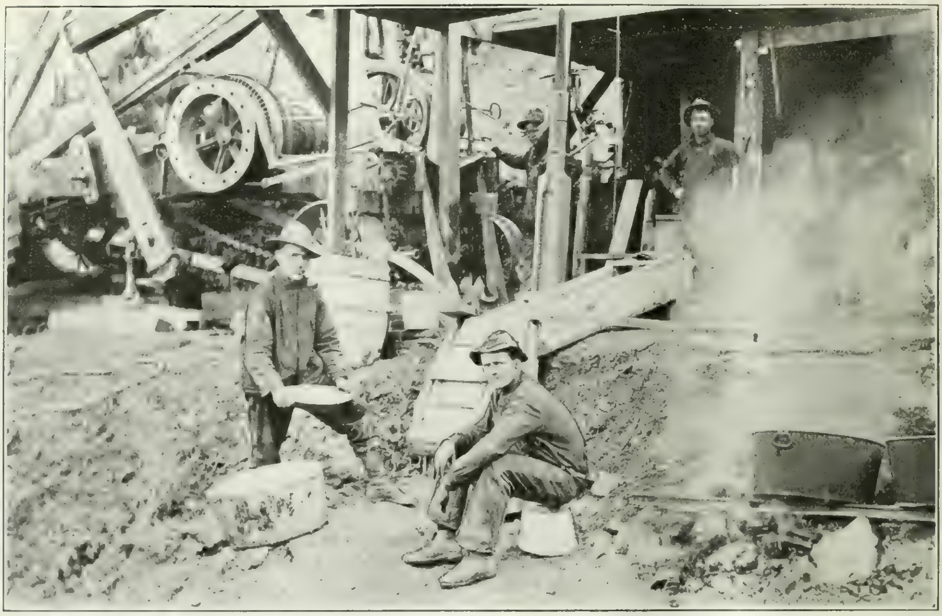
I have only recently read Mr. Van Arsdale's comments on my article published in *Engineering and Mining Journal* of April 2, to which Mr. DeFries has kindly replied. Regarding Mr. De Fries' reply I beg to give some additional information: The cement copper secured in the mechanical precipitator described in my article (*Engineering and Mining Journal*, March 5, 1921) contains on a dry basis, about: Cu, 85 to 90 per cent; Fe, 2 to 3 per cent; and Cl, less than 0.2 per cent. The percentage of iron in the cement copper is to a large extent governed by the quality of scrap iron which is being used, and also by the care with which the cement copper is separated from the remaining iron scrap and then washed. Most of the iron present is either in the metallic state, or as rust, or as basic iron compounds. The weaker the copper solutions are the more likely are basic iron salts to be thrown down with the copper. If a high-grade cement copper is to be secured, it is therefore important that the copper liquors are kept as strong as possible. The chlorine content is also governed by the washing process, and as the cement copper is washed in filter presses, the water-soluble chlorine can be removed to a minimum.

When copper is precipitated in tanks, there is a strong tendency toward the formation of cuprous chloride, insoluble in water. This subchloride has little chance to form in this mechanical precipitation process.

The high content of sodium sulphate given by Mr. De Fries clearly indicates that this cement copper had been poorly washed. In case of copper solutions containing appreciable amounts of precious metals, the Claudet silver process can be applied before the cementation, or the cement copper must otherwise be smelted into anodes, these to be refined electrolytically. When the cement copper does not contain precious metals, the smelting and refining operation, as carried out in Helsingborg, produces a copper equal in quality to the best "Best Selected Copper." This copper has a purity of 99.87 per cent. The cost of this refining process is said to be low.

I may finally mention that a method to refine the cement copper by electrolysis without a previous smelting has been developed and carried out on a commercial scale in Helsingborg. I am, however, not familiar with the details of this process. Nils Ostman.

Upsala, Sweden.



CHURN DRILL, SHOWING HOLE IN PROCESS OF BAILING. ALSO ARRANGEMENT OF SLUDGE LAUNDER AND SAMPLE SPLITTER

Tubs at right contain samples being dried over coal fire.

Churn Drilling of Disseminated Copper Deposits—I

Ability To Do Necessary Work and Reliability of Operation Should Govern Selection of Equipment—Problems and Methods of Drilling Accuracy and Reliability in Sampling Insure "Cost Per Sample" Perspective and Secure Dependable Results in Drilling Operations

By E. R. Rice

Written for Engineering and Mining Journal

DURING the past decade, the copper supply of the world has been profoundly influenced by the advent of the so-called "porphyry" copper mines. In the blocking out of the enormous tonnages of ore necessary to the economic exploitation of these mines, churn drilling has played an important part.

The accompanying table, compiled from the 1920 edition of *The Mines Handbook*, shows the relationship of the production of the leading "porphyries" of the United States to that of the entire world. Although there are other large mines of this type, notably in South America, the main ones of the United States are chosen, as it was the enterprise and ability of the men connected with these pioneers that has brought the art of mining and milling low-grade copper ore to its present state of efficiency.

[illegible] FOR THE YEAR 1918

[illegible]	[illegible]	[illegible]	1918 [illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Consolidated	[illegible]	[illegible]	81,037,777
[illegible]	[illegible]	1911	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Inspiration Consolidated	[illegible]	[illegible]	98,540,041
[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]

The world's production for 1918 was 3,066,578,758 lb. The eight mines listed in the table produced 21.1 per cent of this, or over one-fifth of the production of the entire world. The year 1918 is used for this comparison because during that year all of the copper mines were running to capacity.

The following are the principal economic considerations in the development of this type of ore deposit: The determination of the existence in the formation undergoing exploration of copper minerals of a grade high enough to warrant mining if found in large enough quantities; the development of sufficient tonnage to warrant mining and milling, and the development of this tonnage as rapidly as possible in order to bring the property to an early production stage, intelligently plan mining methods, and determine the best type of milling plant to be used.

Practically all of the disseminated deposits of copper ore lie in or near intrusions of granite-porphyry, monzonite-porphyry, or quartz-monzonite-porphyry and are overlain by a capping that varies in thickness from a few feet to as much as 1,500 ft.

At the beginning of prospecting operations on a supposed copper deposit the grade, tonnage, and location of the orebody are unknown. These factors should be determined with a minimum expenditure of time and money. Drilling, either churn or diamond, offers the best solution of this problem. This is true especially in the earlier stages of the enterprise, for the outfit is portable and may be easily moved from one location to another, thus allowing the different formations to be prospected in the order of their relative geological merit. Furthermore, the drilling equipment can be assembled and definite information obtained more rapidly than by regular sinking and drifting, the scale of operations can be expanded at will, and, in majority of operations, the cost of obtaining data is less than by regular sinking and drifting.

FORMATION DETERMINES DRILLING EQUIPMENT AND PRACTICE

The choice of proper equipment depends primarily on the formation to be drilled. In most instances the churn drill will be preferable to the diamond drill, though in some operations the latter will be more advantageous. At the beginning of operations in which all factors are unknown, the choice lies unquestionably with the churn drill. The principal reason for this is that the churn drill is suitable for either hard or soft ground, irrespective of whether it is massive or shattered, whereas the diamond drill is at a decided disadvantage, both from an operating and sampling standpoint, when operating in a formation that will not core readily. I do not wish to give the impression that the churn drill is always to be preferred, for there are cases where the diamond drill can be used to advantage. The point I wish to make is that in starting operations in unprospected territory it is better to begin with a churn drill, for one is sure of obtaining the desired information, whereas with a diamond drill one may not be able properly to drill the formation under consideration. The more I have to do with mining enterprises, the more I am convinced that in the selection of equipment the primal requisites are ability to do the work necessary and reliability of operation. Other factors are of secondary importance.

After a few holes have been drilled and the salient factors determined, if operations are expanded the final choice between churn and diamond drill may be made.

Most of the disseminated orebodies occur in altered brecciated material, traversed by numerous joints, slips, and faults, so that in most investigations the churn drill will be found preferable for all work.

The following equipment is recommended for initial prospecting work in new territory. Of course, if operations are being conducted in a district where salient factors have already been determined, the equipment can be better chosen to suit local conditions. The accompanying equipment list is based on the possibility of having to drill to 1,000 ft. in depth, in a strange formation:

RIG

One No. 24 Star traction type drill complete with temperscrew, belt, mast-guys, turn-buckles, guy-stakes, and other necessary parts. Drill to be equipped with No. 25 boiler, boiler to be lagged and lagging held in place with Russia iron.
Three No. 2 Barrett automatic lowering jacks.
Four handles for above (forged handles).
Two 2-in. x 14-in. screw jacks.
One 10-ft. derrick crane with traveler.
One 1-ton Yale geared chain block.
One No. 2 Barrett swivel wrench.
One scoop shovel.
One ½-pint oil can.
One 1-pint oil can, long snout.

MISCELLANEOUS DRILLING TOOLS FOR 6¼-IN., 8¼-IN., 10-IN. AND 12-IN. HOLES

One No. 2 Barrett wrench circle and jack.
One set manila rope clamps.
One set Mechling wire-line rope clamps for ⅞-in. wire line.
One set ordinary wire-line rope clamps for ⅞-in. wire line.
One right-hand tool wrench for 3¾-in. square.
One left-hand tool wrench for 3¾-in. square.
One bailer, 9-in. outside diameter by 10 ft. long, dart valve.
One bailer, 7-in. outside diameter by 12 ft. long, dart valve.
One bailer, 5-in. outside diameter by 14 ft. long, dart valve.
Three drilling stems 4½ in. diameter by 20 ft. long, 5¼-in. diameter box.
Two drilling jars, 6-in. stroke, 5¼-in. diameter.
Two 12½-in. full mother hubbard bits, 5 ft. long.
Two 10-in. full mother hubbard bits, 5 ft. long.
Two 8¼-in. full mother hubbard bits, 5 ft. long.
Two 6¼-in. bits, 5 ft. long.
Two wood-pecker manila rope sockets, 2⅜-in. bore, 5¼-in. diameter box, neck 3½-in. diameter x 8-in. long.
Two wire-line rope sockets bored for ⅞-in. wire line, 5¼-in. diameter box, neck 3½-in. diameter x 8-in. long.
All stems, jars and sockets to have full squares of 3¾ in. All stems, jars, sockets, and bits to have 2¾-in.x3¾-in. 7-thread joints, flat threads.

MISCELLANEOUS DRILLING TOOLS FOR 4½-IN. HOLE

Two 20-ft. stems, 3⅝-in. diameter, 3¾-in. diameter box.
Two drilling jars, 8-in. stroke, 3¾-in. diameter.
Two wire-line rope sockets bored for ⅞-in. wire line, 3¾-in. diameter, neck 2⅞-in. diameter by 6 in. long.
Two 4½-in. bits, 5 ft. long.
One dart-valve bailer, 3½-in. outside diameter by 16 ft. long.
One right-hand tool wrench for 3-in. square.
One left-hand tool wrench for 3-in. square.
All stems, jars and sockets for 4½-in. hole to have 3-in. full squares. All stems, jars, sockets and bits to have 1⅝-in. x 2¼-in. 8-thread joints, flat threads.

FISHING TOOLS FOR 6¼-IN., 8¼-IN., 10-IN. AND 12½-IN. HOLES

One wall hook for 10-in. hole, 10 ft. long.
One wall hook for 8¼-in. hole, 10 ft. long.
One slip socket for 8¼-in. hole, with bowl for 10-in. hole, slip socket bored to go over 5¼-in. joints.
Two medium and two heavy slips for slip socket.
One combination socket to run in 6¼-in. hole and bored to catch rope socket, neck 3½-in. in diameter.
Two sets plain slips for combination socket.
One set pin slips for combination socket to catch 2¾-in. x 3¾-in. 7-thread pin.
One horn socket for 6¼-in. hole.
One horn socket for 8¼-in. hole.
One horn socket for 10-in. hole.
One heavy center rope spear with collar small enough to run in 6¼-in. hole.
One three-prong rope grab for 10-in. hole.
One three-prong rope grab for 6¼-in. hole.
One 16-ft. jar bumper.
One latch jack to run in 6¼-in. hole.
One 10-ft. side spud to run in 6¼-in. hole.
One 30-ft. spear to run in 6¼-in. hole.
All fishing tools above to have full squares of 3¾-in. and 2¾-in. x 3¾-in. 7-thread joints.
One horse-shoe trip rope knife complete with sinker and jars for cutting.
Two ⅝-in. manila line.
One Spang jar-down wire rope knife complete with sinker, jars, and swivel to run in 4½-in. hole and cut ⅞-in. wire line.

FISHING TOOLS FOR 4½-IN. HOLE

One slip socket to run in 4½-in. hole and catch neck of rope socket 2⅞-in. diameter.
Two sets slips for slip socket.
One combination socket to run in 4½-in. hole and catch neck of rope socket 2⅞-in. in diameter.
Two sets plain slips for combination socket.
One set pin slips for combination socket to catch 1⅝-in. x 2¼-in. 8-thread pin.
One horn socket for 4½-in. hole.
One center rope spear for 4½-in. hole.
One latch jack for 4½-in. hole.
One 10-ft. side spud for 4½-in. hole.
All fishing tools for 4½-in. hole to have 3-in. full squares and 1⅝-in. x 2¼-in. 8-thread joints.

CASING AND CASING TOOLS

400 ft. 40 lb., 10-thread, 10-in. California special casing.
700 ft. 28 lb., 10-thread, 8¼-in. California special casing.
1,000 ft. 20 lb., 10-thread, 6¼-in. California special casing.
1,200 ft. 12 lb., 10-thread, 4½-in. California special casing.
Two each 4 ft., 6 ft., 8 ft., 10 ft. and 12 ft. nipples for each string of casing.
Four extra couplings for each string of casing.
Two casing shoes for each string of casing.
One steel casing nipple with male and female threads for each string of casing.
One forged-steel drop drive head for each string of casing.
One set drive clamps and wrench to fit tools with 3¾-in. square.
One set drive clamps and wrench to fit tools with 3 in. square.
Two 50-ton hydraulic jacks with 18 in. run-out.
One spider with liner and slips to take from 12½-in. to 4½ in. casing.
One set Fairs patent elevators for 10-in., 8¼-in., 6¼-in. and 4½-in. casing.
One 2½-in. tubing hook.
One 4½-in. casing hook.
One 20-in. single, one 20-in. double and one 20-in. triple iron casing blocks.
Two large chain tongs, with extra jaws and chain.
Two medium chain tongs, with extra jaws and chain.
One 10-in., one 8¼-in., one 6¼-in. and one 4½-in. Henderson trip casing spears.

BLACKSMITH TOOLS

One 200-lb. anvil, one 2-lb. ball-pein hammer, one 14-lb. cross-pein sledge, one 14-lb. straight-pein sledge, one set bit gages from 12½ in. to 4½ in. inclusive.
Six 2-in. hot cutters, four 1½-in. track chisels, one bar ⅞-in. hexagon tool steel.
One 1-in. crowbar 6 ft. long, one 1¼-in. crowbar 6 ft. long, one 20-in. straight tongs, one 24-in. straight tongs, ½-in., ⅝-in. and ¾-in. bolt tongs, one 20-in. rivet tongs.
Two bars each ¼-in., ⅜-in., ½-in., ⅝-in. and ¾-in. round iron.
Miscellaneous assortment bolts and nuts.
Miscellaneous assortment of nails, preferably keg of 8d, 10d, and 40d.
One set taps and dies from ¼ in. to 1 in., pipe stock and dies from ½ in. to 2 in.
One combination 6-in. vise, pipe cutters, one ratchet drill and bits from ¼ in. to ⅞ in. x $\frac{1}{16}$ in., six 14-in. mill files, six 8-in. mill files.
Twelve 8-in. triangular files, one hack saw and two dozen 12-in. hack-saw blades.

CARPENTER TOOLS

One hand saw, one steel square, one level, one claw hammer, three wood chisels ¾-in., 1-in. and 1½-in., three assorted screw-drivers, one brace and set bits from ¼ in. to 1 in., one expansive bit to bore up to 2½ in., one draw knife, one adze.
One poll ax, one hand ax.

DRILLING CABLE AND SUPPLIES

500 ft. 2½-in. Tubbs hawser-laid manila drilling cable.
1,500 ft. Leschens California special ⅞-in. steel drilling cable.
1,500 ft. $\frac{7}{16}$-in. sand line.
Twelve ⅞-in. Crosby wire rope clips.
Twelve $\frac{7}{16}$-in. Crosby wire rope clips.

MISCELLANEOUS SUPPLIES

Three gasoline torches or three carbide lamps. Six lanterns, two dozen lantern globes, twelve 36-in. sledge-hammer handles, twelve machinist-hammer handles, one 8-in. monkey wrench, one 12-in. monkey wrench, one 14-in. monkey wrench, one 8-in. Stillson wrench, one 12-in. Stillson wrench, two 14-in. Stillson wrenches, one set assorted S wrenches, two flue scrapers, one beading tool, one flue roller, miscellaneous pipe, fittings and valves depending on water supply.
30-ft. ¾-in. hose, one dozen gage glasses, three dozen gage glass gaskets, gasket rubber, assorted, packing for engine, one 50-ft. metallic tape, 25 lb. good-grade babbitt for bearings, 50 lb. poor grade babbitt for rope sockets, shovels, picks, pick handles, 10 ft. each of ⅜-in., ½-in. and ⅝-in. chain. 10 ft. of 2 in. x 10-in. oak board.
Four 400-gal. capacity water tanks for rig.
One 5,000-gal. main storage water tank.
One sample splitter, one sample drier, two dozen ore sacks, 100 6-in. x 12-in. sample sacks.

EXTRA PARTS

Two wrist pins for crank, one wrist pin for deep-groove pulley, one wrist pin for slide arm, one temper screw complete, one set balls and races for temper screw, one injector, one lubricator, one sand reel eccentric, one sand pulley, one set belt clamps and bolts, one walking beam, one walking-beam saddle, one pinion and yoke for friction shaft, one pittman, one set grate bars.

SYSTEM OF CO-ORDINATES ADVISABLE

The first hole should be drilled in the most promising area, geologically, and at one of the co-ordinate intersections of the co-ordinate system decided upon. The standard accepted practice in development has been to divide the area to be drilled into a series of squares measuring 200 ft. on a side and drill holes at the corners of these squares. For this purpose the property is divided into squares by a co-ordinate system, the distance between parallel ordinates and abscissi being 200 ft. The 200-ft. interval may be accepted as standard practice, as the data derived from the use of this interval have been proved reliable in the mining of millions of tons of ore by different companies.

In laying out the co-ordinate system, the origin of co-ordinates should be taken to the southwest of the property, so that all points on the property will be in the northeast quadrant. In the designation of hole locations, the best method is by indicating the number of feet the hole is north and east of the origin of co-ordinates. For instance, the location of a hole that is at the intersection of the ordinate 1,600 North and abscissa 1,800 East would be designated as N 1,600, E. 1,800

The system should be laid out accurately with transit and tape and the meridian determined to within thirty seconds of arc and co-ordinates laid out due north and south and east and west, for if this is not done, drilling maps will not check with regular property maps. If the above scheme is followed, all surveys can have a common origin of co-ordinates and a great deal of time and trouble will be saved. The system need not be laid out in its entirety, for the position of the first hole may be assumed and the co-ordinate system expanded from it.

CONDITIONS GOVERNING SHIFT BASIS

One of the important points to be decided at the beginning of operations is the number of shifts to be employed, whether one, two, or three. Where the property is under option and time is an important factor due to impending payments on the property, three shifts will be the logical number. Later it may be found to be advantageous to operate only two. A great deal depends on the character of the ground and the personnel of the crews. By operating three shifts, the plant is worked to capacity and overhead expense is reduced, but it will be found that a great deal of trouble will be experienced on the "grave-yard" shift. The only satisfactory method of operating on a three-shift basis is where there are enough drills in operation to employ a night foreman, so that close supervision of the work may be assured.

In some articles on churn drilling I have noticed that a greater footage is sometimes indicated on the night shift as compared with the day shift. For the benefit of those not familiar with this class of work I will say this is probably due to the fact that all repairing and such work is done by the day shift.

At the beginning of operations where only one drill is employed the crews will comprise one driller and one helper to each shift, one of the drillmen acting as foreman. There will also be a teamster, who hauls fuel, casing, tools and other supplies. Besides those mentioned there should be a technically trained man who combines the duties of sampler, assayer, and engineer.

SELECTION OF SUITABLE FOREMAN IMPORTANT

Great care should be taken in the selection of the foreman, for upon him devolves the successful prosecution of the work. It will be found in churn drilling, more than in most lines of work, that the men need careful and intelligent handling. Petty jealousies between individual drillers often lead to a great deal of grief, and the company is the loser thereby. Many drillers think they know more about drilling than any other man on the job, the foreman not excepted. This is easy to understand, for some of the drillers may have been foremen on other jobs and it may happen that the foreman on the present job may have worked alongside of, or for, some of the drillers now under him. There is a general tendency among drillers to leave everything to the foreman, and this is exemplified by the following expression, which is as standard as a 10-in. bit: "I'm not paid to think. I'm paid to dig the hole." The foreman has no easy job, and it takes an exceptionally good man to get the best out of the men.

The principal qualifications of a good foreman are personal ability, tactfulness, fairness, firmness, and a pleasant personality. A good way to start to build up the morale of the organization, if there are several drills operating, is to find out which drillers like each other and then put personal friends on the same drill. This method goes a long way toward preventing friction, for if there is one man in a crew that the other drillers do not like, constant friction is inevitable and the company will suffer. The driller should have the right to "turn in" his helper to the foreman if he is not satisfactory.

The driller should not be forced to work with a man who is not satisfactory to him, for it is the driller who either makes or loses money for the company.

The management should never go over the foreman's head in issuing orders to the men excepting in emergencies, for to do so is sure to undermine morale, for the men lose respect for the foreman and the foreman gets sore and will either quit or lay down on the job.

As the work expands, auxiliary forces will have to be increased. It will be found that a man and a team will be required for every three to five drills in order to handle casing and tools. This is in addition to those necessary for handling fuel. An extra horse should be on hand, so that three horses may be used to a team in dragging heavy tools and casing, and also to provide a spare in case of sickness.

TRACTION DRILL LOADED FOR SHIPMENT. BEAM AND MAST ARE REMOVED

FUEL AND WATER CONSIDERATIONS

In handling fuel a satisfactory method is to haul coal from the cars and store it in a stockpile at some centrally located point for distribution to the drills. This can be done either by team and wagon or by burros. Five burros can supply three drills within a radius of one-quarter of a mile. The coal is packed in boxes swung from the pack saddle, each box holding approximately 100 lb. Fuel oil also may be satisfactorily used for both firing the boiler and heating bits, the choice of fuel being dependent on relative cost and facilities for handling. A sled with iron-shod runners is used for handling casing, tools and other essential materials.

Water for the drilling of the initial hole will have to be obtained in the best and most convenient manner possible. Water usually is encountered in the course of drilling operations, and after the first hole has been drilled a string of perforated casing may be left in the hole and the hole used as a water well. A 4-hp. Fairbanks-Morse gasoline engine with pumping jack and walking beam makes an ideal pumping outfit for this class of work. The walking beam operates a single-action force pump by means of sucker rods.

Water from the well should be pumped into a main storage tank set at such an elevation that water will flow to the drills by gravity. For one drill this tank should be of 5,000-gal. capacity, and two of the same size will serve for three drills. Water is distributed to the drills by means of ¾-in. or 1-in. pipe lines, depending on the distance it is to be carried. Pipe lines should have drain cocks at low points, so that the lines may be drained during freezing weather. Four 400-gal. tanks should be situated at the drill, and these should be kept full of water at all times, so as to provide for the contingency of the main water supply being temporarily shut off. A drill will require 2,000 gal. to 2,500 gal. of water per twenty-four hours and about 3,000 lb. of coal. This is during the period that the drill is running, but consumption will average less than this on account of delays.

DRILLING PROBLEMS TO BE MET

It is well to emphasize at this point, in the order of their relative importance, the problems confronting the management at the inception of operations. These are as follows: To get the holes down to, and through, the zone of mineralization; to sample accurately the ore-bearing horizon, and to accomplish the above with the minimum expenditure of time and money.

In churn drilling, one of the factors that has considerable bearing on cost, time, and methods employed is the depth to which it will be necessary to drill the holes. On a new property this is unknown, and the first hole should be drilled with the expectation of having to go at least 1,000 ft. In ordinary ground, it will be safe to start with a 12½-in. hole, using 10-in. as the first string of casing.

Then Fight the Big Hole Down. The importance of carrying the big hole (12½-in., 10-in., and 8¼-in.) as far as possible is not generally recognized by an inexperienced management, but it is by the experienced driller.

The reasons for carrying the big hole as far as possible are as follows:

To insure the hole reaching the desired depth; it is easier to fish out tools in the large hole than in the smaller because it is possible to use a greater assortment of fishing tools and there is more room in which to work; and ore should be reached with a hole of sufficient diameter to give a fairly large sample per foot of hole. Also, there should be a leeway of one or two strings of casing when ore is reached, so that if caves are encountered in the orebody the hole can be cased and the cave shut off to insure accuracy of samples. If possible, the 8¼-in. hole should reach the orebody and the 6¼-in. casing set on top of the ore to prevent capping caving into the hole and contaminating the samples. This leaves the 4½-in. casing for shutting off caves in the orebody itself.

In shallow deposits occurring in good drilling ground, the first holes are likely to be started and carried too large, but this is far better than the other way round. After three holes, not in the same straight line, have been drilled, the pitch of the deposit can be determined and the succeeding holes started and drilled accordingly.

METHODS OF DRILLING TO DEPTH

If it is found that the hole as drilled will not reach the desired depth, several courses may be pursued, as follows:

1. Get a string of 3-in. tools and a string of 3-in. casing and continue the hole this size. By this method the hole can be driven from 100 to 150 ft. deeper in ordinary ground.

2. Pull the 4½-in., 6¼-in. and 8¼-in. casing and ream the hole, trying to get each string of casing considerably deeper than before. I do not favor this procedure, as it will be useless if each string has been "fought down" in the first place.

3. Pull the 4½-in. and 6¼-in. casing and free the 8¼ in. casing by pulling it up the hole far enough to allow all of the caved material behind it to fall into the hole, thereby freeing the casing. Then under-ream the 8¼-in.

casing, getting it down as far as possible. Do likewise with the 6¼-in. and 4½-in. casings. This method will usually be found satisfactory.

4. The use of mud-laden fluid in the course of drilling, accompanied by under-reaming. This method, borrowed from rotary practice, consists of pumping mud around the last string of casing, the mud rising to surface through the casing. The mud penetrates the loose formation, holding up the walls and preventing caving of the hole and freezing of the casing. This method necessitates special equipment as pumps, connections, and other parts.

5. The abandonment of the hole and the starting of a new one. Methods 1 and 3 are preferable. Under-reamers are not included in the list of equipment, there being no need to get them for ordinary ground. If under-reamers are necessary, extra cutters, dressing, blocks, and ratchet rope socket should be ordered also.

WIRE LINE FOR WET DRILLING

Manila line should be used for drilling as long as possible. If the formation is dry, it may be possible to drill the entire hole with it. If the formation is wet, by the time the hole has reached a depth of 250 to 300 ft. below water level it will be necessary to use a wire line. The wire line is babbitted directly into the rope socket. This is done by heating the end of the cable to a bright red and then turning the individual strands inward and back on themselves after first running the wire line through the rope socket. The cable is then pulled tightly into the rope socket and molten babbitt poured around the cable. Care should be taken not to heat the cable in such a way that the annealed portion will extend out of the rope socket.

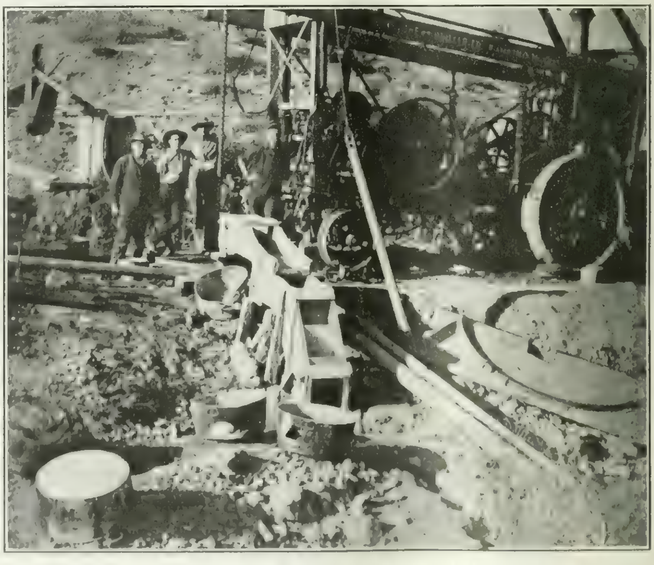
The drilling cable should be of ⅞-in. diameter, 6-strand, and 19 wires to the strand. I have found Leschens California Special will give excellent results. The reasons for the choice of a 6-19 cable as against a 6-7 are: The 6-19 is more springy and has more "life" in it than the 6-7; it is easier on the rig and can stand short bends better, and with its smaller diameter wires the 6-19 will show signs of approaching failure quicker than the 6-7. Breakage of drilling lines is usually caused by the line rubbing against the casing and thus wearing out, especially at a point where the line has been kinked or bent enough to give it a permanent set. The outside wires of the 6-19 will wear through before the cable is too dangerous to run. The 6-7 will not show these signs, as there are no inside wires, and when the individual wires wear thin the cable will part as a whole without showing signs of incipient failure.

Let me impress on the management that it is unreasonable and ultimately may be expensive to find fault and grumble when the drill foreman puts in a requisition for a new wire line. It is better to be on the safe side, and make sure that he doesn't run the old one too long. By running the old line a few days longer, he may get fifteen or twenty dollars' worth of extra wear out of it, but he is taking a chance on creating a fishing job that may cost from fifty dollars to the losing of a hole on which one or two thousand dollars has been spent.

HASTE MAKES WASTE IN REMOVING TOOLS

In removing the tools from the hole, they should be hoisted slowly unless the cable is known to be in first-class condition. The driller should hold a sack around the cable, allowing the cable to pass through his hands so that any wires that may be broken will catch on the sack and indicate any point at which failure has started. If broken wires are found, the cable should be inspected, and, if the place is bad enough, it should be cut and spliced. In splicing, unlay each end to be spliced for 24 ft., making the total length of splice 48 ft. and tuck the ends until they meet. That is, each end to be tucked will be 4 ft. long.

Tools should never be run into the hole at a high velocity. Throwing back the brake and letting the tools practically fall into the hole will save little time as compared with lowering the tools at a safe and reasonable velocity, and not only does the fast lowering put an excess strain on the drum, mast, brake, and cable, but there is a good chance for the tools to get beyond control and "jump off" a pin or two when they strike bottom.



DRILL OPERATING IN 6¼-IN. HOLE, SHOWING ARRANGEMENT OF SAMPLE SPLITTER

When drilling with a wire line a wooden plug with a hole bored through the center of it should be used in the top of the casing to prevent wear of the drilling line and threads of the coupling. This plug is split in half and is hinged on one side by means of old belting to allow the plug to be placed around the cable and inserted in the casing.

In bad ground where tools are likely to stick or get hung up, it often helps to run a 4-ft. sinker above the jars and use a longer stroke jar. By having this additional weight above the jars it frequently happens that the drilling string can be jarred out after being partly buried, when otherwise the tools would have to be fished out.

Disadvantages of Drilling Under Caving Conditions

Another point I would emphasize is the folly of drilling ahead when the hole is caving and there is danger of getting the tools buried. For purposes of illustration, we will take the following instance: The tools are 200 ft. ahead of the casing and progress has been approximately 10 to 15 ft. per eight-hour shift. The hole begins to cave, and progress is cut down to 5 ft. per shift, which may be satisfactory from the standpoint of cost. In the ordinary course of events, either one of two things will happen; the hole will have to be cased in the next day or two, or the drilling string will get buried and a fishing job will result. It is poor business to run the risk of a fishing job for the sake of gaining 25 or 30 ft. of hole. If it is known that the hole can be finished with the remaining strings of casing, the proper thing to do is to case the hole. If it cannot be so finished, under-ream the casing and set it on bottom.

In under-reaming, the two secrets of success are keeping the casing free and thoroughly under-reaming the hole as you go. Just because the under-reamer will go down the hole considerably below the casing is no sign the casing will go. The proper thing to do is to thoroughly under-ream the hole from the bottom of the casing down, for a bump sufficient to stop the casing may not be struck by the under-reamer once in ten strokes. A ratchet pipe socket is of great aid in successful under-reaming, for when run with the proper motion it absolutely assures the proper rotation of the tools.

Bits should be kept to gage and water courses cut out. The face of the band wheel should be covered with old belting and the belt should be protected from the weather by a good belt house. If this is not done it will be impossible to run in wet weather, on account of slippage.

In drilling difficult ground, the problem changes from that of drilling a hole to one of successfully getting the necessary casing in the hole. When the hole reaches ore, the main consideration is that of obtaining reliable samples.

Sampling a Matter of Careful Judgment

On the first hole or two, samples should be taken every five feet and assayed. After some definite information has been gained with respect to the formation, sampling may be dispensed with in the leached capping overlying the ore. When it is known that the hole is approaching the ore zone regular 5-ft. samples should be taken but not dried, five samples being kept in the tubs. As soon as the orebody is reached, the previous five samples should be dried and sent to the assay office.

A sample consists either of all or a definite proportion of all of the sludge obtained in the drilling of five feet of hole. If the hole is small all of the sludge obtained in the drilling of a 5-ft. section may go into the resulting sample. If the hole is large the sludge is put through a splitter cutting to ½, ¼, ⅛, or $\frac{1}{16}$. (For detailed drawing of splitter see Peele's "Mining Engineer's Handbook," p. 426.) The sludge is dumped directly from the bailer into the sludge launder which runs to the splitter and the final sample is collected in a tub placed under one of the splitter outlets.

Samples for panning should be taken at 5-ft. intervals from the top of the hole down. These need not be put through the splitter, a portion from one bailerful being set aside for panning. These panning samples are for the purpose of keeping track of the different formations penetrated and minerals encountered as the drilling progresses. Panning is best done with a 12-in. white enameled vanning plaque. Formations and minerals encountered are entered on the "Daily Drill Report" by the sampler.

My experience has been that the copper minerals encountered are usually found in the following order, the first named being higher up in the formation: Chrysocolla, malachite, azurite, cuprite, native copper, chalcocite, chalcopyrite, and pyrite. Of course the occurrences of these minerals will overlap, but the order as set down is typical.

The transition from leached capping to chalcocite-bearing ground is usually abrupt, and the first indication of the chalcocite zone having been reached is the appearance on the top of the sludge in the bailer of a dull lead-gray scum composed of slimed chalcocite. An experienced driller will spot this scum as soon as he sees it.

When the chalcocite zone has been reached, the hole should be cased to insure reliability of samples. The depth of the hole should be measured so that accurate information as to the vertical position of the ore may be obtained. Samples should be taken at exact 5-ft. intervals, the hole being bailed clean after each sample. The sludge from the entire 5-ft. section is put through the splitter until the sample is of proper size to dry and send to the assay office. The dried sample should weigh approximately 75 lb. and fill an ordinary ore sack.

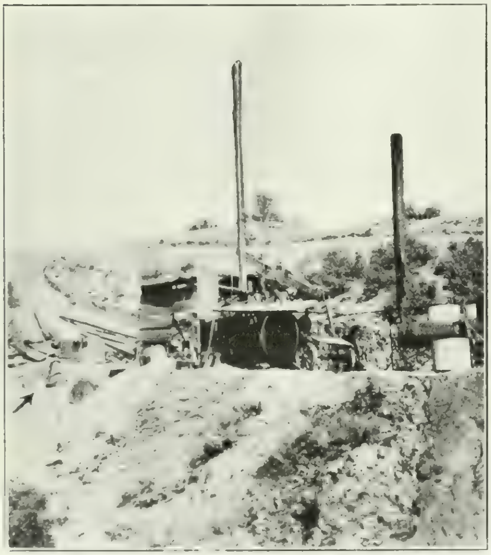
Make Wash Water a Part of Sample

The sludge launder and splitter should be washed thoroughly after each sample and the wash water and washings treated as a component part of the sample. The water should never be poured off of a sample, but should be evaporated.

In the early application of churn drilling to the development of disseminated copper deposits, samples were dried in tubs over a coal or wood fire. This was a dirty, expensive, tedious, and unsatisfactory process. The samples frequently got red hot on the bottom, and it was no uncommon thing to smell sulphur dioxide caused by the oxidation of the sulphides present. This tended to make the sample unreliable when tested for the purpose of determining the amount of copper present in sulphide form. Also, owing to the general nastiness of this method of drying samples, the sampler was prone to slight his work. This he would do by pouring most of the water and slime off of the samples, or he would make two or more samples out of one. That is, one or more wet samples would be thrown away, and the retained one dried and divided into two or more parts. There are a great many things that go on, on "grave-yard" shift, that are unknown to the man with the "gasket around his neck."

Recently some of the operators have been using a steam drying pan and drying the samples by means of live steam obtained from the boiler of the drill rig. This pan is circular, being about 3½ ft. in diameter and about 1 ft. deep, and is constructed of boiler iron. It has a double bottom, into which live steam is turned at full boiler pressure, the outflow of steam and rapidity of drying being regulated by means of a waste valve. The double bottom is kept from bulging by the use of stay bolts, as in boiler construction. All stay bolts and rivet heads on the inside of the pan are flush with its surface. This permits the easy cleaning of the pan by means of a scraper and wire brush. The steam drying pan is a most efficient means of drying samples and by its use, time, money, and worry are saved and the reliability of the sample is increased. After drying, it is sacked, tagged, and sent to the assay office.

The management should rigorously insist on accuracy and reliability of sampling. The drillers and drill foreman should thoroughly understand that the landscape is not being punched full of holes for mere pastime, but for the purpose of obtaining reliable samples from a certain horizon. This is something that is extremely hard to do, for the driller has learned to think in terms of "feet of hole," and it is hard for him to change his point of view. Sampling is no concern of his, for is he not employed to "dig holes"? The proper perspective is obtained when costs are thrown into terms of "cost per sample" instead of "cost per foot of hole."


PORTABLE DRILL, WITH HOUSING
Arrow at left indicates new type of steam drying pan

Take the following illustration as an example: Suppose the total cost of drilling a 1,000-ft. hole is $3,500 and the ore is 100 ft. in thickness. In 100 ft. there are twenty 5-ft. samples. The cost per foot of hole is $3.50, but the cost per sample is $175. Therefore, should not particular pains be taken to insure reliability of samples from a cost standpoint alone, to say nothing of the more important functions of the samples; *i.e.*, their bearing on the grade of the orebody.

On the 200-ft. square system, one hole controls 40,000 sq.ft. If the ore is 100 ft. thick, twenty samples control 320,000 tons of ore, and one sample controls 16,000 tons. A variation of 0.1 per cent *in one sample* with copper selling at 12½c. per lb. denotes a variation of $4,000 in the value of the orebody.

When the hole begins to show signs of caving, either a new string of casing should be put in, or the string above should be lowered, either by under-reaming or driving, so as to shut off the cave.

If there is water in the hole, as is usually the condition, before the bailer is run for samples water should be run into the hole so as to have the hydrostatic head inside the casing greater than that on the outside. This tends to prevent the water from washing material from around the casing into the hole. In fact, in many instances I have found it advantageous to keep water running into the hole at all times, for the water passing up around the casing tends to keep the rock particles from settling around the casing and freezing it in.

To Be Continued.

Sintering of Flotation Concentrates

In *Engineering and Mining Journal* of June 11 was described the plant of the Calaveras Copper Co., where flotation concentrates are sintered to prepare them for charging to blast furnace. The same practice is followed at the Mount Lyell plant, in Tasmania, and the practice is described in the *Proceedings* of the Australasian Institute of Mining and Metallurgy, No. 38.

A Dwight-Lloyd machine is used, of the following specifications:

Grate area, 300 x 30 in.
Grate speed, 15 in. per minute.
Vacuum in suction boxes, 12 in. of water.
Ignition, wood burned in standard ignition box.
Impeller, 5 ft. 6 in. diameter, 900 r.p.m.
Horsepower, 50.
Intake, 4 x 4 ft.
Outlet, 3 ft. 1 in. x 2 ft. 1 in.

The charge to the machine averages 60 per cent concentrates, 30 per cent blast furnace flue dust, and 10 per cent ore screenings, and contains 11 per cent moisture. The sulphur contents of the charge average 19 per cent, and the sinter, 6 per cent. The capacity is 50 to 55 tons of the mixture per twenty-four hours, the sulphides being in the form of chalcopyrite and pyrite chiefly.

A nodulizing kiln, fired with pulverized coal, has also been erected but not yet put into operation, on account of shortage in coal.

World's Largest Deposit of Rock Salt

In New York, Ohio, Michigan, Pennsylvania, West Virginia, and other states there are large salt deposits, but the largest deposit in the United States, and probably in the world, is that which extends from northern Kansas across the west end of Oklahoma, the panhandle of Texas, and southeastern New Mexico to western Texas. The area underlain by these great Permian salt deposits is not far from 100,000 square miles, according to the U. S. Geological Survey.

The limits of the deposit, especially to the northwest and southeast, have not been ascertained, but in general the area of thick salt extends fully 650 miles from northeast to southwest, and is 50 to 150 miles wide. The thickness and the succession of the beds are variable, but 700 ft. is reported in one hole, and in many places the aggregate is more than 300 ft. On the assumption of an average thickness of 200 ft. of salt, the gross quantity in the area of 100,000 square miles is so large, about 30,000 billion tons, that the present needs of the United States (about 7,000,000 tons a year) can be supplied for millions of years.

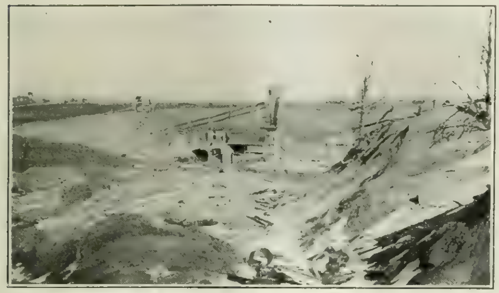
The Crahall Tailing Plant

Re-Treating 200,000 Tons of Tailings Assaying 1.75 Per Cent Zinc Necessitated Great Economy of Construction and Operation —Recovery by Drag Bucket, and Concentration Solely in Jigs

By W. F. Boericke

Written for *Engineering and Mining Journal*

DURING 1920 a number of attempts were made to remill the tailing piles in the New Diggings area of the Wisconsin zinc field. Labor for the mines was scarce and inefficient, and some of the operators, instead of trying to mine, held their organizations together by running on tailings alone. In some cases the original mills were utilized by making small changes in the flow sheet; in others a cheaply constructed, temporary plant was built adjacent to the tailing pile. Of such a type was the mill erected to treat the tailing pile of the old Crahall mine, estimated to contain over 200,000 tons.



GENERAL VIEW OF THE MILL

The material to be milled, hereafter to be called the heads, consisted of mill chats (tailings), which had been lying undisturbed for seven years, and were now in an extremely compact, almost cemented formation. The loose, spongy character of many of the Joplin tailing piles was entirely lacking, owing to the fact that in the original milling work no attempt had ever been made to deslime the tailings, and the included fines therefore made a compact mass that would stand almost perpendicularly without caving when cut.

Before construction was undertaken, the pile was sampled at various points on the surface by means of shallow test pits. Although this sampling was superficial, it was assumed from a knowledge of the mine's production and history that such samples would give a fair indication of the interior of the pile, and this conclusion was justified by subsequent work. An effort was made, of course, to avoid sampling at any point of obvious concentration that was due to weathering.

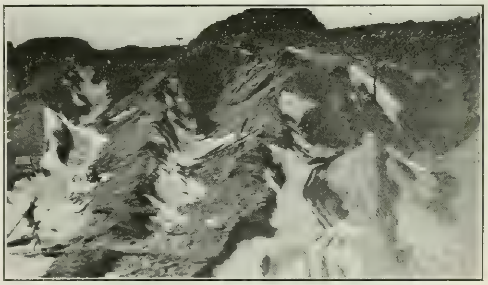
SCREEN ANALYSES OF THE HEADS

	Weight, Per Cent	Cumulative Weight, Per Cent	Zn Content, Per Cent
On 4 mesh	28.0	28.0	0.4
On 8 mesh	28.0	56.0	1@2
On 16 mesh	16.0	72.0	1@2
On 28 mesh	9.5	81.5	2@3
On 48 mesh	12.5	94.0	3@4
On 65 mesh	2.0	96.0	3@4
Through 65 mesh	4.0	100.0	3@4

Assays of general samples varied between 1.3 and 2.0 per cent Zn. The minus-4-mesh material, comprising 72 per cent by weight of the heads, assayed 2.1 per cent Zn. This suggested that an improvement could be made by screening out the oversize, which carried negligible values. Careful examination of the zinc in the undersize showed that only a small proportion was combined with gangue. This indicated that regrinding would not be necessary, and the ore was practically free-milling.

As the mill was to be short-lived, and as its entire cost had to be amortized during the life of the pile, which was estimated at three years, there was no need for elaborate construction. A plank jig, constructed of 2 x 12-in. timbers laid edgewise between frames of 4 x 6's, properly bound together with tierods and buckstays, offered a substantial saving in lumber, and promised to be as permanent as needed. It could be put together without skilled labor or supervision, and the actual erection took only six weeks. This included the building of all elevators, and placing of pulleys and line shafting. The general layout is shown in Fig. 1.

With practically all of the values in the less-than-1-mm. size, it was evident that to make a separation by simple jigging would not be easy, and it was realized that there would be a considerable loss in the slimes which could not be saved except on tables or by flotation. Except for the fact that the zinc was practically all free, it would have been impossible to go ahead without a prohibitive cost in more elaborate equipment, which was not justified.



CLOSE-UP VIEW OF THE CUTS

As the original concentrates from the Crahall averaged between 45 and 50 per cent zinc, it was anticipated that the concentrates from the tailings would run about the same, but considerably higher in lime. As there was a penalty on every per cent of lime above 3, it was decided to build two jigs—a rougher to make a low-grade concentrate, which should run about 15 per cent Zn, and a small cleaner to make the finished product. In this way a heavy suction stroke could be used on the rougher to pull the very fine particles of zinc, and the lime that would come down with it could be removed on the cleaner.

Fig. 1 shows the plant layout, and the flow sheet is given in Fig. 2. The rougher consisted of six 30 x 40-in. cells, and the cleaner of four 24 x 34-in. cells. Settling boxes, the same size as the cells, were provided at each end of the jigs to dewater the tailings. Most of the water was saved and run into settling tanks outside the mill, and thence to the pond.

Possibly the most interesting point in the design was driving the cleaner jig and elevators direct from the jig shaft on the rougher, without using the customary lineshaft to the motor. This was made possible by mounting a 6-ft. pulley on the end of the rougher jig shaft, and using an outside bearing support, so obtaining the proper reduction in speed. This arrangement eliminated a lot of construction work and extra belts, and proved satisfactory.

The most serious trouble found in the construction after six months' operation was in the "panting" of the rougher jig. Extra timbers bolted across the ends, and extra tierods, eliminated this particular trouble.

With the heavy unclassified feed to the rougher it was found after some experimenting that a speed of 145 r.p.m. gave the best results. A long stroke was needed to loosen up the beds, accompanied by a large quantity of back water. Most of the work of the jig had to be done in the first three cells, before the rush of the top water over the tailings toward the end of the jig had so accelerated the material that it became difficult to make any separation. The taps on all cells were left open slightly, so there was a constant stream of concentrate being drawn off as a feed for the cleaner.

Six-inch beds were used on the rougher, with a bottom layer of coarse concentrates. The drop between the cells was two inches. Not enough coarse concentrates were accumulated during the shift to justify a gate and dam draw-off, but at intervals the beds were lightened by shoveling off with a short-handled shovel. When to do this depended on the millman's judgment.

With the heavy feed, large amount of water, and unclassified product, a considerable loss in fines was bound to occur. In attempting to obviate this the hutch of the last cell was drawn freely, and the bed carried very thin. The limy middling product from this cell was returned to the feed elevator to go through the cycle again.

Little trouble was experienced with the cleaner jig, and it did consistently good work. The jig was run at 155 r.p.m. with a very light stroke, much back water, and as little top water as possible, so as to almost neutralize the suction, and make a pulsion jig out of it. The cleaner had the advantage of running on a much more closely sized product than the rougher, and in the first two cells made very clean concentrates, assaying less than 2.5 per cent CaO. The last two cells were run with a heavier stroke and less back water, to catch the last particles of zinc, though they included fine lime and middlings.

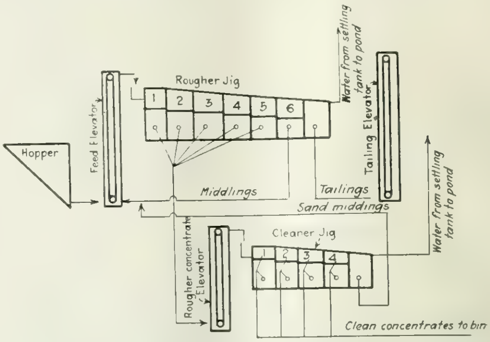

Rougher Jig
1
2
3
4
5
6
Water from settling tank to pond
Tailing Elevator
Hopper
Feed Elevator
Middlings
Tailings
Sand middlings
Cleaner Jig
1
2
3
4
Water from settling tank to pond
Rougher concentrate Elevator
Clean concentrates to bin

FIG. 2. FLOW SHEET OF THE CRAHALL PLANT

The speed of the cleaner, 155 r.p.m., may seem too low in comparison with the speed of sand jigs generally, which average around 200. A higher speed was tried, but apparently did not work out as well as the other, and this was the experience of other operators.

The mill was run on two twelve-hour shifts, to take advantage of the short season, as it was impossible to operate in winter, on account of the tailings being frozen. The actual running time, however, did not exceed seventeen or eighteen hours on the average With so light a construction, it was inevitable that time would be lost. The low grade of the heads, yielding only 2.0 per cent of their weight in concentrates, made the margin of profit very narrow. Only competent millmen were employed, and it was a constant struggle with them to get the beds right, so as to make the best recovery. With the zinc all in the fines, if too heavy a suction were used on the rougher, the beds would mat and the screens bind, ruining the work. If not enough suction, all the fine zinc would be carried off in the tailings. If the feed came too fast, the jig became sluggish and simply served as a launder; and if the feed slowed up there was no recovery. A sudden rush of

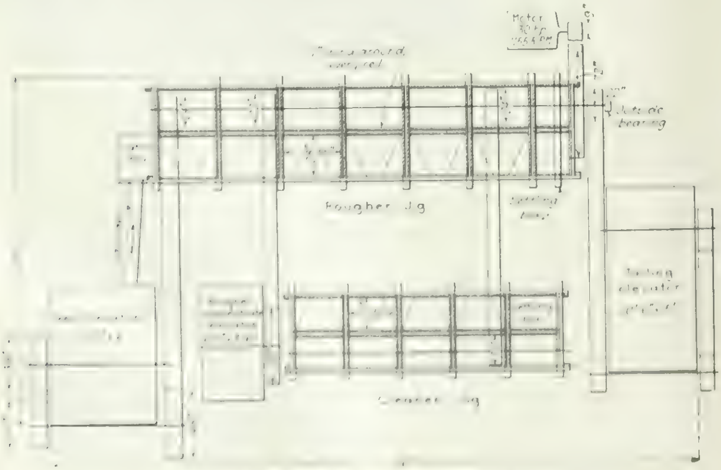


FIG. 1. LAYOUT OF CRAHALL TAILINGS MILL

tailings was likely to bury the tailing elevator and cause an hour's shutdown while the boot was dug out.

No exact figures on the tonnage actually handled per day are available, but 225 tons is not far off, which is at the rate of fourteen tons per hour. The crew consisted of two men, the millman and the hoistman, who operated the drag and in case of trouble acted as mill backer. A third man was often needed for repairing, shooting tailings, and other general work.

Power was furnished by a 30-hp. induction motor. Separate motors were used for the hoist, booster, and pumps. Of the 30 hp. needed for the mill, a large proportion went into the tailing elevator, which was 50 ft. high.

The mill recovery is worth noting as showing what can be done with jigs on a low-grade feed, with all of the zinc in the fines. A screen analysis of the concentrates shows:

	Opening, Mm.	Per Cent	Cumulative, Per Cent
On 10 mesh	1.65	25.8	25.8
On 20 mesh	0.83	23.3	49.1
On 48 mesh	0.29	35.0	84.1
On 65 mesh	0.21	7.5	91.6
On 100 mesh	0.15	5.0	96.6
Through 100 mesh	.	3.4	100.0

In other words, of the total zinc recovered about 60 per cent was in the minus-1-mm. sizes, which should normally go to a table. The average heads ran 1.75 per cent Zn, and the tailings 0.6 per cent Zn. Of the tailings, the plus-10 mesh, comprising 32 per cent by weight, assayed 0.4 per cent Zn, and the minus-10 mesh, 68 per cent by weight, 0.95 per cent Zn. The slimes, lost in the settling tanks, ran 8 per cent Zn. All of this latter material was less than 40 mesh.

The recovery may be calculated as follows, the weights being approximate:

Tons milled per day	220
Assay heads, per cent Zn	1.75
Zinc in heads, per day, tons	3.85
Concentrates recovered, tons	4.5
Grade of concentrates, per cent Zn	48
Zinc in concentrates, tons	2.16
Recovery, per cent	56

This compares with the normal mill recovery in Wisconsin of 65 per cent when running on 6 to 7 per cent mill feed. Undoubtedly the recovery could have been much improved had tables been installed to treat the fines that were simply lost, but as an extra man would have been needed, and the added installation expense would have been considerable, the net saving is questionable.

Jigs Not Efficient on Minus-20-Mesh Feed

Screen tests of concentrates made at a number of mills in the district which were running on 6 per cent ore and crushing through ⅜ in. showed that 75 to 80 per cent of the concentrates were coarser than 20 mesh. As the recovery in this case was 65 to 70 per cent, the conclusion follows that jigs are more efficient on sizes coarser than 20 mesh than on finer sizes, but they can, at a pinch, make a fair saving on fine material when no better means are at hand.

Fully as important as the milling was the problem of getting the heads to the mill at low cost. Any system of shoveling in cars, or using horse and scrapers, was dismissed at the start as being too expensive, even if an adequate tonnage could be obtained in the hot summer months with labor scarce and inefficient. As alternatives, there was the choice of sluicing in the heads to the mill with water, or using a hoist and drag system. Both of these were tried. At the outset, as the mill was close to the base of the pile, sluicing was attempted. The boot of the feed elevator was sunk 10 ft. below the ground level, and a sluiceway was dug up to the tailing pile, with a pitch of three inches to the foot. Water was run up to the pile, and the tailings were washed down by undercutting. It was found that nozzles on the hose were of little benefit; volume of water was needed, not head. The practical difficulty lay in adjusting the right amount of water. If too little were used, the tailings would not run, but would choke up in the launders and overflow. If too much water, then the elevators would choke, and the jigs would have so much top water that the fine ore would be carried away.

It was soon seen that the natural slope of the ground would not suffice to carry the tailings to the mill, even though the slope were theoretically steep enough to carry the material. Consequently, ditches were dug in the soil, and launders, with cast-iron half-moon troughing, were put in. The slope necessary was 2½ in. to the foot. It was hoped that the included slimes in the heads would make the material flow on an easier grade, but it would not. About 400 to 500 gal. of water per minute was needed.

As the distance from the pile increased, there was more trouble. The grade rose so sharply that it was impossible to keep the launders on the bottom, and once they were set on the tailing pile, the whole area acted as a big concentrating table. The heavier particles would settle, and only the lighter ones get into the launders. This meant following the ore down with the hose, or "taking up bottom," and created much trouble on the jigs, as the feed would vary so much from hour to hour that it was difficult to keep the beds. With a longer distance to sluice, moreover, it became increasingly difficult to maintain a steady feed to the jigs. The scheme was finally abandoned.

Advantages and Disadvantages of Sluicing

Sluicing has of course many obvious advantages. It is foolproof, and requires no expensive installation that must be amortized from the profits of a short operation. Water is needed for the mill anyway, and it requires very little more power to introduce it by sluicing. Unskilled labor can handle the job—a boy is quite as handy as a man. Where the necessary grade can be obtained with plenty of water, it is by all odds the cheapest way of moving tailings. An excess of water could be removed from the tailings by dewatering from the catchbox. But where plenty of grade or sufficient water is lacking, the scheme leads to trouble, and will slow up the milling by giving irregular feed and too great a variation in the values.

The hoist and drag system consists of a double-drum hoist on a movable platform, which can be shifted for about thirty degrees of arc, so as to pull from more than one angle. A cable is passed from one drum to the drag, or scraper, thence around a sheave set out on the pile, about 300 ft. distant, and then back to the other drum. A 35-hp. induction motor, geared to a countershaft, furnishes power. Friction clutches are on both drums, so the motor runs continuously, and the hoist is reversed by operating the clutches. The hoist had a speed of 228 ft. per minute. Cable ⅝ in. in diameter was used. Double drums are necessary to take care of the slack line.

The drag consists of a 5-ft. bottomless scraper, with slightly flared sides, and a notched back to cut into and break down the tailings. It should be strongly built, for it has to stand rough usage. In this case it was built of ⅜-in. iron, reinforced by ⅝-in. straps, and could have been advantageously built of stronger material. Its capacity was estimated at 1,000 lb., or nearly ½ cu.yd. of tailings.

APPARATUS REMOVES LARGE AMOUNTS OF MATERIAL PER SHIFT

A bin, or hopper, is constructed about 16 ft. square, and 10 ft. deep. Across the top a grizzly is built of old rail, with the ends bent down, so the drag may ride over them. As these rails must be moved parallel to the line of pull when a new cut is made, they should not be fastened permanently to the caps. With this apparatus and an experienced hoistman, a great amount of material can be moved in a shift, from a maximum distance of 250 ft. The illustration shows the condition of the tailing pile after three months' operation with the drag.

The amount that can be pulled in by the drag will vary directly with the distance of the cut from the hoist, assuming that the dragway is in good condition and a full load can be taken from all points. A maximum of 300 trips in ten hours is theoretically possible from 250 ft., at a speed of 250 ft., and if the distance is halved, the number of trips is doubled. There is no time lost in dumping the load, as the drag is pulled clear up on the grizzly, the tailings are dropped through, and the hoist is immediately reversed.

During September, in twenty-six working days, a total of 11,461 loads were pulled, at the average of 220 tons per day. The maximum pulled in any one shift was 406 loads. The average distance from hoist to cut was 200 ft. The cost of dragging may be figured without allowance for repairs or depreciation as:

Labor, two hoistmen, @ $6	$12.00
Power, 600 kw.-hr. @ 3c.	18.00
Total	$30.00

Tons pulled 220
Cost per ton 13.6c.

With a shorter haul and consequently greater tonnage, this could be cut to less than 8c. per ton. It will be noted that power is figured at a high rate.

METHOD OF REMOVING THE CEMENTED MATERIAL

Mention has already been made that the Wisconsin tailing piles are cemented together, owing to the sands and slimes not having been screened out, as in Joplin. This results in giving the piles a compactness that takes considerable power to break down. The problem is not one like moving a sand bank. For this reason the back of the drag is notched, to grip and tear down the walls of the tailings, and a bottom is not wanted. Frequently the walls of the cut will be almost perpendicular for 20 or 30 ft. In such a case the walls must be shot down with powder. Holes are bored with an auger, and a light charge of 40 per cent dynamite is inserted. Some experimenting was done with a lower grade powder, but it did not seem to work as well.

Instead of shooting down the walls, a snatchblock can be used on the cable between the sheave and the drag. It is anchored at right angles to the line of pull, and by varying the distance the drag can be made to take new cuts off one side or the other. When the cut is so wide that the angle between the two cables is appreciable, and friction and power largely increased, the sheave must be taken up and moved up to a new location and a new cut started. This takes time, as the sheave must be anchored firmly. If the new location makes a considerable angle with the old, the rails on the hopper must be taken up and relaid.

Despite every effort to place the cuts to good advantage, it will be impossible to clean up the ground completely. Ridges will be left between the cuts, and though the size and height of these may be reduced by shooting down and swinging the drag with a snatchblock, a considerable proportion will be left. A close-up of the cuts, with the ridges between, is shown in the illustration. It does not pay to come back after these. In the first place, the tonnage remaining will not warrant much expense; in the second, there would be much difficulty in starting a cut on a narrow ridge, as the drag will slide off on either side and spill the load.

USE OF DRAG NECESSITATES SHOOTING OUT STUMPS AND BOULDERS

Among the practical difficulties found in operating a drag, the most grief comes from meeting obstacles in the tailing pile that are covered up. Where the original tailings were run on the side of a hill or stacked with an elevator, trees, stumps, and other objects or materials are frequently covered up, and only discovered later as the cut is made. These must be shot out or cut out, either process being a mean job, which delays the work. Boulders are another nuisance —if met unexpectedly they may break a cable or badly damage the drag before the hoist can be stopped. Among other things to try the heart of the hoistman is the danger of caves when the cut is deep and the walls are high. It frequently happens that a rush of tailings will bury the drag completely and necessitate a lot of work to dig it out.

With all its disadvantages, however, the drag when properly operated under the right conditions has much to recommend it. It is a simple, positive method of getting material to the mill. Barring accidents, there is nothing to get out of order, and repairs can usually be made right on the spot. It is not affected by weather conditions. Its capacity is entirely adequate for a small mill. Finally, in case of a mill shutdown it can be operated without stop until the hopper is full, thus giving the mill a reserve capacity—a feature impossible with sluicing. The salvage value of the outfit is considerable.

OPERATING COSTS OF MILL AND HOIST PER 24-HOUR DAY

	Amount	Per Ton Tailings
Dragging tailings to mill		
Labor, two hoistmen @ $6	$12.00	
Power	18.00	
Total	$30.00	13.6c.
Milling		
Labor, two millmen @ $6	$12.00	
One helper @ $5	5.00	
Power	19.00	
Total	$36.00	16.3c.
Superintendence	5.00	2.3c.
Total	$71.00	32.2c.

With a milling ratio of 1:50 the cost of concentrates was $16.10 per ton. To this figure should be added repairs and amortization of plant. It is obvious that with the zinc market prevailing at the end of 1920 it was impossible to operate except at a loss, but under normal prices and advantageous operating conditions there is a fair margin of profit.

BY THE WAY

A Lead Devil

The Old Boy was doubtless the patron saint of smeltermen in a more superstitious, less intelligent age. This probably accounts for the half-aspirated prayers that even now fall upon and shock the pious ear occasionally when something about the charge goes wrong. Ofttimes a smelter veritably looks at night like hell, so much so that Dante would feel in familiar surroundings. One is not startled then, even on Friday the thirteenth, when he comes across a bit of metal, grotesquely shaped, like that shown in the accompanying illustration. This "devil" was accidentally formed when a sample of lead was poured on an iron plate. The figure is about 8 in. high and a quarter-inch thick and will do very well as an idol for the profane at the plant in Newark where it had its origin.

THE LEAD DEVIL

The Green Goddess

Mining engineers must not fail to see "The Green Goddess" the next time they come to New York. First register at the Institute and pay those dues, incidentally; then ho! for the nearest taxi and the verdure-hued divinity. We hope this notice will do some good, because the producer has offered us two tickets for the publicity and we want him to get his money's worth. Mr. Winthrop Ames also sent a little blurb about the leading man, but of course we can't run anything of the sort in our editorial pages. It pains us even to think of it. We are trying very hard to be ethical nowadays.

Opportunity Knocks

Only the present business depression and the general all-around rottenness of the market prevent us from getting in touch with the writer of the following letter, which is translated from the French. It was received in the Paris office of a large American machinery house:

> I have just learned that you do core drill prospecting in all countries of the world, and inasmuch as I also am engaged in searching for mines, I address you with the sole aim of communicating to you my proposition.
>
> I possess a silver-lead mine on which work has ceased due to lack of capital necessary to arrive at the exploitation stage. The preliminary work has given good results. An analysis has shown 45 to 50 per cent lead, 25 to 27 per cent silver, and 10 per cent copper.
>
> For this mine, I am willing to associate myself with your company or I will sell the mine with the provision that I direct the mine works and for a royalty per ton. If necessary, I am willing to cede my rights to all my other mining properties according to the terms of the contract concluded between your company and myself. And I shall provide you with all useful information to put the mine into operation from the point of view of exploitation. A capital of 100,000 fr. is needed. The mine is well situated. The entries pass under the right of way of the Paris-Lyon-Mediterannée railway and under a road only three kilometers distant from a railway station. The veins are heavy, varying from one to three meters thick for an established distance of several kilometers.
>
> I have also discovered in the same district other deposits such as coal, silver-lead, gold-bearing quartz interlaid with antimony. The vein is 1m.80 wide and has been traced for 400 meters. You will please advise me if these affairs interest you.
>
> I am very loyal in business. In fact, I believe that enterprises of this sort can succeed and conserve for a long time their success only if they rest on a condition of honesty and absolute frankness.
>
> In consequence, I give you the best guarantee that my teaching is as I have outlined, the most precious for you. You certainly are convinced that I would not promise this were I not absolutely sure that my prospects are such as I have described them to you.

After all is said and done, human nature *is* the same all the world over.

Goin' h'On Shif'

By D. E. A. Charlton

W'en thee wakes tha sun is streamin' in tha winnow, an' tha gleamin'
O' tha dewdrops as they glisten in tha grass
Makes tha worl' look snug an' fitty, an' thee naws that it's a pity
If thee lies there 'stead o' startin' in thy task.

So thee jumps h'up in a 'urry, puts tha clothes h'on in a flurry,
An' gaws daown to 'ave some 'am an' h'eggs an' tea.
There's tha missus, neat an' tidy, with a laugh she stops to chide 'ee
For she's wish'd for fear that late to work thee'd be.

Then thee finishes tha h'eatin', sez good-bye, an' starts a-meetin'
O' tha chaps 'oo's travelin' long tha road with thee.
"Moornin' Jan, an' Bill, an' 'Arry. 'Ow's gettin' on." They carry
H'each 'is bucket full o' pasty an' o' tea.

There's a good-sized crowd a-waitin,' 'oo is askin' for a ratin'
An' 'oo's 'opin' that they'll lan' some kin' o' job,
W'ile tha chaps 'oo's workin' steady, in tha dry-'ouse gettin' ready,
Is discussin' differen' ways o' cavin' gob.

'Fore tha w'istle starts a-blawin', mos' tha boys is dressed an' jawin'
An' a-walkin' with tha shifters to the shaf',
There we lines h'up on tha cages, an' gaws daown by easy stages—
But that day's work, son, is not commenced by 'alf.

W'en we reach tha bloody station, there's tha nipper jus' a-pacin',
An' a-passin' h'out the newly sharpened steel.
Then h'each contrac' starts a-makin' for their place, an' soon a shakin'
O' tha drills is 'eard—an' work is h'on, you feel.

CONSULTATION

The Metallurgy of Tungsten

"Will you kindly tell me whether tungsten is used very much in the metallic state and for what purposes? I would also like to know briefly how tungsten is reduced to the metallic form from its ores?"

Tungsten metal is used in the well-known tungsten lamp filaments, for targets and cathodes in X-ray tubes, for electric contacts for the make and break of magnetos, and for induction coils. Its greatest application, however, is as an alloy in the manufacture of high-speed steel and machine parts. The insistent demand for tungsten in ferro-alloy manufacture during the war led to extraordinary increases in price and greatly stimulated tungsten production in the United States. At present, owing to the quietness of the ferro-alloy industry and the low prices of foreign ores, tungsten mining in the United States is dormant.

Tungsten metal is usually obtained from wolframite (FeMn) WO_4, by thoroughly mixing the mineral, after it has been ground in a ball mill, with sodium carbonate (a small amount of sodium nitrate may be used), care being taken that the soda is in excess of the WO_3 content of the ore. This mixture is roasted in a gas-fired reverberatory furnace at a temperature of about 800 deg. C., the consequence of this operation being the formation of a pasty mass, sodium tungstate, covering the bottom of the furnace. This sodium tungstate is raked out while hot, and after cooling is finely crushed.

The next step in the process is to get the sodium tungstate in solution by agitating it in a vat with hot water and filtering the solution. The clear liquid is then heated to a boiling temperature and calcium tungstate precipitated by treating it with calcium chloride, $CaCl_2$. Washing the white precipitate and boiling with hydrochloric acid yields tungstic acid, H_2WO_4, a yellow precipitate. Although usually of high purity at this stage of the process, it is brought to a higher degree by boiling with a solution of ammonium hydroxide, to give, after filtration, a clear solution of ammonium-paratungstate. This solution is evaporated, and the residue treated with nitric acid to form the yellow tungstic acid. Repetition of this refining step may be necessary to obtain a sufficiently pure product.

The next stage is to fire the tungstic acid in silica crucibles at about 1,000 deg. C., driving off the water. Impurities remaining in the product may be iron, aluminum, and calcium oxides. The WO_3, oxide of tungsten, remaining after this operation, is reduced in a closed furnace, heated to about 1,200 deg. C., through which a continuous flow of pure hydrogen is passed. The process leaves pure tungsten in the form of a dark gray, finely crystalline powder, stable under normal conditions. This is removed from the furnace after about [illegible] hours' treatment and pressed in special disks under hydraulic pressure. The metal crystals adhere together to form a bar. The pressed bar is then heated in a special furnace supplied with an atmosphere of hydrogen, to prevent metal oxidation, to about 3,000 deg. C., giving a heavy, silvery metal, hard and brittle. R. M. Keeney has estimated that probably half the consumption of tungsten in alloy steel is used in the form of ferrotungsten, the remainder being tungsten metal. The U. S. Geological Survey states that the ratio has changed, and that now about three-fourths of the tungsten used is introduced into steel as ferrotungsten, because of the purer form in which ferrotungsten is manufactured and because, for a time, the powder could not be obtained.

Ferrotungsten is generally made in an electric furnace and has a high density and fine gray fracture, and is not crystalline. The metallurgy is simple, including the reduction of the ore with carbon as a reducing agent and a subsequent refining and decarburization, details of which can be found in a paper in Vol. LXII of the *Transactions* of the American Institute of Mining and Metallurgical Engineers, "Manufacture of Ferro-alloys in the Electric Furnace," by R. M. Keeney. It is described as being a ferro-alloy easy to manufacture, except for the fact that it must be made in a knock-down furnace. At one time tungsten ores were put in the charge and the tungsten was alloyed directly with the steel, the original method of manufacturing tungsten steels, but because impurities were introduced into the finished product by this arrangement, the method was not continued.

No definite schedule of specifications for tungsten ore seems to exist, transactions being consummated according to the different requirements of individuals. During the war all grades of tungsten ore were used, and although the demand was first for ores of high concentration and purity, it gradually gave way to the use of low-grade and impure material. One firm is reported by the U. S. Geological Survey to have been organized specifically for the purpose of purchasing ores carrying less than 60 per cent WO_3 and ores containing sulphur, copper, arsenic, bismuth, tin, antimony, phosphorus or other impurities, to which most users objected. Another company was organized to handle tailings carrying as little as 1 per cent WO_3.

The prices of tungsten concentrates are so low that the entire tungsten industry in the United States is at a standstill. Because of the high cost of mining domestic deposits, compared with the cheap foreign mining, the industry can thrive only under stress of war and an exceptionally high tariff. Consumption prior to the war in the United States was between 3,000 and 4,000 tons annually of concentrates carrying 60 per cent of WO_3. During the war it jumped to 10,525 tons (1918), and during 1921 it will be very low, because of the general industrial inactivity and slack demand for most metal products.

For further details the reader is referred to Bulletin No. 12 of the South Dakota School of Mines, "The Occurrence, Chemistry, Metallurgy and Uses of Tungsten," by Runner and Hartman, the March-April, 1921, issue of *The South African Journal of Industries*, containing an article "The Manufacture and Uses of Tungsten," by W. E. John, and the annual publications on tungsten in the volume *Mineral Resources*, of the U. S. Geological Survey.

HANDY KNOWLEDGE

Trimming a Steel Smokestack

By H. H. HUNNER

Written for *Engineering and Mining Journal*

A heavy windstorm developed a breach in a 48-in. x 100-ft. steel stack 70 ft. from the base. As the boiler plant was no longer to be used except for steam heating, it was decided to cut the stack off at the break. The stack was fitted with a stationary ladder of ¼ x 2-in. strap, which was all that had saved the top 30 ft. from tearing off.

As two buildings stood close to the base of the stack, and as men were daily employed in them, the first quiet day was decided upon as an opportune occasion on which to do the work. A U-hook of ⅝-in. round iron, with an eye for 1-in. rope at one end, was dropped over the top of the stack. The lower end of the rope was strung through a snatch block at the base of a tree and tied to a locomotive.

Three strands, about 40 ft., of wrapped cordeau were slipped around the stack just above the horizontal joint at the 70-ft. break, the last strand having previously been threaded through 1-in. powder about every 2 ft. and the cartridge tied to the wrapped cordeau. A half stick of 1¼-in. powder was tied on each side of the ladder and connected with the other explosives. A battery was used to fire the shot. The locomotive engineer was signaled to open the throttle wide and the shot was fired a second or two later. Five sections of the stack landed about 30 ft. from the base of the stack.

The section just above the shot stayed hanging at the intersection of the horizontal and vertical joints. The hook was fastened to this and the rope put under tension. Two sticks of powder finished the job and left the stack in condition for future use.

Power Required in Gold Dredging

Written for *Engineering and Mining Journal*

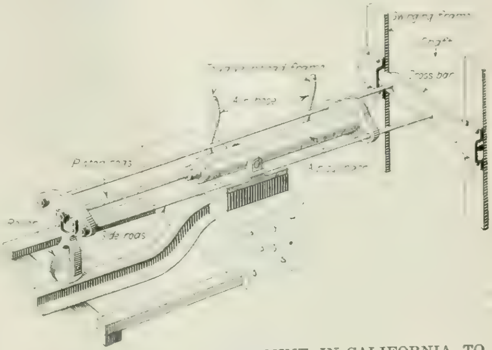
In the dredging of over 43,000,000 cu.yd. of gold-bearing gravel in 1920 in California, the consumption of power was slightly in excess of 63,000,000 kw.-hr. The average power required for dredging operations was 1.465 kw.-hr. per cu.yd. In one large operation, power averaged 1.36 kw.-hr. and in another of similar magnitude, 1.54 kw.-hr. These figures are for large dredges operating under favorable conditions.

Changing Skips at the Plymouth Mine

Written for *Engineering and Mining Journal*

At the working shaft of the Plymouth Consolidated Gold Mines, Ltd., at Plymouth, Cal., ore skips, man cages, and timber skips are in use. To change from one to the other with a minimum of time a convenient method has been devised. Back of each hoisting compartment a light steel frame, suspended from a transverse shaft at its upper end, is placed. On the lower part of the frame are four small wheels, as shown in the accompanying illustration.

The lower cross bar of the frame is attached to two rods which at their other extremities are attached to a crosshead. The crosshead is attached to a piston rod and piston operated by an air cylinder. The air cylinder is suspended on trunnions, and part of the weight of the side bars is carried by a small wheel attached to the crosshead. The wheel travels upon a short length of track supported by cross pieces. The arrangement is shown by the sketch. The stroke of the cylinder is approximately five feet and it is operated by compressed air. The valve for its operation is on the platform upon which the operator who changes the skips stands. The cylinder and its accompanying gear are beneath the ore pocket and away from the shaft.



DEVICE USED AT PLYMOUTH MINE, IN CALIFORNIA, TO FACILITATE CHANGING SKIPS

SWINGING FRAMES, INDICATED IN ACCOMPANYING SKETCH, IN PLACE IN HOISTING COMPARTMENTS

When it is desired to change a skip, the hinged sections of the guides are swung out of their regular position, the skip is hoisted to the change position, and a chain attached to a chain block hooked into an eye at the top of the skip. The chain block is tightened up, picking up the weight of the skip. The skip is then pushed out of the compartment, the hoisting rope slackened, and the hoisting-rope pin disconnected, thereby releasing the skip.

The chain block is attached to a crab, which is supported on an overhead track, and the skip is moved along this track out of the way, and the cage shoved into position, the hoisting cable attached and the chain block eased up, the air cylinder and frame allowing the cage to be moved over the compartment without shock or swing. The chain block hook is then disconnected, the cage is lowered, and the guides are swung and locked in their proper position. The whole operation requires less than five minutes.

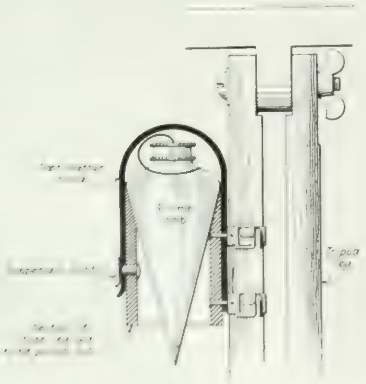
The track supporting the skips and cages extends across in front of the shaft compartments and closes on itself at a point close to the inclined members of the steel headframe. It is at a height to give sufficient clearance in handling the skips. Each skip and cage is provided with separate chain blocks. The device was made in the mine shops.

The Plumb Bob Pocket

By S. H. Hamilton

Written for *Engineering and Mining Journal*

"Do not begin the day's work by leaving the plumb bob behind," says Prof. Tracy. "And do not put it in the transit box," says Experience. "Don't carry it in your pocket," says Friend Wife. So here is a suggestion as to how it may be carried:



POCKET ON TRIPOD LEG FOR PLUMB BOB

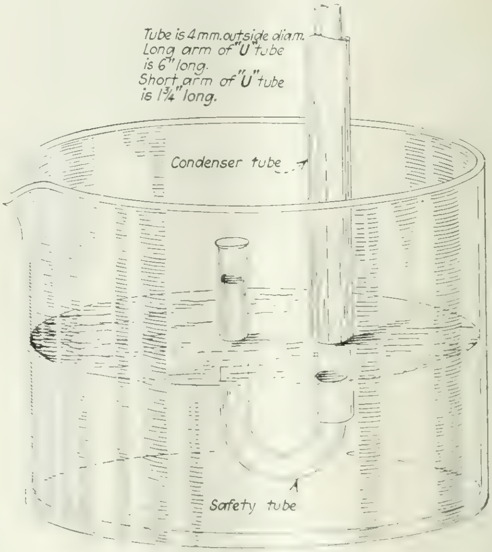
Take a short length of tough but flexible hose (a salesman's sample would be just the thing). Ream out the inside of the hose at one end so that it will receive the plumb bob. A triangular piece of glass from a broken bottle will serve as a taper reamer. A solid ring of uncut hose should be left at the bottom to prevent the bob from slipping through. Fashion a hood or cover for the bob from an old leather upper and attach both to the tripod leg, as shown in the accompanying sketch.

Safety Attachment to Arsenic Condenser

By Herman Schwerin

Written for *Engineering and Mining Journal*

The following notes and sketch describe a device that I have used in my laboratory for several months in connection with an arsenic condenser and which I have found useful in preventing the solution from sucking back into the flask owing to condensation. The device consists of a bent U-tube with one limb about 6 in. long and the other 1¾ in. made of tubing of 4 mm. external diameter. The long limb goes up into the condenser tube. The short limb stands about half an inch above the solution in the beaker. The U-tube is filled with water. If condensation occurs in the flask before the distillation is finished, the water will be sucked back out of the U-tube and then enough air to take care of the condensation will also be sucked through the U-tube. In this way all the distillate is left in the beaker. If the distillation was not complete, the U-tube should be sealed again with a small quantity of water from the wash bottle.


Tube is 4 mm. outside diam.
Long arm of "U" tube is 6" long.
Short arm of "U" tube is 1¾" long.
Condenser tube
Safety tube

U-TUBE USED IN ARSENIC CONDENSER TO PREVENT SOLUTION FROM BEING SUCKED BACK

Cleaning Linen Tracings

By C. Nye

Written for *Engineering and Mining Journal*

Linen tracings can be thoroughly cleaned with gasoline. A clean wad of cheesecloth or linen is soaked in gasoline, the excess is squeezed out and the surface of the tracing is then carefully wiped with it. It is best to have a clean sheet of paper underneath the tracing when doing this. This method removes all dirt and pencil marks and leaves the ink lines and tracing linen clean and not injured in any way. Better blueprints can be obtained. Of course, the gasoline used should be kept free from dirt. [The gasoline should be free from water also.—EDITOR.]

THE PETROLEUM INDUSTRY

Peruvian Oil Fields

BY VERNON F. MARSTERS

Written for *Engineering and Mining Journal*

MORE THAN A CENTURY AGO petroleum in the form of *"la brea"* was known to exist in northern Peru, and formed the basis of a small industry. Its occurrence in the interior from Negritos was known to the Spanish invaders, and it was actually "mined" by them, the product being used for painting ship bottoms. As a national trait of the Spanish people, they were much more interested in the early days in a vigorous search for the precious metals than anything else in Peru. The occurrence of *la brea* interested only the sea-going group, so the little oil deposits, as they oozed from the desert sands near the south end of Cerro de Amotape, were soon forgotten.

In the early 60's activity in the search for petroleum began, and in the early 70's actual drilling was started in the Province of Tumbes. Even at this early date American, English, and French prospectors were scouting the Province of Tumbes and the Department of Piura. English and French prospectors failed in their attempts to find oil in Quwbrada Heath, southwest from Tumbes. An American who had started actual drilling in the region of Zorritos (Province of Tumbes) obtained some appreciable production and later entered into partnership with the well-known business man of Callao, Sr. Faustino Piaggio. This gentleman is now the sole owner of the Zorritos field.

DEVELOPMENT OF IMPORTANCE BEGUN IN EARLY 90'S

Serious development began in the Negritos field in the early 90's, when Herbert Tweddle transferred his interest in this concession to the London Pacific Petroleum Co. In the Lobitos field prospecting did not begin until 1901, and by 1905, under the direction of the Peruvian Corporation, some fairly good shallow wells had been drilled. In 1905 the Lobitos Oil Co. assumed the ownership of this field. About 1905, the discovery of asphaltic sands, near the northwest slopes of Cerro de Amotape and in the drainage basin of Quebrada de Mancora, Department of Piura, led a Mr. Taiman to drill a well near a point known as La Brieta (Hacienda de Fernandez). Although this well was drilled to a depth of only 455 ft., not less than four distinct sands were found. The production was not large and consisted of a heavy black oil containing an asphaltic base. So far as I am aware no further drilling has been done in this locality.

The remaining producing area of Peru is in the Department of Puno, in the southern part of the Peruvian Republic. The field is on the northwest side of Lake Titicaca. It was first recognized by the Brown brothers, of Los Angeles, Cal., who formed a company to test the region. This area is known as the Pusi or Pirin field. No fewer than ten wells were drilled, and from five to seven of these gave some production. The Pusi field was a producer from 1906 to 1915, when all operations ceased.

The early prospecting in the Peruvian Republic has led to the development of the following fields: The Zorritos field, on the coast line, forty kilometers southwest of Tumbes, Province of Tumbes; the Lobitos field, on the coast line, approximately forty-five kilometers northwest of Talara, Department of Piura; the Negritos field, on the coast, Department of Piura, and extending over large concessions from Talara to the south and east (Talara is the shipping port of the Negritos field); Hacienda de Fernandez (La Brieta), in Quebrada de Mancora and approximately thirty kilometers to the interior from the port of Mancora, Department of Piura, and the Pusi or Pirin field, Department of Puno, on the northwest side of Lake Titicaca and northeast from Juliaca, the railway junction point to Cuzco on the north and Puno on the south.

FORMATIONS OF THE NORTHERN PERUVIAN OIL FIELDS

From the accompanying map it will be seen that the producing fields in northern Peru are confined to the north end of the coastal plain that borders the Andes on the west and extends to the Pacific shore line. The coastal plain extends north into Ecuador and south through the Province of Tumbes and the Department of Pinra and from Lambayeque to Rio Saña, where the foothills of the Andes reach the coast.

The formations of the coastal plain are composed entirely of Tertiary sediments. My investigations[1] led to the conclusion that not less than 400 ft. of Tertiary sediments would be found in the north arm of the plain or that portion west of Cerro de Amotape. The central and widest part of the coastal plain will probably contain even a thicker series of Tertiary sediments than is exhibited in the north.

In the north sector there are not less than three members in the Tertiary sediment with unconformities existing between each. The uppermost member, composed mainly of coarse sediments with some clays, forms the table-land topography in the region of Payta and the many benches or *mesas* in the interior from Negritos and Lobitos. This member rests unconformably upon a series of red and gray clays, which, from Payta north, form the shore cliffs to the Ecuadorian border.

Investigation of well records from different fields has brought to light facts which strongly suggest that another unconformity exists at a depth of approximately 650 ft., and further that this break may occur anywhere from 650 to 1,000 ft. Since these investigations were published a well has been drilled to a depth of 3,900 ft. The drill was still in Tertiary at this depth, so it is evident that the early estimate of the total thickness of the Tertiary sediment in the northern part of the coastal plain had not been overestimated.

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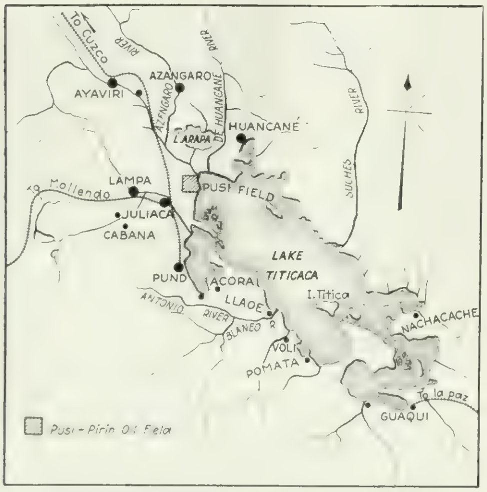
[1] "Informe preliminar Sobre la Zona Petrolifera del Norte del Peru," Por V. F. Marsters, Bol. No. 50, Cuerpo de Ingenieres de Minas del Peru.

It may be stated here that other parts of the Peruvian shore line are likewise bordered by coastal plain sectors, but none of these has been subject to detailed investigation or testing for petroleum deposits, although seepages of oil are known to exist on some of them.

The remaining sectors may be described as follows: The Tambo de Mora-Pisco-Nasca coastal plain, with approximately 250 kilometers of shore line; the Ocoña-Mollendo-Tambo sector, the southeast end of which is not completely severed from the broader and remaining sector, and the Moquequa-Tacna sector, which continues into northern Chile. The Peruvian portion of the plain is bounded on the southeast by the River Sama.



PRODUCING OIL FIELDS OF NORTHERN PERU

CHARACTERISTICS OF INDIVIDUAL FIELDS

Zorritos Field—The Zorritos field was the first to produce petroleum in commercial amount. A refinery was built in the field during the earlier stages of development. Later the owner, Sr. Piaggio, built a larger refinery at Callao, where he continued to refine his own production and built up a large remunerative trade on the west coast of South America. His refined product was mainly kerosene. According to statistics available, 313 wells had been drilled in this field by 1914. Apparently fifty wells seem to have been the maximum number producing at any one time. Three sands are known in this field. They vary in depth from 194 to 1,640 ft. The deepest well of which I have any note was drilled to 3,020 ft.

Lobitos Field—This field is operated by the Lobitos Oil Co. By 1917 that company had drilled 113 producing wells. Not fewer than four sands had been encountered, with depths varying from 400 to 2,500 ft. The deepest well drilled in the field is reported to have reached 3,435 ft. In 1912, drilling operations were greatly extended. During that year a number of flowing wells were obtained, some of which showed an initial production of 500 bbl. per day. This company has its own tank ships, and carries the greater part of its crude to refineries on the coast of British Columbia.

Negritos Field—Negritos field was formerly operated by the London Pacific Petroleum Co. It is now under the control of the International Petroleum Co., with the subsidiaries (Standard) Lagunitos Oil Co., London Pacific Petroleum Co., and West Coast Oil Fuel Co. In 1917, a total of 695 producing wells had been drilled in this field. Not fewer than seven distinct producing sands have been found, varying in depth from 300 to 3,000 ft. The deepest well drilled in this field attained a depth of 3,900 ft. Refineries have been established at Talara, the shipping port of this field. The West Coast Oil & Fuel Co. transports all crude and refined products from this section.

Pusi Field—In the Pusi field, no detailed investigations have been made by the government officials, as in the northern fields, and such information as may be available is derived solely from those who have conducted private investigations. It can be said with a fair degree of certainty that the formations in the vicinity of the Pusi field are in part Tertiary and in part Cretaceous in age. Favorable structural conditions exist in the Pusi region. The formations with which the Pusi oil deposits are associated are believed to cover a considerable area. In fact, oil seepages are known at many points in the north and northwest extension of the high plains from Lake Titicaca. It is a significant fact that similar seepages are known on the high plains of Bolivia south and southeast of Lake Titicaca, the same geographical and geological province as that on which the Pusi field is situated. The remoteness of this region from the coast and the high cost of transportation are among the difficult factors to be overcome if production in any great amount is ever to be obtained.

In the Pusi field not fewer than ten wells were drilled. Producing sands were found between 250 and 700 ft., the deepest well reaching 1,500 ft. It is understood that much of the production obtained was used as fuel on the engines of the Southern Peruvian Ry.

It may be added, without going into details, that many places remote from the present fields are known to possess seepages showing petroleum of different grades. Samples have been collected from some of these occurrences and tested, with fair results. These localities extend from the coast at points remote from production to the east slopes of the eastern Andean range.

COMMERCIAL CHARACTER OF PERUVIAN PETROLEUM (a)

Production of the Northern Fields	Per cent
Naphtha and gasoline	15 to 25
Kerosene	20 to 24
From remaining distillate, lubricating [illegible] etc.	20 to 30
Production of the Pusi Field	
Gasoline	0 to 7
Kerosene	7 to 20

(a) For details concerning Peru [illegible] "[illegible] Petróleo Peruano," por Ricardo A. Deustua, Lima, Perú, [illegible] Nacional de Industria Minera, 1918.

Lubricant oils are present in large amount, but no figures are available.

An accompanying table shows the production of Peru from the earliest date at which any statistics are available to 1920. From the figures, it is evident that the Negritos and Lobitos fields are gradually increasing their production. The Zorritos field reached its maximum production in 1910: from 1910 to 1915 the total annual production fell, but from 1915 to 1918 it was again increased. The only district that has been commercially productive and that is now inactive is the Pusi field, and that fact is due largely to its geographical position and high cost of transportation.

PRODUCTION OF PETROLEUM IN PERU, SOUTH AMERICA, FROM 1896 TO 1920, BY DISTRICTS

Year	Lobitos, Bbl.	Negritos, Bbl	Zorritos, Bbl.	Pusi, Dept. of Puno (a) Bbl.	Lagunitos, Bbl	Total Production, Bbl
1896						47,536
1897						70,831
1898						70,905
1899						89,166
1900						274,800
1901						274,800
1902						286,725
1903						278,092
1904						290,123
1905	75,000	335,160	37,720			447,880
1906	162,000	330,510	42,419	1,365		536,294
1907	279,000	396,750	65,476	15,000		756,226
1908	319,896	543,750	71,429	76,103		1,011,180
1909	421,195	740,070	70,750	76,103		1,316,118
1910	400,088	773,025	107,000	50,000		1,330,105
1911	391,290	882,698	94,048	30,000		1,398,036
1912	587,048	1,071,000	87,095	15,000		1,751,143
1913	557,355	1,130,490	83,343	10,000	346,673	2,133,261
1914	504,743	1,032,210	88,136	10,000	282,713	1,917,802
1915	664,972	1,355,925	72,736	1,000	392,618	2,487,251
1916	654,060	1,822,733	73,852		(d)	2,550,645
1917	686,595	1,771,560	75,262		(d)	2,533,417
1918	639,698	1,820,814	76,190		(d)	2,536,102
1919						2,616,000 (c)
1920						2,790,000 (d)

(a) Quoted from Richardson, U. S. Geological Survey. (b) Quoted from American Petroleum Institute. (c) Estimated (d) Included in the Negritos production.

PETROLEUM PRODUCTION OF SOUTH AMERICAN REPUBLICS FOR 1920

Countries	Barrels
Peru	2,790,000
Argentine	1,366,926
Trinidad	1,628,637
Venezuela	300,000

In the world's production of petroleum, Peru ranks the ninth, Trinidad the eleventh, Argentine the thirteenth, and Venezuela the fourteenth in the list of oil-producing countries.

Petroleum in Panama

The following summary regarding petroleum resources in Panama has been prepared for the U. S. Geological Survey, section of Foreign Mineral Reserves, by Arthur H. Redfield:

Evidences of petroleum in Panama occur on both the Pacific and the Caribbean coasts of the narrow isthmus, whose backbone of ancient crystalline and post-Tertiary igneous rocks is flanked on both sides by sediments chiefly of Cretaceous and Tertiary age. Seepages of oil or asphalt are reported on the shores of San Miguel Bay; along the Tonosi River; around the Gulf of Montejo; and along the Mosquito Gulf, especially near Bocas del Toro.

Little is known or published regarding the geology of Panama outside the Canal Zone. The indications of oil in Panama appear to occur in Tertiary formations. The sedimentary rocks of Panama resting unconformably on the igneous backbone of the isthmus are folded into steeply dipping, shattered, and faulted anticlines and synclines, bearing N. 55-60 deg. W., intruded in places by igneous rocks. A recognized anticline is found in the State of Bocas del Toro, extending through Columbus Island, Provision Island, Nancy's Cay, and Valiente Peninsula. The most promising portion of the anticline is a dome-like structure occurring on Columbus Island.

The petroliferous character of the Panaman formations is attested by seeps of oil and asphalt. Gas was encountered in a well drilled for water near Bocas del Toro.

Active development of the Panama oil fields is of recent date. A well drilled by the Sinclair Gulf Corporation in 1918 on the center of Columbus Island is producing considerable gas.

Early in 1917 the National Assembly of Panama authorized the making of concessions of unoccupied territory for purposes of exploration for not more than three years, and for purposes of development for not over twenty years. These are renewable for like periods. The royalty prescribed is 10 per cent of the net profits of the oil or gas marketed, or 5 per cent of the gross receipts.

The Sinclair Gulf Corporation (U. S.) holds a concession for exploration covering 11,000,000 acres in the Republic of Panama, with the right to select and retain 1,200,000 acres. This is a strip of land fifteen miles wide, extending for considerable distances along both coasts of the republic. The Chorcha Petroleum Co. has permission to prospect claims located about twelve miles from David, State of Chiriqui. The Chorcha company's holdings have been leased by Thomas Navins & Co., of New York.

Nova Scotia Oil Shales To Be Treated

SPECIAL CORRESPONDENCE

The rich torbanitic oil shales of New Glasgow, Nova Scotia, will soon be worked by a low temperature carbonization process. During the last six months experiments have been carried out at the works of the Carbonization Co. in Pennsylvania in co-operation with the Pennsylvania Coal & Coke Co. The shale was shipped in carload lots from the Nova Scotia fields and was worked during the final runs under the supervision of Harold C. E. Spence, owner of the properties, and Dr. B. F. Howard, chief of the Fuel-Testing Division, Mines Branch, Geological Survey, Ottawa, and others. The type of retort has a capacity of from 50 to 100 tons per day and can be brought up to 300 or more tons per day for single retorts. Harold C. E. Spence has purchased the Canadian and Newfoundland rights, and on interviewing the Minister of Customs, Ottawa, received assurances the retorts would be allowed in Canada free of duty.

The property consists of about twenty thousand acres and contains several billions of tons of shale. The deposits have been bored to 1,200 ft., showing numbers of seams aggregating 600 to 700 ft. in thickness. The torbanites are found to be richer than any others discovered, carrying from 80 to 135 gal. of oil per ton, and some picked samples showing as high as 199 gal. per ton. The product can be pumped into ocean-going tankers on the field a mile from the works, and the upper seams to a height of 150 ft. above the river levels can be mined by open-cast workings and quarrying. A plant of 5,000 tons' capacity per day is planned for the initial operations. A torbanite yields better oil than an oil shale, at a lower temperature, and the oil refines more easily. The yield of oil also is invariably higher. With access to the Atlantic and the Gulf of St. Lawrence direct from the works, transportation is ideal.

[In our issue of May 14, p. 851, it was incorrectly stated that Harold C. E. Spence is president of the Nova Scotia Oil Fields, Inc. Mr. Spence is president of the Oil & Nitrate Products, Ltd.—EDITOR.]

Technical Papers

Mine Atmospheric Conditions.—The South African Institution of Engineers publishes in its *Journal* for March, 1921 (Johannesburg, price 4s.), an account of quantitative studies by A. J. Orenstein and H. J. Ireland, carried out at the request of the South African Chamber of Mines, to determine the influence on the output and fatigue of workers, of atmospheric conditions and noon rest, and the best working period for efficiency. By means of ergometers devised and calibrated by themselves, they measured work performed in different ways by two African native miners at different levels in the Village Deep mine and at the surface, during June to December, 1920. Atmospheric conditions were observed by means of the kata-thermometer, and varied by means of a blower or fan. Surface tests were made at 6,000 ft. altitude, and underground between depths of 4,500 ft. (1,500 ft. alt.) and 5,260 ft. (740 ft. alt.). The authors reach conclusions essentially the same as those urged by D. Harrington, of the U. S. Bureau of Mines, in his paper read before the Lake Superior conference. Noteworthy points made are: A short rest at half-time seemed to be not worth while; air-stirring may increase work output by 46 per cent; four hours underground, at full capacity, is all that a South African native can put in efficiently at the place where the experiments were conducted.

Storing Coal—Those who have had trouble with their coal stockpiles catching fire will be interested in a well-illustrated article in the April 15 issue of *Factory* (price 25c., Cass, Huron and Erie Sts., Chicago, Ill.). Cold weather, small piles, and ventilation tend to prevent spontaneous combustion by keeping the temperature down; or a deep pile may be made, surrounded by a tight board fence, and covered by a layer of fines, thus preventing the access of air necessary for combustion.

Scrapers—"The Use of Scrapers in Metal Mines," by Lucien Eaton, appears in the May issue of the *Compressed Air Magazine* (11 Broadway, New York, N. Y., price 35c.). This article reviews the machinery and methods used in several districts in "slushing" work. It is well illustrated with photographs and diagrams. Much interest is attached to the practice of "slushing," and in the Lake Superior districts the methods have greatly reduced the cost of ore removal.

Chromium Ore—"Chromium Ore" is a separate monograph in the series being issued by the Imperial Institute, London, S. W. 7, England, and may be obtained for 3s. 6d. This is a brochure of fifty-eight pages, describing the occurrence, character, and uses of chromium ore and giving brief reference to sources of world supply.

Picric Acid—Large stocks of picric acid were in the hands of the Government at the close of the war, and must be used up in industrial work. Ordinarily this explosive is too expensive and causes too much smoke to be used commercially. The U. S. Bureau of Mines *Reports of Investigations* No. 2,243, fifteen pages, free from the Bureau, Washington, D. C., tells of the history and nature of picric acid and how it should be used.

Iron Ore—Under the title "Mesabi Sinter," Clement K. Quinn & Co., Duluth, Minn., and Cleveland, Ohio, has issued an illustrated brochure describing the plant, process, and product of the Mesabi Iron Co., Babbitt, Minn. The sinter is obtained by the treatment of magnetic concentrates in Dwight & Lloyd machines after fine grinding and concentration. Flow sheets of the various processes are given.

Mine Fires—The use of emergency fans for fighting mine fires is described in U. S. Bureau of Mines *Reports of Investigations* No. 2,240, three pages, obtainable on request to the Bureau at Washington, D C.

Oil Production—The U. S. Bureau of Mines has issued Bull. 194, "Some Principles Governing the Production of Oil Wells," by Carl H. Beal, former petroleum technologist of the Bureau, and J. O. Lewis, former chief petroleum technologist. The bulletin discusses some of the fundamental factors affecting oil production. The subjects covered include porosities of oil sands, ultimate production of recoverable oil, the percentage of oil recovered from oil sands with present-day methods, the effect of geologic structure and rock pressure and depth on ultimate production, well spacing, water conditions, factors governing the decline of oil wells, the policy of drilling to maintain production, and considerations on "flush" and "settled" production.

Salt—"Permian Salt Deposits of the South-Central United States" is the title of U. S. Geological Survey Bulletin No. 715-M, obtainable on request to the Survey at Washington, D. C. The bulletin is of eighteen pages and gives the principal data so far obtained concerning the vast salt deposit which has been discovered by drilling for oil, gas, and water in New Mexico, Texas, and Oklahoma.

Cadmium—"Cadmium in 1920," six pages, containing statistics and other summarized information about the metal and its marketing, may now be obtained from the U. S. Geological Survey, Washington, D. C.

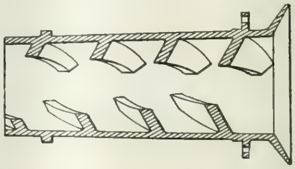
Safety Fuse—*The Detonator* for March, 1921 (1540 San Pablo Ave., Oakland, Cal., sent free), has a two-page article discussing the various kinds of fuse, their uses, and methods of storage.

Asbestos—"Asbestos in 1919," a nine-page separate of "Mineral Resources," is now obtainable from the U. S. Geological Survey, Washington, D. C.

Recent Patents

Blast Furnace Charging— No. 1,376,947. Jules Labarthe, San Francisco, Cal. A method which consists in dumping charges at different parts of a furnace, the quantity of each constituent in the complete charge being the same in any vertical line.

Ball-mill Discharge—No. 1,369,653. N. L. Hall, Salt Lake City, Utah. The prevention of oversize material from discharging through the trunnions of mills not provided with grates, by means of interrupted spiral vanes on the inner surface of the trunnion discharge spout. These vanes are cast successively higher toward the outlet end, to secure proper classification. The illustration shows a discharge spout so made.



Sulphur Dioxide—No. 1,377,013. William H. Howard, Salt Lake City, Utah, assignor to American Smelting & Refining Co., New York, N. Y. A method of obtaining a continuous flow of SO_2 in converting copper matte by treating different batches each for a predetermined time. Another process for recovering sulphur dioxide from matte is covered by patent No. 1,377,012 issued to the same applicant.

Flotation Process — No. 1,375,233. Walter A. Scott, Chicago, Ill., assignor to Minerals Separation North American Corporation, New York. A process by which the gas used for floating mineral particles is removed from the bubbles before they reach the surface of the pulp, and the mineral carried by the bubbles separated from the remainder of the ore.

Flotation Machine — No. 1,374,447. William E. Greenawalt, Denver, Col. A flotation machine in which the compressed air, supplied at the bottom, is atomized by means of rotating perforated disks revolving between perforated stationary plates.

Flotation Machine — No. 1,374,499. William E. Greenawalt, Denver, Col. A flotation machine with a rotary member and means for passing an electric current from the rotary member to the stationary members.

Flotation Reagent British patent No. [illegible] Luckenbach Processes, Inc. Pine pitch converted to a colloidal state by treatment with caustic soda or ammonia and other alkalies and certain oxidizing and fixing agents is claimed to give improved and selective effects in the flotation of minerals.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Standardization Conference Held in London Will Promote Mutual Understanding

The secretary of the American Engineering Standards Committee, Dr. P. G. Agnew of Washington, D. C., has just returned from a short trip to Europe, in the course of which he attended the conference in London of the secretaries of national standardizing bodies of several countries. After the London conference he visited France, Switzerland, and Germany for a more detailed study of the standardization work in those countries.

The conference, which was called by the secretary of the British Engineering Standards Association, C. le Maistre, had for its object the exchange of experiences and the furtherance of co-operation among the various national bodies in their work of industrial and engineering standardization.

It is interesting to note that, notwithstanding great differences in the details of procedure, the same general method of work is followed in the countries represented. Technical decisions concerning any specific piece of work are in the hands of a working committee which is so constituted as to be broadly representative from both the technical and the managerial points of view of the particular branch of the national industry concerned. This same general method is followed, whether the work is of the nature of specifications, methods of test, or dimensional standardization.

The secretaries who attended will submit the suggestions of the conference to their respective home organizations for approval.

The suggested measures have to do with the interchange of publications, a reciprocal arrangement for making foreign standards available to the industries of each country through their sale by the offices of the national bodies, the exchange of information as to the status of work in progress, and other methods of furthering co-operation among the national bodies.

It was the view of the conference that international co-operation in industrial standardization work should proceed along such informal lines, being based primarily upon the interchange of information on active subjects of mutual interest, rather than by any attempt at the present time to form a general international standardizing body. In cases in which formal organization should be found necessary, it was held that the organization should preferably be by subject or industry, somewhat along the lines of the International Electrotechnical Commission; but that in all cases efforts should first be made to secure results by less formal methods. To this end it would often be desirable that, in a given subject, the office of one of the national bodies most interested should by informal agreement perform such secretarial functions as would further international agreement in the particular subject.

Arrangements are being made for close co-operation among the national standardizing bodies and the International Chamber of Commerce. The chamber will give special consideration to the subject of standardization at its convention in London the week of June 27, and has organized a committee to develop interest in the subject on the part of industrial and commercial interests, and to distribute information on standardization. It is the policy of the International Chamber of Commerce to further the standardization movement by such means, considering only the more general aspects of the problem and the policies to be followed. The details of industrial standardization it would leave to the national bodies, who will co-operate directly with the national organizations of the International Chamber of Commerce in their respective countries.

It was felt by all concerned that the conference was a very successful one, and that it constituted an important forward step in establishing a closer relationship and understanding among the various national bodies.

The secretaries present were: Belgium, G. Gerard; Canada, R. J. Durley; Great Britain, C. le Maistre, C. B. E.; Holland, E. Hijmans; Norway, A. Eriksen; Switzerland, M. Zollinger; United States, P. G. Agnew.

The Story of Sulphur Interests Southern California Engineers

Local Section of A. I. M. E. Holds Annual Meeting and Dinner in Los Angeles

The annual meeting of the Southern California Section of the American Institute of Mining and Metallurgical Engineers was held at the City Club, Los Angeles, on the evening of May 12, with Dr. Ralph Arnold presiding and fifty-seven members present. The principal feature of the program was a paper presented by Colonel Seely W. Mudd, whose subject was "The Story of Sulphur." The address was illustrated by two reels of moving picture obtained through the courtesy of the U. S. Bureau of Mines. After giving a general résumé of the sulphur industry, Colonel Mudd presented in detail the different steps involved in the mining of sulphur by the use of superheated water under pressure, as practiced in the Texas gulf district. This interesting account was followed by the election of officers for the ensuing year. The account showed that Harvey S. Mudd had been elected chairman; Alvin B. Carpenter, vice-chairman; Desaix B. Myers, secretary-treasurer; and F. B. Close, Walter A. Schmidt, Harry R. Johnson, and W. F. Staunton, as members of the executive committee.

Following the business meeting a buffet supper was served. The office of Secretary D. B. Myers is 433 Merchants National Bank Building, Los Angeles, Cal.

Forty-fourth Annual Dinner of the Royal School of Mines

Old Students From Many Countries Express Appreciation of the School and Its Influence

The Old Students' Association of the Royal (British) School of Mines conducted the annual dinner of the school on May 27 last. As reported in a recent issue of *The Mining Journal* (London), Professor S. J. Truscott, president of the association, was in the chair, and representatives from all corners of the empire were in attendance.

Sir Edgar Walton, High Commissioner for South Africa, proposed the toast to the school, and in the course of his appreciatory remarks took occasion to urge that if the school granted degrees the latter should be a guarantee that the holders were not only engineers and miners, but also possessors of a wider knowledge enabling them to deal with questions of economics, of health, and of bodily safety.

The president thanked Sir Edgar for his assurance that South Africa recognized the importance of her mining industry, and took occasion to point out, among other things, that though the British Isles had limited mineral wealth, nevertheless her engineers had first developed the cyanide process, and had also developed the flotation process, thereby adding to the stores of precious metals available to humanity.

Sir James Allen, High Commissioner for New Zealand, and Mr. C. McDermid, secretary of the Institution of Mining and Metallurgy, made replies to the toast, "Our Guests." Sir James pointed out that the graduates of the school were spreading through parts of the world other than the dominions and that through them the Royal School of Mines was exerting considerable influence on public opinion throughout the world. Mr. McDermid, after recounting the many difficulties that had often hindered the development of the school and of the Imperial College, stated that it could be demonstrated that the latter had now reached vigorous manhood and that, judged by any standard, it occupied a unique position in the world.

MEN YOU SHOULD KNOW ABOUT

George H. Gerry is making examinations in the Lordsburg and Central districts of New Mexico.

J. R. Finlay, mining engineer of New York City, has been retained to appraise the mines of New Mexico.

E. H. Nutter, of San Francisco, Cal., chief engineer of Minerals Separation, Ltd., is in New York City for two or three weeks.

F. G. Stevens, mining engineer of Toronto, Ont., has gone to the Rex mine, in northern Manitoba. He will spend the summer there.

C. E. Van Orstrand has completed temperature measurements in the well of the Hope Natural Gas Co., at Volcano, W. Va.

Charles W. Wright, mining engineer, of Rome, Italy, who had been in Michigan recently for a couple of weeks, sailed from New York on June 17, returning to Italy.

William F. Ward, mining engineer with the Carrib Syndicate, has returned from Colombia, S. A., and will spend the next few months in New York City and in Denver, Col.

D. H. Harrington, supervising mining engineer of the U. S. Bureau of Mines, with headquarters at Denver, has been in Washington conferring with the chief mining engineer of the bureau.

R. G. Hall, manager of Burma Corporation, Ltd., operating the Burma mines, railway, and smelting plant at Namtu, Burma, has resigned and will return to the United States at an early date.

Stanly A. Easton general manager of Bunker Hill & Sullivan Mining & Concentrating Co., Kellogg, Idaho, has been appointed a member of the Idaho State Board of Education and of the Board of Regents of the University of Idaho.

Dr. George A. Young, of the Canadian Geological Survey, left Ottawa on June 8 for his trip to the Belcher Islands in Hudson Bay. He and his party will spend the summer making an examination of the iron-ore deposits of the islands.

Irvine E. Stewart, consulting petroleum geologist, of Stewart & Wright, Lewistown, Mont., announces the dissolution of that firm. Mr. Stewart has opened offices in Billings, Mont., where are associated with him **Fred A. Davies**, geologist, and **Edwin H. Hunt**, engineer.

Max Ball, petroleum geologist, of Denver, Col., who recently resigned as manager of the Matador Oil Co. of Wyoming, was in Washington last week. He is now in New York City conferring with **Charles Lupton** and ex-Governor Frantz, of Oklahoma, on affairs connected with the Ute Oil Co.

C. A. Fisher, of the firm of Fisher & Lowrie, consulting geologists and engineers, Denver, Col., is a delegate from the American Petroleum Institute to the first annual meeting of the International Chamber of Commerce to be held in London on June 27 to July 2. Mr. Fisher sailed on June 14.

Dr. H. M. Ami, of Ottawa, has returned there from London, where for the last three months he has been acting governor of the Imperial Mineral Resources Bureau. In January Dr. Ami went to the south of France to recuperate after a prolonged service at the Washington, D. C., headquarters of the bureau. He expects to resume work with the Canadian Geological Survey.

Scott Cardelle Bone, of New York City, whose nomination as Governor of Alaska was confirmed by the Senate on June 15, has made a special study of the affairs of that territory since 1911, when he became editor-in-chief of the *Seattle Post-Intelligencer*. In 1914 and 1915 he was chairman of the Alaska bureau of the Seattle, Wash., Chamber of Commerce. Mr. Bone was born in Shelby County, Ind., on Feb. 15, 1860. He was for some years prominently connected with Indianapolis papers until in 1888 he went with the Washington, D. C., *Post*, the managing editor of which he finally became. After seventeen years on the *Post's* staff he was for a short period editor of the *Herald*, of that city, but left in 1911 to go to Seattle. Mr. Bone's long active service on one of the best papers of the National Capital, gave him an unusually broad grasp of national affairs and interests. Among other honors he has received a foreign decoration.

Harris & Ewing
SCOTT C. BONE

Colonel **H. H. Stout**, who recently returned from New York City to Douglas, Ariz., where he has been superintendent of the Copper Queen smelter for the last four years, announces that he has temporarily severed his connection with the smelter. After traveling through the West and Northwest Colonel Stout, who is a graduate of West Point Military Academy, will return to New York City as consulting metallurgist for Phelps Dodge interests.

James Hopkins, mining engineer, of Ramey, Pa., who returned from the diamond fields of the Belgian Congo in April, has been engaged for exploration work on the west coast of Africa. He sailed from New York on June 15 by the "Mauretania."

Mining engineers recently in New York City included: **Arthur Notman**, of Bisbee, Ariz.; **Gunnar Schjelderup**, of Christiania, Sweden; **William Kelly**, of Vulcan, Mich.; **Djevad Eyoub**, of the National Petroleum Corporation, Constantinople, Turkey, and Tampico, Mexico; **Frederick G. Lasier**, of Detroit, Mich.; **Charles T. Joslin**, of the Arizona Mining Supply Co., Prescott, Ariz.; **W. F. Staunton**, of Los Angeles, Cal.; **Horace V. Winchell**, of Minneapolis, Minn.; **Veleair C. Smith**, of Tuzpam, Vera Cruz; and **William Ryer Wright**, of Evanston, Ill.

OBITUARY

Captain James E. Richards, superintendent of the Isle Royale mine, Isle Royale, Mich., died there toward the end of May after a long illness. Captain Richards spent the first twenty years of his life at the Cliff mine, Keweenaw County, Mich., where he was born on June 11, 1858. He early learned the practical side of mining from his associates. About 1880 he moved to Osceola, and after several years there went to the Tamarack Junior mine as master mechanic. Nine years later, still in the same capacity, he went over to the Isle Royale, where he spent the rest of his life, eventually attaining the superintendency.

James F. Callahan, part owner of the Callahan Zinc-Lead Mining Co., formerly the Consolidated Interstate-Callahan company, died at his home at Wallace, Idaho, June 12, after a stroke of paralysis. Mr. Callahan went to Eagle, Idaho, in 1883, when he was twenty-five years old and before the town of Murray was established. He discovered the Interstate-Callahan deposits in 1885, but worked on them until 1887 before he located the property. Despite a small showing in his tunnel and wall-rock theretofore not known to be associated with pay deposits, his faith held and was finally rewarded by his uncovering some of the richest pockets in the Cœur d'Alenes. Mr. Callahan was born in Galena, Ill., Aug. 12, 1858, and started westward in 1876, when he set out for the Black Hills of Montana. On the way he worked in Minnesota lumber camps and elsewhere. In 1879 he had reached Montana and found work among the cattle ranchers until the news of the gold discoveries in Idaho in 1883 drew him into the Cœur d'Alenes at Murray.

THE MINING NEWS

LEADING EVENTS

WEEKLY RÉSUMÉ

The action of the House Committee on Mines and Mining in refusing to concur in the Senate bill permitting further postponement of the 1920 assessment work on mining claims makes it appear unlikely that any such legislation will pass. A statement of Secretary Fall's regarding Mexican petroleum reserves is alleged to have been twisted to aid a bear movement in the stock market. The Senate Committee on Public Lands has reported a bill amending the act admitting Washington, Montana, and the Dakotas as states in order to permit mineral lands there to be leased on a different basis.

In California, the Shasta Zinc & Copper Co. has recently started its new plant at Winthrop. In Arizona, United Verde Extension passed its quarterly dividend. The property of the Silver King of Arizona, at Superior, is to be sold by the sheriff on July 6. In Texas, the hearing of the suit of the Union Sulphur Co. against the Texas Gulf Sulphur Co. has been postponed until October. Considerable activity is reported from Mexico, in the district tributary to Culiacan, Sinaloa. In Colorado, the long-delayed spring thaw has caused floods that have isolated Ouray, Telluride, and Silverton. In Nevada, strike conditions at Tonopah are practically the same. In the Black Hills, the Homestake Mining Co. has just announced a 50c. cut in wages. In the Coeur d'Alenes, the report that the Bunker Hill and Hecla companies were to work the Star mine jointly has been confirmed by the managers of both companies.

Shasta Zinc and Copper Co.'s Plant Started

Reverberatory Handling 160 Tons of Ore Per Day

The Shasta Zinc & Copper Co., at Winthrop, Cal., started its reverberatory recently, and is smelting at the rate of 160 tons of ore per day. From twenty to thirty days will be required before all parts of the plant are in proper working adjustment. Clean slag, low in zinc and copper, was being made at the start. Successful operation of the plant seems to be assured. Over two and one-half million dollars in new capital has been put into the enterprise. A description of the plant will be published in an early issue.

Homestake Cuts Wages

The Homestake Mining Co., of Lead, S. D., has announced that it will make a general reduction of wages of 50c. per day, effective July 16. This will make miner's wages $4.50 and shoveler's $4 per day.

The New Copper Queen Concentrator, at Bisbee

Phelps Dodge Corporation Is Now Completing Four-Unit Mill of 4,000-Ton Initial Capacity —Expected To Be in Operation in Five Months

By J. Boyd Trimble, Jr.*

Written for *Engineering and Mining Journal*

THE NEW MILL of the Copper Queen branch of the Phelps Dodge Corporation, which is situated near Bisbee, Ariz., is nearing completion. It was designed and is being built by H. Kenyon Burch, consulting engineer for the Phelps Dodge concentrating department. The initial capacity of the four units in the concentrator will be 4,000 tons treated per twenty-four hours. The capacity of the crushing plant is greater than otherwise would have been the case, as it is designed to handle leaching and smelting as well as milling ore. The mill will handle ore from Sacramento Hill, a large open-pit deposit of low-grade porphyry previously described in *Engineering and Mining Journal.*

THE COARSE-CRUSHING PLANT

Ore will be brought from Sacramento Hill in 40-yd. side-dump cars and discharged over a stationary grizzly into the receiving hopper of a 66 x 84-in. Blake jaw crusher set to 8 in. It will then be conveyed by two 4-in. pan conveyors to a 500-ton surge bin. Four 48-in. apron feeders will feed the 8-in. product to two 48-in. belt conveyors, which will carry it over two revolving grizzlies to the gyratories. These are two No. 9 Gates crushers set to 4 in.

Provision has been made under the surge bin for bypassing leaching and smelting ore through a series of four 42-in. belt conveyors, having an aggregate length of 918 ft., to the concrete loading bins. It will also be possible, if found desirable, to run the smelting ore through the gyratories, or gyratories and disks.

The 4-in. milling ore from the gyratories will be carried by two 36-in. belt conveyors to four Allis-Chalmers iron-frame trommels having 2-in. round openings. The oversize will pass to four 48-in. Symons disk crushers which will complete the coarse crushing to 1¼ in.

Trommels constitute the screening equipment at present installed. A different type of screen is now being considered. A final decision has not been reached.

A 42-in. inclined belt conveyor, 335 ft. long, will discharge on to a 42-in. belt conveyor over the 10,000-ton crushed-ore bins. The latter conveyor, in turn, will discharge on to a shuttle conveyor which will distribute it.

It is desired to complete the crushing of the entire 4,000 tons of milling ore in one eight-hour shift. The leaching and smelting ores will occupy another shift. However, if the tonnage of the latter two warrants it, the plant will operate the full twenty-four hours.

CONCENTRATOR WILL HAVE FOUR 1,000-TON UNITS

Wet grinding will start in the primary mills. Six 20-in. apron feeders will regulate the flow of crushed ore through a series of three 24-in. belt conveyors to two 6½ x 12-ft. Marcy roller mills. These mills, each driven by a 150-hp. motor, will carry a normal charge of eighteen tons of 3-in. diameter high-carbon steel rods at a speed of 17.5 r.p.m. The primary reduction will be 14 mesh.

The 14-mesh product will pass for desliming to one 6 x 18-ft. Dorr classifier. The slimes will be floated as described later. The sands will flow to ten Plato tables for roughing. An air lift will elevate the coarse concentrates to Blaisdell excavator bins, from which they will be dropped to standard railroad cars.

Two secondary mills, identical with the primary mills, each in closed circuit with a Dorr duplex classifier, will further reduce to 48 mesh and classify the sands from two 4½ x 18-ft. Dorr classifiers which will dewater the reject from the roughing tables. The resulting pulp will be combined with the slimes from the primary classifiers and treated in two Callow machines of the Inspiration type. The rougher concentrates will be elevated by air lift to two Callow cleaners. The cleaner tailings are to be returned to roughers.

The rougher machines each have twenty-two cells, with a total area of 231 sq.ft., and can handle a total feed of 2.11 tons per sq.ft. per twenty-four hours; and 1.92 tons of this will be returned from the cleaners. The cleaner machines each consist or six cells, with an area of 83 sq.ft., and can handle a feed of 1.62 per sq.ft. per twenty-four hours.

Flotation machine boxes will be made up of concrete slabs 6 to 10 ft. wide, 2½ in. thick and from 10 to 20 ft. long. The slabs, reinforced by ¼-in. rods, will be cast flat and bolted in place when

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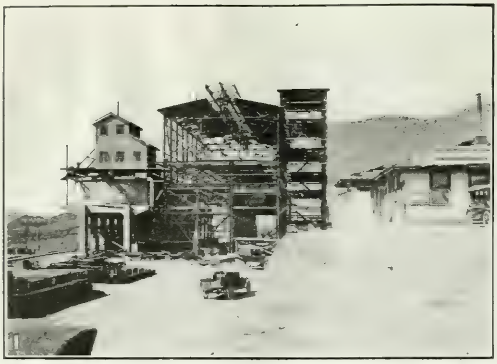
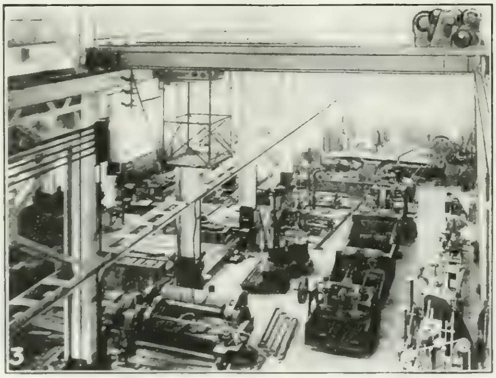
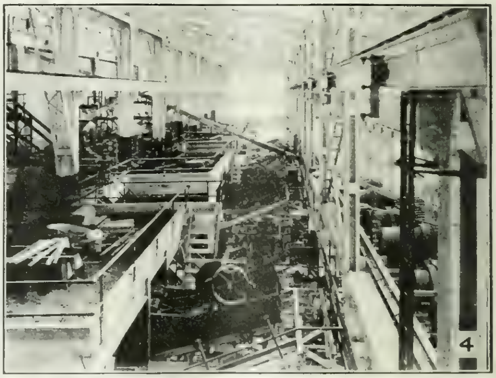
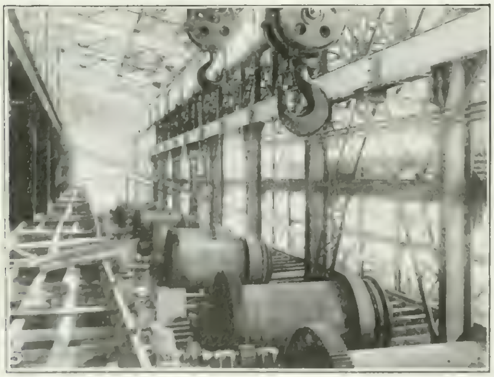
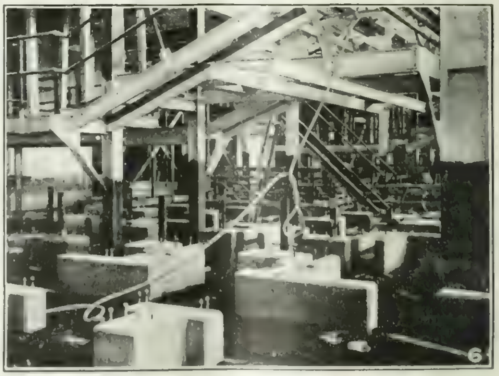
*Formerly engineer with Phelps Dodge Corporation, Concentrating Department.











VIEWS OF PHELPS DODGE CORPORATION'S NEW COPPER QUEEN CONCENTRATOR, BISBEE, ARIZ.

1 Filter Plant and Tramway Bridge, Feb. 1, 1921. 2 Dorr [illegible] April 1, 1921. 5 Secondary Mills from Roughing Table Floor, [illegible] Machine Shop [illegible] Feb. 16, 1921. 6 Roughing Table Foundations, March 1, 1921. [illegible] April 1, 1921. 3 [illegible] Mill Floor and Classifiers. [illegible] Roughing Tables Are Collected in the Flow Sheet

being erected. Grooves 3 in. wide in the floor provide [illegible] in. caulking.

A new series of experiments is in progress to determine the best design for the air outlets. Several types are under consideration, but nothing definite is yet forthcoming.

Twenty Plato finishing tables will receive and treat the flotation tailings, each table handling [illegible] tons. These tables, as well as the roughing tables, will be driven by individual motors. All tables are provided with concrete discharge boxes. The walls of these are 2½ in. thick, reinforced by [illegible] in. rods. Each tailing and each concentrate box is cast entire in a special wood-and-steel plate form and moved into place after setting.

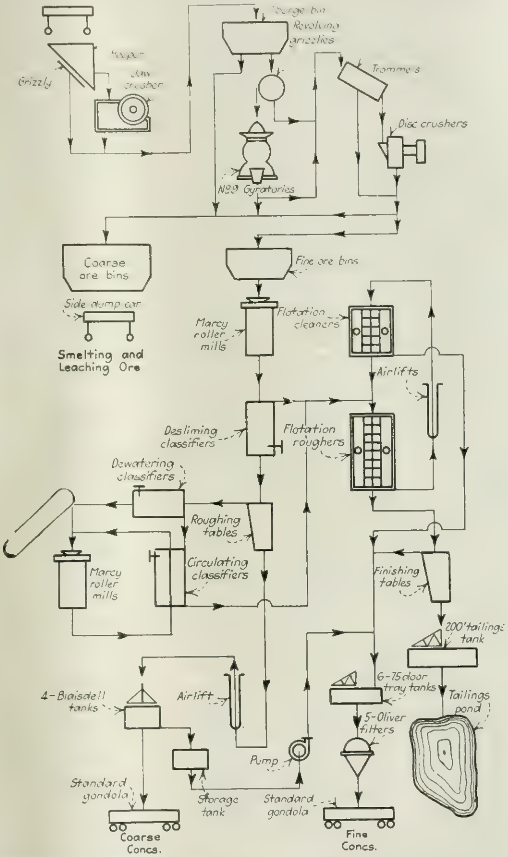
Flotation and finishing-table concentrates will be combined with the return from the Blaisdell tanks and thickened in six 75 ft. diameter Dorr tray tanks. The capacity of these is 1.02 tons per sq.ft. per hour for a total effective area of 42,450 sq.ft.

The dewatered concentrates will be lifted by two bucket elevators to five 14 x 14 ft. Oliver filters, from which, after filtering, they will drop into the fine-concentrate bins.

Dewatering of the final tailings is to be accomplished in a 200 ft. diameter Dorr tank. All Dorr tanks and the Blaisdell tanks, as well as several storage tanks, are of reinforced concrete.

Scarcity of water has made it imperative to reclaim all water possible. A total of 1,516 gal. is required per ton or ore treated. Of this, 376 gal. will be fresh, the remaining 1,140 gal. being returned from the Dorr tanks and filters.

Fresh water is to be obtained from the Calumet & Cochise shaft, a company property approximately 1,000 yd. on the other side of the mill. It will be pumped from the 1,800 level through a 200-ft. tunnel to a 1,000,000 gal. reservoir above the mill. A maximum use is made of the sloping mill site to provide a gravity flow of pulp. Belt conveyors, where used, have ball-bearing troughing and return idlers. All conveying and crushing machinery is equipped with an automatic electric interlock, preventing damage and delay due to stoppage of any one unit. Power will be obtained from the smelter power house at Douglas. A subsidiary Diesel plant, however, is installed at the mill site and will provide 6,000 hp. The buildings are all of steel, with corrugated iron siding and composition roofing, except the power house, which has concrete side walls, and the warehouse, which has a concrete roof. All foundations are of concrete. Construction throughout is extra heavy, to lessen the cost of replacements. A sample mill has been designed and will eventually be built. For the present, however, there is no need for it.



FLOW SHEET OF NEW COPPER QUEEN CONCENTRATOR, BISBEE, ARIZ.

It is expected that the completed mill will be in operation before five months have elapsed.

Minnesota Steel Buys Adjacent Acreage

The Minnesota Steel Co., a subsidiary of the U. S. Steel Corporation, has added to its holdings by purchasing 330 acres, which will give it all the water front between its present plant and New Duluth. There is some speculation as to the purpose for which this ground is to be used.

Bunker Hill and Hecla Combine To Operate Star Mine

Managers of Both Companies Confirm Report—Hecla Workings and Equipment To Be Used

The most important piece of news affecting mining operations in the Cœur d'Alene district, Idaho, that has been heard in many months is that regarding the combination of the Bunker Hill & Sullivan and the Hecla mining companies in taking over and operating the Star mine, reference to which was made in a recent issue of the *Engineering and Mining Journal*. The report has now been confirmed in a public statement authorized by Stanly A. Easton, manager of the Bunker Hill & Sullivan, and James F. McCarthy, manager of the Hecla. According to this statement, the two companies will co-operate in the development of Star ground which has been under option to the Bunker Hill & Sullivan company. The option price is not given in the statement, but from a dependable source it is learned that it is $750,000. The option has now been transferred to the Sullivan Mining Co., which will be the operating corporation, and the stock will be divided equally, 50 per cent each, between the Bunker Hill and Hecla companies. The plan of development is explained in the following paragraph taken from the statement:

"It is planned to use the Hecla workings and the Hecla equipment for development and mining the Star ground. A crosscut will be run from the 2,000-ft. bottom level of the Hecla to reach the Star vein, which it is estimated will have an approximate length of 8,000 ft. Preparation for this work has already begun. A special skip pocket at the 2 000-ft. station and a bin at the collar of the shaft will have to be constructed before development work begins, to handle the waste from the Star development and the output of ore. Work on these is now under way."

An interesting feature of the statement is the reference to the electrolytic zinc plant to be established by the Bunker Hill. Of this project the statement says: "The Bunker Hill company for upward of two years has been experimenting in the electrolytic reduction of zinc ores with special reference to the treatment of the zinc product from the Star mine. Substantial progress has been made in this experimentation and a small pilot test plant is now in operation upon zinc concentrates from the Star, and plans are being developed for a plant of sufficient capacity to treat local custom zinc ores from Pine Creek, Sunset and elsewhere as well as the entire Star output."

Silver King Coalition Arranges New Contract with A. S. & R. Co.

The Silver King Coalition Mines Co., of Park City, Utah, has settled its controversy with the American Smelting & Refining Co., so that it pays $2 more per ton than its contract requires, the contract being extended to Jan. 1, 1926, and the extra $2 being stated by the smelting company to be the amount it has been losing on the Coalition ores. According to the new arrangement the mining company will be given a market for low-grade sulphide ores, which up to the present time it has not been able to ship.

Independent Steel Companies Cut Wages

A reduction in wages and salaries of employees, effective June 16, has been announced by independent steel companies of the Pittsburgh and Youngstown districts. Although in all instances the amount of the cut was note definitely announced, it is assumed it will be 15 per cent, as the Brier Hill Steel Co. has announced that it has made such a cut.

Another announcement effecting the mill men has been made by the Jones & Laughlin Steel Co., of Pittsburgh, to the effect that all overtime will be abolished. This order follows the course set by other companies of recent date.

Miners' Wages in United States Show General Decrease

Wages paid metal miners in fifty non-ferrous metal-mining camps in the United States by sixty-one companies are given in the accompanying table. Wages paid on Jan. 1, 1919, Jan. 1, 1920, and at present are compared.

A COMPARISON OF NON-FERROUS METAL MINERS' WAGES IN THE UNITED STATES

State	Camp	No. of Companies Reporting	Class	Wages Jan. 1, 1919	Wages Jan. 1, 1920	Wages June 1, 1921
Arizona	Warren District	2	Machine men	$6.10	$6.10	$4.50
			Common labor	3.25—3.75	3.25—3.75	2.20—2.40
	Globe	3	Machine men	5.15—5.90	5.15—6.15	4.40—4.50
			Common labor	3.90—5.90	3.15—5.65	2.50—4.00
	Miami	1	Machine men	5.90	6.15	4.50
			Common labor	4.15	3.90	2.50
	Johnson	1	Machine men	5.00	5.00	5.00
			Common labor	4.00	3.50	5.00—5.50
	Huron	1	Machine men	..	6.15	5.15
			Common labor		5.50	4.50
	Oatman	2	Machine men	5.50—6.00	6.00	5.00
			Common labor	5.00—5.50	5.50	4.50
	Dos Cabezas	1	Machine men	4.00	4.50	4.50
			Common labor	3.00	3.50	3.00
	Jerome	2	Machine men	5.90—6.10	5.10—6.10	4.50
			Common labor	3.50—4.00	3.00—3.70	2.50—3.00
New Mexico	Mogollon	1	Machine men	4.50	4.50	4.25
			Common labor	3.50	3.50	3.25
Texas	Shafter	1	Machine men	2.75	3.00	3.00
			Common labor	2.00	2.25	2.25
California	Portola	1	Common labor	4.50—4.75	4.50	4.25
	Shawmut	1	Machine men	4.00	4.50	4.00
			Common labor	3.50	4.00	3.25
	Engelmine	1	Machine men	4.50	4.50	4.50
			Common labor	3.50	3.50	3.50
	Grass Valley	1	Machine men	4.00	4.40	5.00
			Common labor	3.00	3.25	3.75—4.00
	Copperopolis	1	Machine men	4.50	4.50	4.50
			Common labor	4.00	4.00	4.00
	Keswick	1	Machine men	5.00	5.25	5.25
			Common labor	3.75	4.00	4.25
	Plymouth	1	Machine men	4.00	4.50	4.00
			Common labor	3.50	4.00	3.50
	Sheepranch	1	Machine men	4.00	4.25	4.25
			Common labor	3.50	3.75	3.75
South Dakota	Lead	2	Machine men	4.00—4.25	4.00—4.25	5.00
			Common labor	3.60—4.00	3.60—4.00	4.25—4.50
Colorado	Hahn's Peak	1	Machine men	5.00	5.50	5.00
			Common labor	4.00	4.50	4.50—4.25
	Victor	1	Machine men	4.50	4.50	4.50
			Common labor	3.75	3.75	3.75
	Naturita	1	Machine men	6.00	6.00	5.25
			Common labor	4.50	4.00	4.00
	Cripple Creek	1	Machine men	4.50	5.00	4.50
			Common labor	3.75	4.25	3.75
	Aspen	1	Machine men	3.50 (a)	4.00 (a)	4.00 (a)
			Common labor	3.50 (a)	4.00 (a)	4.00 (a)
	Boulder	1	Machine men	5.50	5.50	4.50
			Common labor	5.00	5.00	4.00
	Telluride	1	Machine men	5.00	5.00	4.50
			Common labor	4.25	4.25	3.75
	Breckenridge	1	Machine men	5.25	5.25	4.75 (a)
			Common labor	4.75	4.75	4.25
[illegible]	Eureka	1	Machine men	4.75	5.25	4.25
			Common labor	4.25	4.75	3.75
	Park City	1	Machine men	5.25	5.25	4.25
			Common labor	4.75	4.75	3.75
	Alta	1	Machine men	5.00	5.25	4.25
			Common labor	4.50—4.75	4.75—5.00	3.75—4.00
	Bingham Canyon	1	Machine men	5.00	5.25	4.25
			Common labor	4.25	4.50	3.75
[illegible]	Battle Mountain	1	Craftsmen	5.25	4.75	4.75
			Common labor	4.75	4.25	4.25
	[illegible]	1	Machine men	5.50	6.00	Strike
			Common labor	5.00	5.50	Over 75c. cut
[illegible]	Wallace	3	Machine men	5.25	5.25	4.25
			Common labor	4.75	4.75	3.50—3.75
	Kellogg	1	Machine men	5.25	4.75	4.25
			Common labor	4.75	4.50	4.00
	[illegible]	1	Machine men	5.50	5.50	5.50
			Muckers	4.75	4.75	4.75
	[illegible]	1	Machine men	5.00	6.00	4.00
			Common labor	4.00	4.50	3.50
	[illegible]	1	Machine men	62½c	62½	56¼
			Common labor	50	50	44½
[illegible]	[illegible]	1	Machine men	4.50	4.50	4.50
			Common labor	4.50	4.50	4.50
	[illegible]	[illegible]	[illegible]	5.75	5.75	4.75
			[illegible]	4.75—5.00	4.75—5.00	4.25
[illegible]	[illegible]	1	[illegible]	5.25	5.75	Shut
			[illegible]	4.75	5.25	down
Washington	Valley	1	Machine men	5.50	4.50	Shut
			[illegible]	5.00	4.00	down
	[illegible]	1	[illegible]	5.00	5.50	Shut
			[illegible]	4.50	5.00	down
	[illegible]	1	[illegible]	4.50	5.00	4.25
			[illegible]	4.00	5.00	3.50
[illegible]	[illegible]	[illegible]	[illegible]	40—44c	49c	38—41c
			[illegible]	28—33c	39c	30—31c
[illegible]	[illegible]	1	[illegible]	50c	50c	35c
			[illegible]	[illegible]	[illegible]	20c
[illegible]	[illegible]	1	[illegible]	5.00	7.00	Shut
			[illegible]	[illegible]	[illegible]	down
	[illegible]	1	[illegible]	4.00	4.25—4.75 Jul 1	4.00
			[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1	[illegible]	4.00	4.50	[illegible]
			[illegible]	3.50	[illegible]	[illegible]
[illegible]	[illegible]	1	[illegible]	4.75	4.80	[illegible]
			[illegible]	4.50	4.60	2.70

(a) [illegible] 1920

Hearing Postponed in Suit of Union Sulphur vs. Texas Gulf

A preliminary hearing of the suit of the Union Sulphur Co. vs. Texas Gulf Sulphur Co. was held before the district court at Galveston, Tex., on June 6. The hearing was postponed until October at the plaintiff's request.

Peñoles Mining Co. Expands

Now Entirely Self-Contained—Supplies Its Smelters and Refineries With All Fuel, Ore, and Transportation

The Peñoles Mining Co. (Cia. Minera de Peñoles, S. A.), owning mines and smelters at Mapimí, Durango, is one of the most important and best-known lead and silver producers in Mexico. It has recently acquired all of the mines, smelters, and refineries belonging to the Cia. de Minerales y Metales as well as its share interest in kindred properties, thus consolidating into one organization all the interests heretofore separately held by the Cia. de Minerales y Metales and the Peñoles Mining Co., both of which are managed and controlled by the American Metal Co., Ltd. These properties also include important coal mines, fully equipped for production of the coal and coke required in the smelting operations of the Peñoles company. Included in this transaction is the transportation equipment of the Cia. de Minerales y Metales, consisting of thirty large locomotives, 700 railroad cars, and extensive repair shops in Monterrey. Thus the Peñoles company has become an entirely self-contained enterprise, furnishing to its own smelters and refineries all their fuel and ore requirements and the transportation thereof.

Mayo Silver Ore To Be Smelted At Selby

About 3,000 tons of silver-lead ore mined in the Mayo district of the Yukon will be sent to Selby, Cal., for smelting. The regulations of the Department of the Interior of the Dominion provide that it must be refined in Canada, but this shipment has been permitted by an Order in Council, in view of the fact that there are at present no Canadian smelters who can accept the ore.

Vogelstein Petition Dismissed

The U. S. Court of Claims has dismissed the petition of L. Vogelstein & Co. against the Government for $424,196 in connection with copper purchases during the war.

Oliver Iron Mining Co. Curtails

Operations of the Oliver Iron Mining Co., the mining subsidiary of the U. S. Steel Corporation, on the Gogebic Range in Michigan, were reduced by half June 20. In all, 2,500 men are now working day shift only on that range. Shipments from stock have also been cut in half. Similar action has been taken on other ranges.

On the Mesabi, the Oliver company will reduce its open pit and underground forces 25 to 30 per cent at once in the Hibbing and Chisholm districts.

Officials in Washington who are keeping close to the Russian situation are of the opinion that no great amount of gold still is held in Russia. Purchases being made in that country have decreased more and more.

NEWS FROM WASHINGTON

By **PAUL WOOTON**
Special Correspondent

Time for 1920 Assessment Work Not To Be Extended

House Committee Refuses To Concur in Resolution Passed by Senate

No further suspension of assessment work requirements on mining claims will be authorized. Rights to claims will lapse on July 1 if the statutory $100 worth of labor has not been performed. The Senate passed a bill suspending assessment work up to and including June 30, 1921. The Committee on Mines and Mining of the House, however, refused absolutely to concur in the proposition, and, after extended discussion of the subject, voted against the bill. Only one vote was cast for a favorable report on the bill. This action of the House Committee is expected to put an end to the constant agitation for the continued suspension of assessment work.

Though the Senate passed the exemption bill without a rollcall being demanded, it was evident that there was no great amount of enthusiasm for the measure. Senator Smooth, of Utah, said it ought to be thoroughly understood that no further exemption should be allowed, even if the present bill should become a law. "If we are going to develop mines in the West," he said, "we cannot develop them by continually exempting the assessment."

The bill, as it passed the Senate, contained a proviso that, to secure the advantage of the act, notice would have to be filed before Aug. 1. It was argued that this time was insufficient, for the reason that information as to that action would not reach many holders of mining claims in time. It would give an unfair advantage to the claim holders who have access to newspapers and journals, Senator Smoot argued.

Senator Walsh, of Montana, insisted on the passage of the bill and on the retention of Aug. 1 as the date of notice, so that knowledge could be had as to the claims which have been abandoned during the last three and one-half years.

The hard work done in the Senate to secure the passage of the bill came to naught, however, as the action of the House committee eliminates all chance of securing the legislation.

Fall Withholds Recommendations On War Minerals Relief

The Secretary of the Interior expects to make no rulings as to war minerals relief policies until he has received the recommendations of Ira E. Robinson, the new commissioner.

The status of war minerals relief affairs, as of June 11, is as follows: Unexpended balance of the appropriation, $4,672,021.91; total amount recommended for award on 380 claims, $3,441,860.06; number of claims recommended for disallowance, 824; amount involved in disallowed claims, $9,507,805.99; total administrative expense, $386,118.03, or 2.07 per cent of the total amount of the claims considered.

Would Lease Mineral Lands Differently in Four States

Senate Committee Reports Bill Amending Act Admitting Montana, Washington, and North and South Dakota to Union

A new basis for leasing mineral lands in Montana, Washington, and North and South Dakota is provided in a bill which has been reported out of the Senate Committee on Public Lands with the recommendation that it be passed. The measure amends the act which admitted these states to the Union and authorizes the leasing of mineral lands for a longer period than that fixed in the original act. The original statute provides that public lands granted to these states may be sold at not less than $10 per acre, or leased for periods of not more than five years. The committee recommends that the law be changed so as to bring these lands under the General Leasing Act.

Senator Walsh, of Montana, points out that it is quite appropriate to provide for the sale of agricultural land at not less than $10 per acre and that leases should not be for periods greater than five years. He calls attention to the fact, however, that ordinarily lands believed to be valuable on account of the mineral contained in them are not salable at any price, or by reason of their highly speculative character can be sold for cash in an amount very much less than development may show to be their actual value. Such lands, he says, usually are acquired in these states under what is known as a lease and bond, by which the prospector goes into possession without an initial payment upon an agreement to carry on certain development work and to pay a royalty on any mineral he may extract, with the right to purchase within a period named in the instrument.

The Public Lands Committee is of the opinion that mineral lands should not be sold, but should be leased for a twenty-year period as is prescribed in the General Leasing Law.

Government's Silver Purchases

Purchases of silver under the Pittman Act during the week ended June 18 totaled 918,000 fine ounces. This brings the total purchases under this act to 59,331,697 fine ounces.

Fall's Statement on Petroleum in Mexico Twisted

Effort To Depress Value of Oil Stocks Seen—Secretary Said Reserves Were Large

Bearish interests on the Stock Exchange have used a recent letter of the Secretary of the Interior in a clever way in their effort to depress the value of Mexican oil stocks. Entirely erroneous deductions have been made from the letter, even by some of the more careful news services. The full text of Secretary Fall's letter, which was written to the Secretary of State on May 27, is as follows:

"It is generally reported that some of the important fields that swelled Mexico's output in 1920 are being rapidly drained of their oil, although reports differ widely regarding the extent of the depletion. Mexico contains oil reserves that have been conservatively estimated by this department at 4,500,000,000 bbl., but the present issue relates to Mexico's ability to maintain her production from this reserve at the rate established in 1920 in response to market demand. Public concern naturally springs from the lack of unquestionable information regarding the results from drilling done and in progress and the development of new fields of the type that yield the present production.

"The information at hand in this department is not of the authenticated nature requisite to the formulation of a report to Congress and to the public on a question so critical as that of the prospective output of oil in Mexico."

It is clear that Secretary Fall's point is that there are large reserves of petroleum in Mexico and that it is only a matter of the relative speed of production and consumption.

There are many indications that those most interested are taking no stock in the pessimistic reports and rumors as to Mexican oil production. It is pointed out that the Dutch interests are expending large sums of money for additional tank steamers. Practically all of the large producers in Mexico are spending enormous sums on pipe lines. One of the companies is building a $175,000 hospital, an improvement which would not be made unless there were expectation that its activities would expand.

The present controversy centers around the report of a business man who made an investigation for the Shipping Board. This is pointed to as another example of probable consequences when a business man is sent to make a report on a technical subject. "It is like sending a geologist to examine a bank," says the head of one of the important technical bureaus in Washington.

Need for Separate Department Of Mines Pointed Out By Shortridge

Senator Shortridge in supporting his contention that there should be a separate Federal department established (as proposed in his bill reported last week) in recognition of the basic importance of the mining industry, said in part as follows:

"A grave danger exists in that there is now no adequate system of obtaining and recording data relative to the mineral industries such as was shown to be of first importance to the successful prosecution of the war. Such data would even in peace time be of inestimable service to the Government and the public in co-ordinating and bringing about a wise balance of development of resources as a basis for trade.

"No adequate system now exists for investigation or inspection of the manufacture and handling of explosives, and the misuse of these materials is a constant source of danger and loss to the public. While responsibility must in the main rest upon the states for regulation, the power to investigate and report, together with the power to regulate transport in interstate commerce, may be properly used to remove a large portion of this danger. . . .

"Power development is at the heart of all industry, and only by introducing more power will it be possible to sustain and enlarge American industries of all kinds without opening the doors to the unlimited influx of labor from all the world. Power comes from water and fuel, and any large schemes for cheaper power development can only be realized with a thorough knowledge of the distribution and character of the water and fuels available. For this reason it is proposed to centralize in the Department of Mines and Mineral Resources the activities of the Federal Government as regards power.

"Ten years ago, in response to an insistent public demand for a Department of Mines, a bureau of mining, metallurgy, and mineral technology was created in the Department of the Interior by Congress. In a report favoring establishment of such a bureau made by the House Committee on Mines and Mining (59th Congress 1st Session, Report 1184) this statement was made:

"'What the Congress may ultimately do toward further recognition of this industry must necessarily be largely a matter of growth as the situation develops. Several of the executive departments have started as bureaus and have been enlarged from time to time as their work and its importance grew. The committee hopes that such may be the case with the legislation under contemplation.' . . .

"The United States is the largest producer of minerals in the world and one of the few powers which has no department of mines. With the largest industry our Government has done relatively the least to help the miner and has been repeatedly forced in the face of grave national emergency in time of war or domestic strife to resort to temporary organization in order to collect and compile the necessary facts, to say nothing of determining a policy. An informed, alert, fact-finding organization in intimate touch with all branches of the mineral industry is of first importance and will be a national asset."

NEWS BY MINING DISTRICTS

London Letter

Latest Report of Zinc Corporation Unfavorable—Another Gold Discovery Alleged in Nigerian Tin District

By W. A. Doman

London, June 7—In consequence of the labor troubles at Broken Hill and elsewhere, the report of the Zinc Corporation for the last calendar year makes a very unfavorable showing. This is not surprising when one remembers that operations were suspended for a period of nineteen months. Work was only possible for about the last three or four weeks in December, and on resumption the expenses of unwatering the mine reached the high figure of 3s. 2d. per ton of ore treated. The total cost of mining and milling was 48s. 4d., a substantial and serious advance upon the 27s. 6d. ruling in the previous year.

Doubtless to assist costs, the grade of the ore mined was high, namely, 10.4 per cent zinc, 2.8 oz. silver, 17 per cent lead, as compared with 9.1 per cent zinc, 2.8 oz. silver and 15.5 per cent lead during the previous period. The recoveries of silver and lead in the lead concentrates were 79.1 per cent and [illegible] per cent respectively, rather better than before, owing to the higher grade of the ore. The zinc recovery was not quite so good, [illegible] per cent against [illegible] per cent, owing to the zinc in the slime middlings not being recovered during the latter portion of the period.

Little in the nature of development work could of course be done, so that the ore reserves show scarcely any variation. At Dec. 31 last there were 2,115,700 tons, averaging 14.6 per cent lead, 2.6 oz. silver and 9.4 per cent zinc, as compared with 2,114,600 tons with the same metallic contents a year earlier. These figures do not include the zinc lode. The quantity of tailings left on the dumps is 664,633 tons. Even now operations at the mine are restricted, showing that the wage award made last September involves conditions that at the present price of lead cannot profitably be fulfilled. The result is that productive work is restricted to the zinc-treatment department. The preference shares, which before the war were considered one of the finest of mining investments, do not receive any dividend for the second half of last year, the matter remaining in abeyance until conditions at Broken Hill improve.

I have previously referred to the discovery of gold in Nigeria. It sometimes happens that when one company has a find, the manager of another is stimulated to search and also makes a discovery. Within the last few days, the Dua Tin Co. reports having found a deposit giving high values in gold, say 1 oz. to the cubic yard. The news naturally excites curiosity, and the market is awaiting further news. Another company, the Akoko Main Reef, reports having struck a rich new shoot at a depth of 350 ft. yielding by assay "phenomenal results." The figures have evidently been cabled over here, but are not published; confirmation, however, has been requested. There may be a good deal in the gold discoveries at present being reported in West Africa, but some skeptics attribute the matter rather to a desire to invigorate the share market.

MEXICO

Sinaloa

Santa Cruz de Ayala Properties Change Hands

San Lorenzo District—J. T. Wallace and associates, of New York and Bisbee, Ariz., have recently acquired large copper holdings in the San Lorenzo district near the station of Quila, on the Southern Pacific Ry. of Mexico. Development work will start at once on these properties with the intention of blocking out a large tonnage of copper-silver ore. This company will probably connect its holdings with the main line of the Southern Pacific at Quila with a railroad of its own to facilitate transportation of supplies.

At Santa Cruz de Ayala the properties of the old West Coast Mining Co. have been taken over by Frank Noble, John R. Roper, and Enrique Peña. They have large holdings in the Santa Cruz section, and are now installing machinery and a complete cyanide plant to treat the old tailings from the concentrator. These properties were worked extensively over 100 years ago and have a large record of production. The property is equipped with a ten-stamp mill and Wilfley tables. The concentrates shipped assay about 650 oz. silver and 3 oz. gold per ton, leaving about 16 oz. in silver in the tailings. This will be cyanided in the future, and experiments show that a saving of 80 per cent of the value can be made from these tailings.

Cosala District—At Cajon de Minas the Prieta mine being operated by E. A. Montgomery and associates is again ready to operate the thirty-ton flotation mill. The ore is complex, and on account of the zinc contents some difficulty has been encountered in getting good extraction. The mill has recently been reconstructed, and it is expected that a good extraction will be made when operations are resumed.

Mocorito District — The Los Cuates (meaning "twins") mine is under option to J. Q. Kiler and associates from California. This property is near the famous Santiago de los Caballeros properties which are now being worked by the same parties. The Cuates was a famous silver producer before the revolution and has been worked for fifty years by the Piero family living at Pericos, in the State of Sinaloa. The ore was of such a grade that they experienced heavy losses during the revolution, shipments of native silver being made which averaged 95 per cent in silver, with no gold. The property has a ten-stamp mill, with pan amalgamation to treat the low-grade ores. This will be put in order at once by the new purchasers, and operations will begin on a large scale.

Senator Zerapio Lopez, Gaston Schwob and Ernesto Espinosa are installing a five-stamp mill on their property near the Potrero mines. This is a gold property and said to contain high values.

Denouncements continue to pour into the mining agencies, and it is expected that with the recognition of the Obregon government there will be an unprecedented boom in the mining circles of this section of Mexico.

Durango

San Juan de Mata Mine Sold to Filer and Innes

Copalquin District—The San Juan de Mata mine, at the town of Chihuahuilla, in extreme western Durango, has been sold by the Rocha Company, of Mexico City, to Filer and Innes, of San Francisco. This property has been a famous producer of silver and gold for many years. Several million dollars of high-grade shipping ore have been sent to Selby in San Francisco by the previous owners. There is said to be a large tonnage of milling ore in sight, carrying 40-50 oz. silver. The new owners intend to dismantle the old five-stamp mill which is now on the property, and install a modern mill with flotation and cyanide. This property with modern methods installed gives promise of making one of the big silver producers of western Mexico. The consideration in this sale is not known.

Topia District—On the Sianori Creek, near the township of Sianori, W. G. Pike and associates are developing a gold property recently acquired. This is said to contain good values in silver as well as gold and it is the intention of the purchasers to install a mill as soon as development will warrant.

Zacatecas

Relocation of Old Properties Continues

Sombrerete—The mining agency at this place has recorded a number of filings during the past month. American mining men who have taken up new properties in the camps included in this district are John Emerson, Charles E. Snider, Gerald Norton and George Davis. A number of old mines recently forfeited for non-payment of taxes have been relocated and several new groups of prospects have been filed on.

CANADA

Ontario

Value of Nipissing's Output for Five Months Decreases $1,000,000

Porcupine—At the Dome mines the stamp equipment which has not latterly been in operation has been overhauled, bringing the capacity of the mill up to about 1,400 tons daily.

The North Crown has suspended mining operations pending financial readjustment. The exploration campaign carried out with a view of finding new orebodies did not meet with the success anticipated.

Kirkland Lake—The first clean-up has been made at the Wright-Hargreaves after the mill had been in operation for about a month. Details have not been given out. The mill is heating approximately 140 tons per day.

The new orebody recently discovered at the 900 level of the Kirkland Lake is being opened up. The vein is stated to contain an average gold content of about $20 per ton across a width of 7 ft.

The shaft of the Bidgood is being dewatered preparatory to resuming work.

Cobalt—During May the Nipissing mined ore of an estimated net value of $142,036, and shipped bullion from Nipissing and customs ore of an estimated net value of $61,207. For the five months ended May the money value of production shows a decrease of nearly one million dollars as compared with the corresponding period of 1920, the figures being $724,434 for the current year as against $1,731,464 for the first five months of last year.

British Columbia

Troy—The Consolidated Silver-Lead Mining Co., a consolidation of the Silver Tip, J. P. Lead, and Troy mining companies, is arranging to extend its No. 3 tunnel, which has been driven 475 ft. and has to go 350 ft. further to cut the vein. There are twenty-six claims in all, located on Grouse Mountain, Lincoln County, about twelve miles from Troy. The values are in silver, lead, and zinc.

Sandon — About thirty-five men are employed on outside work in preparation for the extension of milling facilities of the Silversmith mine. Two cars of crude ore have been shipped recently to Bunker Hill smelter, at Kellogg, Idaho, as a test.

Salmo—The Nugget is maintaining an output averaging 80 tons per day, with a crew of thirty-five men. It is possible to increase the mine output to 100 tons, if skilled miners can be obtained. No shortage of other labor is reported. Ore is also being taken from the Motherlode. Improved mill efficiency is reported by the management. The outlook is regarded as good for a satisfactory season.

Alberta

Edmonton—Gold is reported to have been discovered on Cadotte river, about seventy miles notheast of Peace River town.

WASHINGTON

Iron Creek Mining Co. Adding Cyanide Plant to Mill

Seattle—The state mining commission began an investigation early in June, in an effort to find the true financial status of the coal companies, so as to arrive at satisfactory recommendations to operators and miners with a view to ending the shutdown of coal mines in this state.

Keller—The Iron Creek Mining Co., which practically completed a 20-ton mill last year, is adding a cyaniding section, with a view to securing a better saving than is possible by milling alone. Values are in silver and lead, with a trace of gold. It is anticipated that production will be started in August, this year. About ten men are at present employed on development and mill work.

Preparations by R. H. Blevins, for development of a large acreage controlled by him, is proceeding favorably.

Springdale—A contract has been let for hauling ore from the Queen and Seal mine, in the Deer Trail district, to the S. F. & N. station at Springdale. About 125 tons is reported to be ready, with more being taken out.

The Security Copper Co. has started development of the Chamokane and Copper Butte groups, west of here. Some prospecting is being done by the same company on the Security group, near Chewela.

Kettle Falls—The main crosscut in the Silver Queen mine, after being driven 1,070 ft., cut the vein at a vertical depth of 400 ft.

Chewelah—No indication of activity on the part of magnesite producers in this section is manifest, although the American Refractories Co. has had 500 tons of burned magnesite moved from the Double Eagle mine to Valley, for shipment east. This material was mined and burned before operations came to a standstill last fall.

Quinalt — The Big West Copper Syndicate, which has been developing a group of copper-bearing claims in the Olympic Mountains at the headwaters of south fork of the Quinalt River, has been forced to discontinue work for a short time until the snow is entirely gone, in order that more surface prospecting may be carried on. Spokane capital is behind the venture to a large extent. The original discoveries were made just before the war by trappers, and the ground remained unworked until last year.

Northport—Because of cessation of operations at the smelter here many residents have been removing to other places. Definite information as to intentions of Northport Smelting Co. as to resumption of operations are entirely lacking. Rumors, however, are plentiful. The bulk of the ores treated locally have come from the Day partnership properties; namely, the Hercules and the Tamarack & Custer, in the Cœur d'Alenes, and some ore has come from the Day properties at Republic. The increase in freight rates has added another unfavorable factor to the differential that has always prevailed against Cœur d'Alene ores brought here for reduction.

Republic—San Poil and Knob Hill mines are among the local properties which will probably produce a good tonnage this season. The former is credited with having 3,000 tons broken and ready for shipment. Re-establishment by the Great Northern of the old freight rate has given a decidedly healthier tone to mining in this section and revival of interest in gold mining also improves the outlook. Because of its being largely of a self-fluxing nature Republic ore is much desired by smelters of the Northwest.

Spokane — The Montana Phosphate Co., operating at Maxville and Philipsburg, Mont., has moved its general offices from Maxville to Spokane.

OREGON

Gold Mining Industry Reviving Around Baker

Baker City—A marked revival in gold mining activity in the territory surrounding Baker City appears imminent. Many properties, long inactive, show signs of re-opening, and inquiry for likely-looking ground is very much improved.

MONTANA

Lukens-Hazel To Resume When Lead Reaches 5½c.

DeBorgia—Installation of compressor equipment by the Silver Pick Mining Co. on what was formerly known as the Rock Island group is planned. The property has been under development all winter.

Troy—Snow Storm Mines Consolidated is maintaining a crew of about seventy men. Development consists of drifting on No. 7 level, with some upraising. There is no prospect of early resumption of operation.

Libby—A [illegible] ft. boarding house, capable of accommodating seventy-five men, is being built at the Lukens-Hazel mine. It will adjoin the mill, which was completed last year. Officially, it is announced that as soon as lead reaches 5½c. per pound the mill will be started to capacity production.

Dunkleberg—Ore development in the Butte & Western Mining Co's. Forest Rose property is reported progressing satisfactorily and plans for building a concentrator at Jens, Mont., are being considered. The first-class ore is said to average $80 per ton and the second-class from $20 to $25.

Elkhorn—Arrival of ball mills for the 700-ton concentrator of the Boston & Montana Development Co. is reported, and the installation of machinery is under way.

Philipsburg—Shipments monthly by the Philipsburg Mining Co. are aggregating fifteen carloads of silver ore, carrying an average of 50 oz. per ton and forty carloads of manganese ore.

Champion—The Butte & Jardine has started three eight-hour shifts at the Champion mine and the 150-ton mill is reported to be operating at capacity. Returns of over $6,000 have been received from a carload of concentrates. Another car has been shipped. The Atchison farm adjoining the Champion group of claims has been purchased for $5,000. Five of the Champion veins are believed to strike through this property.

Butte—Gossip is to the effect that Anaconda is planning to resume operations early at one of its larger copper mines, confining itself to a limited production of high-grade ore, which will be utilized for furnishing metal to the wire works. Although no mine has been mentioned considerable talk has revolved around the West Colusa property.

Appraisers for the Anaconda have been looking over the plant of the du Pont powder works, several miles west of Butte. The du Pont interests have suspended operations and plan to abandon the works. A large part of the machinery has already been shipped to Chile, but the tanks and vats will be left, and it is said that Anaconda has these in mind as being of possible use were the plant to offer any advantages in connection with the corporation's entry into the field of the manufacture of fertilizer.

IDAHO

Mill at Armstead Mines To Be of 150 Tons Capacity

Talache—Definite announcement has been made by Major H. H. Armstead as to the capacity of the mill to be built this summer at the Armstead mine. The plant will be able to handle 150 tons per day. Development of the mine continues with a crew of about twenty-five men, with work concentrated on the main raise. About 100 men will be employed when mill construction gets under way. A new motor road is being built to connect the scene of operations with Sagle, the shipping point on the Northern Pacific R.R.

Bonners Ferry—The annual meeting of the stockholders of the Cyanide Gold Mining Co. was held here on June 7, and was attended by shareholders from Montana, Washington and Idaho points. Official reports presented indicated the near apporach of the project to the production stage, despite many difficulties encountered in financing at present.

COLORADO

Ouray, Telluride, and Silverton Isolated by Floods—Cripple Creek More Active

Ouray—The long-delayed spring thaw has begun, and is causing much damage from floods. The Uncompahgre River is over its banks, threatening bridges and damaging property. The suspension bridge carrying the air-pipe line from the compressor to the mine of the Union property has been wrecked, and the pumphouse had to be moved to save it. The railroad brings passengers and first-class mail only to within two miles of the town, but freight and express have been abandoned. The auto and wagon road paralleling the railroad is also in very bad condition, and supplies are becoming somewhat scarce. Neighboring mining towns, particularly Telluride and Silverton, are having the same experience, being still more isolated.

Cripple Creek—Mining activity appears to be increasing in the district, and a number of new leasing pools have been formed recently. Numerous properties are operating two shifts per twenty-four hours. Former Cripple Creek miners have been returning from other states, and an abundant supply of labor is now available. It is the general belief that the usual mine assessment work should be done this year, so as to insure employment to many miners who might otherwise be out of work.

CALIFORNIA

Argonaut Mine Resumes Operations

Jackson—The Central Eureka is increasing the capacity of its tailings dam.

The Argonaut mine has resumed production. Unwatering of the Kennedy is expected to be completed in the near future.

Grass Valley — Empire Mines has shut down its Pennsylvania unit. Pumping only is being continued. About seventy-five are affected. The ore is said to be too low in grade to permit operation under present conditions.

ARIZONA

United Verde Extension Passes Quarterly Dividend

Jerome—United Verde Extension has passed its quarterly dividend for the first time since it began dividend payments in August, 1916.

Miami—Inspiration Consolidated has bought twenty mining claims on Pinto Creek for $44,000. These are 12 miles from Miami.

Superior—The Silver King of Arizona mine is to be sold by the sheriff July 6. There is a report in local circulation of the formation of a new corporation in New York to take over the old mine and to work so as to use the low grade ores by installing a large mill.

THE MARKET REPORT

Daily Prices of Metals

June	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
16	12.60@12.75	28.75	29.25@30.25	4.375	4.20	4.40@4.45
17	12.60@12.75	28.50	29.25	4.375	4.15	4.40@4.45
18	12.625	28.75	29.50	4.375	4.125	4.40@4.45
20	12.50	28.25	29.25	4.375	4.125	4.40@4.45
21	12.50	28.00	28.75	4.375	4.125	4.40@4.45
22	12.50	28.00	29.00	4.375	4.125	4.40@4.45

*These prices correspond to the following quotations for copper, "delivered": 12.85@13; 12.85@13; 12.875; 12.75; 12.75 and 12.75c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

June	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
16	72⅝	72⅞	77	170¼	172¾	22¼	22	26¾	27½
17	71⅞	72⅛	77	167½	170	22⅛	22	26¾	27⅜
18	..	...	...	....	....	...	...	...	.
20	71	71⅛	76	166½	169	22⅛	22	26½	27¼
21	70¾	70½	75	164½	167¼	21¾	21⅝	26½	27
22	70¼	70¼	74	164	166¾	21⅞	21¾	26½	27

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

June	Sterling Exchange	Silver			June	Sterling Exchange	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York, Foreign Origin	London
16	379	99¼	58	34⅝	20	378	99¼	59⅞	35¾
17	378⅞	99¼	58⅜	34⅞	21	375	99¼	59¼	35⅝
18	378	99¼	59	35¼	22	374	99¼	58¾	35⅜

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, June 22, 1921

No improvement can be detected over the depressed conditions reported last week. Consuming demand is practically absent, and speculators are in general also holding aloof.

Copper

Prices show a further decline, owing to pressure to sell in a stagnant market on the part of one or two small producers and some of the dealers. The larger producers are doing practically no business, as they are unwilling to sell, even to favored customers, for less than 13c. delivered, and it is understood that the largest interest of all refuses to quote under 13.5c.

Export demand has been quiet, as would be expected in view of the violent recession in exchange during the last few weeks. Germany has been the only buyer of importance through the Copper Export Association, at prices ranging from 13.50c. early in the week to 13.25c. at present. Japanese interests have been nibbling, but actual business in that quarter seems to be lacking.

Lead

The official price of the American Smelting & Refining Co. was reduced late today from 4.50 to 4.40c. Business is reported to be slightly better but demand is still weak, and some producers report no business at all. The white-lead industry is now about the only important consumer of lead, but this business seems to be flourishing. Paint is not being used much for general industrial purposes, but seems to be in excellent demand at good prices for painting buildings. The important producers of lead are not anxious for business at present prices. Were it not for the presence of weak interests and small demand, it is almost certain that the price of lead would be much higher than at present. Production continues to decrease. Only recently the Granby smelter has closed down, and this brand is now understood to be off the market. Chemical lead is obtainable at the same price as desilverized at present, although recently it has generally commanded a slight premium. The last shipment of Spanish lead under existing contracts reached this country during the week, and it is unlikely that more will be imported, despite absence of a market in England.

Zinc

The price has held steady, with practically all interests quoting 4.45c. St. Louis and the producer who is selling at 4.40c. getting most of the business. Galvanizers continue off the market. Despite the absence of demand, the price seems to be pretty firmly pegged at present levels. High-grade zinc is selling for 6.25c., freight allowed, a few carloads having been marketed during the week.

Tin

A bear raid on the tin market occupied the attention of traders last Thursday and resulted in a rapid recession of the price through an unusual range. Straits tin seems to have fallen definitely below 30c. now, a condition totally unexpected a few weeks ago. Most of the consuming demand is on the part of mixed-metal manufacturers for the lower grades of tin. Sellers of 99 per cent grade are not anxious to get rid of the metal without being assured of replacements. There is practically no price differential for futures. Electrolytic is in small demand at or slightly below Straits.

Arrivals of tin, in long tons: June 15th, Buenos Aires, 60; China, 15; 18th, Buenos Aires, 53; 20th, Australia, 5.

Gold

Gold in London: June 16th, 108s. 7d.; 17th, 108s. 5d.; 20th, 108s. 1d.; 21st, 109s. 1d.; 22d, 109s. 7d.

General stock of money in the United States: Gold coin, $3,175,037,198; standard silver dollars, $284,142,326; subsidiary silver, $271,128,299; United States notes, $346,681,016; Federal Reserve notes, $3,083,680,655; Federal Reserve Bank notes, $172,474,400; National Bank notes, $740,593,359; total, $8,073,737,253. Money in circulation, $5,983,258,293; circulation per capita,

$55.43. The gold holdings increased about $85,000,000 during May and the notes outstanding decreased about $94,000,000.

Foreign Exchange

Exchanges strengthened somewhat during the first three days, but since Monday a recession has again occurred. On Tuesday, June 21st, francs were 8.04c.; lire, 5.005c.; and marks, 1.43c. New York funds in Montreal advanced to 13 3/16 per cent premium.

Silver

The silver market was firm the last week, and advanced in London from 34⅝d. on June 16 to 35¾d. on June 20 on Indian bazaars' buying. There has also been a fairly strong demand in the New York market for China shipment from San Francisco. The higher prices brought out sellers, and with buyers satisfied the market reacted and closed dull and lower. There are rumors that Germany, for reparation purposes, is trying to arrange loans against about 30,000,000 ounces of silver in various parts of the world, from which it can be inferred that the silver is not likely to be sold in a hurry, but may be sold eventually and probably through the London market. Financial interests here are not likely to tie up capital by loans on collateral which is not to be definitely liquidated. The action of the British government in respect to the surplus of silver arising from the reduction of the mint assay of silver coin is difficult to forecast. There have been some further imports of German silver to this country, which are due to the duty of 26 per cent imposed by the Reparation Act on imports of silver into England.

Mexican Dollars—June 16, 44½; 17th, 44¾; 18th, 45¼; 20th, 46; 21st, 45½; 22d, 45¼.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 22@23c. per lb.; 22[illegible] for imports, duty paid.

Antimony—Chinese and Japanese brands, 5@5¼c.; market dull. W.C.C. brand, 5½@5¾c. per lb. Cookson's "C" grade, spot, 9⅝c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb., 500-lb. lots.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1[illegible] per lb.

Cobalt—Metal, $3 per lb.; black oxide, $[illegible] per lb. [illegible]; sulphate, $1.35 per lb. [illegible]

Iridium—Nominal, $[illegible] per oz.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnage lots, spot, [illegible]

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—$75 per oz.

Quicksilver—Nominally, $46@$48 per 75-lb. flask. San Francisco wires $48.50.

[1]**Rhodium**—$150 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $30; ground, $35; f.o.b. Atlantic ports. Quotations are nominal. Market very dull.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55. Prices have been reduced $1 per ton for the 1921 season. Large stocks of ore are reported. Chief shipments are by the producer-consumer class (U. S. Steel Corporation.) Shipments of merchant ore are expected to be light.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5.80; old bed concentrates, 63 per cent, $6.70; Harmony, cobbed, 63 per cent, $6.70; new bed low phosphorus, 65 per cent, $9.50.

Manganese Ore — 25c. per unit, seaport; chemical ore (MnO_2) $55@$60 per gross ton, lump; $70@$75 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¾@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., June 18—Zinc blende, per ton, high, $27.50; basis 60 per cent zinc, premium, $21; Prime Western, $20.50; fines and slimes, $20@$17.50; average settling price, all grades of zinc, $21.64.

Lead, high, $59.45; basis 80 per cent lead, $45@$40; average settling price, all grades of lead, $47.92 per ton.

Shipments for the week: Blende, 4,744; lead, 1,628 tons. Value, all ores the week, $180,670.

Lead settlements average high, on account of slow delivery of ore purchased several weeks ago, before prices began the sharp and continued decline, the basis price having receded $20 per ton in five weeks.

Platteville, Wis., June 18—No sales of zinc or lead ore. Shipments for the week, none. Shipments for the year: Blende, 11,461; lead, 910 tons. Shipped during week to separating plants, 338 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,700@$2,000; No. 2, $1,200@$1,500; spinning fibers, $400@$800; magnesia and compressed sheet fibres, $275@$400; shingle stock, $95@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7@$10 per long ton, f.o.b. Cartersville, Ga. No Southern ore shipments, because of shutdown of lithopone plants and barium chemical plants. Prices largely nominal.

Bauxite — French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $20 per gross ton, f.o.b. shipping point.

Chalk—English, extra light, 5@5½c. Domestic light, 4½@5c.; heavy, 4@4½c per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $7@$9; washed, $[illegible]@$10; powdered, $13@$20; bags [illegible], per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $[illegible], f.o.b. American ports; powdered, $[illegible]@$30, f.o.b. New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3¼c., f.o.b. New England points.

Feldspar—Crude, $[illegible]@$10 per gross ton, f.o.b. Maryland and North Caro lina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@ $23 per ton, ground, f.o.b. Maine. No. 1 Canadian, $26@$28, f.o.b. cars. Market quiet; prices largely nominal.

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[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $13.50, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $30, New Mexico. Good demand for ground grades in West. Shipments of gravel to Pacific Coast indicate improvement in Western steel business.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@ $27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 7@7½c. per lb.; chip, 5½@6c.; dust, 3¼ @4c. No. 1 flake, 6½c.; amorphous crude, ¾@2¼c. Market quiet.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@ $15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned — $33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.; No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@ $4; No. 2, $4.50@$6; No. 1, $5.50@ $6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); ground roofing mica, $25@ $70, all f.o.b. New York.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@ 74 per cent, $11; 70 per cent, $6.75; 68 per cent, $6.25; 68@66 per cent, $6.

Pumice Stone—Imported, lump, 3@ 40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 14c., c.i.f. Atlantic seaport; furnace size, 14c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 12 @ 14c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $8@$12 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic — White arsenic, 6½c. per lb. in carload lots.

Sodium Nitrate—$2.85@$3 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $18@$20 per ton, f.o.b. Western mines, spot and six months' contract; $33@$35 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.50@$1.75 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 14c. per lb. of chromium contained; 4 to 6 per cent carbon, 15c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $75@$80, f.o.b. furnace; resale, $90, delivered; English, $75@$80, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $28@$32, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works. Imported material, $1.70@$2.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $40@$42; 50 per cent, $68@$72; 75 per cent, $140 @$145.

Ferrotungsten—Domestic, 70 to 80 per cent W, 50@55c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$5@$6 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 21¼@21½c. per lb.; wire, 14¼ @14½c.

Lead Sheets—Full lead sheets, 8.25c.; cut lead sheets, 8½c. in quantity, mill lots.

Nickel Silver — 31½c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets 17¾c.; sheathing, 16¼c.; rods, ⅝ to 3 in., 14¾c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina, $35@$50 per ton, f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $60@$65 per net ton, shipping point; arches, keys, wedges, $66; splits, soaps, $84.

Fire Brick—First quality, 9-in. shapes, $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $70 @$75 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000: $35@ $45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, June 21, 1921

Several of the larger independent mills are preparing for a shutdown of indefinite duration at the end of this month. Many small plants have been closed for several months.

The Steel Corporation's drop to a 30 per cent operating rate proves to have been only temporary, as the latest report shows a 35 per cent operation. Including in the reckoning the independent plants that are entirely idle, the average operation by the independents is about 15 per cent, making a rate for the industry of between 23 and 24 per cent. From the smallness of the flow of specifications and orders a rate of about 15 per cent may be predicted for July.

Following the recent $5 a ton decline in wire products, brought about by independent shading, the Steel Corporation following, the Republic Iron & Steel Co. has reduced its prices on black and galvanized sheets by $5 a ton. Some other independents have followed and the Steel Corporation may recognize the cut in a few days. Reduced prices do not seem to bring out more demand, and the more common view in the trade is that they had better be saved until they can be used to stimulate buyers to take hold.

Pig Iron—Bessemer remains quotable at $23, Valley, and foundry at $22.50, and basic is off 50c. to $21, Valley. There is practically no demand.

Coke

Connellsville — Furnace, $3@$3.25; foundry, $4@$4.50.

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[1] Foote Mineral Co., Philadelphia, Pa

Census Bureau's 1919 Summary of Smelting and Refining Industries

PRELIMINARY STATEMENTS of the 1920 census of manufactures with reference to non-ferrous smelting and refining industries have been prepared by the Bureau of the Census, Department of Commerce, and are given below. It will be noted that comparisons are made on the basis of the value of the products handled. Such comparisons are liable to lead to erroneous conclusions unless it is remembered that the value of practically all commodities fluctuated and generally increased greatly during and after the war. The figures tabulated would be of greater value if the units chosen to evaluate the products were given.

Copper Smelting and Refining

The figures are based on returns from 33 establishments, with products valued at $632,897,000. At the census of 1914 there were 37 establishments with products valued at $444,022,000, an increase of $188,875,000, or 42.5 per cent. The products include the values of the copper products of both smelters and refineries, the gold, silver, and other metallic contents of ore and bullion treated, and the sundry byproducts of the respective establishments. A number of plants temporarily suspended operations in 1919 following the close of the world war, on account of the depressed copper market. Plants idle throughout the year are not included. At the census of 1909 there were 38 establishments, with products valued at $378,806,000; in 1904, 40 establishments, and products to the amount of $240,780,000; and in 1899, 47 establishments and $165,132,000. The increases in values of products for the period 1909-1914 were 17.2 per cent; 1904-1909, 57.3 per cent; and 1899-1904, 45.8 per cent.

Quantity of copper produced at smelters, as compiled by the Geological Survey, aggregated 1,310,972,580 lb. in 1919, compared with 1,150,137,192 in 1914. Arizona leads, with 536,515,368 lb., or over 40 per cent of the total, followed, in order of rank, by Michigan, Montana, Utah, Nevada, New Mexico, Alaska, California, Tennessee, Colorado, Idaho, and Oregon.

Primary copper of domestic origin produced at refineries was 1,441,643,000 lb. in 1919, compared with 1,210,423,000 in 1914; and total refined copper, primary and secondary, of both domestic and foreign origin, is reported at 1,863,580,000 lb. for 1919, compared with 1,565,708,000 for 1914, a five-year increase of 297,872,000 lb., or 19 per cent.

The statistics for 1914 and 1919 are summarized in the following statement. The figures for 1919 are preliminary and are subject to such change and correction as may be necessary from a further examination of the original reports.

COPPER SMELTING AND REFINING—CENSUS BUREAU'S 1919 SUMMARY

	Number of Establishments		Value of Products	
	1919	1914	1919	1914
United States	33	37	$632,897,000	$444,022,000
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	4	4	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

(a) [illegible] Washington, 1

Lead Smelting and Refining

The figures are based on returns from 25 active establishments, with products valued at $192,655,000. At the census of 1914 there were 22 establishments, with products valued at $171,579,000, an increase of $21,076,000, or 12.3 per cent. At the census of 1909 there were 28 establishments, with products valued at $167,406,000; in 1904, 32, with $185,827,000; and in 1899, 39, with $175,466,000. The values include, in addition to refined lead, the gold, silver, and copper contents of the ores and bullion treated. There is also, as in the other smelting industries, a considerable amount of duplication, as the value of products of the refineries largely duplicates that of the smelters.

Quantity of primary lead smelted or refined in 1919 as compiled by the U. S. Geological Survey was 485,612 tons, compared with 563,810 in 1914.

The statistics for 1914 and 1919 are summarized in the following statement. The figures for 1919 are preliminary and are subject to such change and correction as may be necessary from a further examination of the original reports.

LEAD SMELTING AND REFINING—CENSUS BUREAU'S 1919 SUMMARY

	Number of Establishments		Value of Products	
	1919	1914	1919	1914
United States	25	22	$192,655,000	$171,579,000
Smelting only	18	12	$70,973,000	$64,695,000
Smelting and refining and refining only	7	10	121,862,000	107,884,000
Utah	3	3	$27,518,000	$21,752,000
All other states	(a) 22	19	165,137,000	149,827,000

(a) Includes 5 in Colorado; 2 each in Illinois, Indiana, and Missouri; and 1 each in California, Idaho, Kansas, Montana, Nebraska, New York, Ohio, Oklahoma, Pennsylvania, Washington, and Wisconsin.

Zinc Smelting and Refining

The figures are based on returns from 38 establishments, with products valued at $103,103,000, as compared with 29 establishments, and products valued at $53,538,000 in 1914, an increase of $49,565,000, or 92.6 per cent. At the census for 1909 there were 29 establishments, with products valued at $34,206,000; in 1904, 31, with $24,791,000, and in 1899, 31, with $18,188,000.

Quantity of primary zinc produced at the smelters, as reported by the Geological Survey, rose from 353,049 tons in 1914 to 465,743 tons in 1919, an increase of 31.9 per cent.

The statistics for 1914 and 1919 are summarized in the following statement. The figures for 1919 are preliminary and are subject to such change and correction as may be necessary from a further examination of the original reports.

ZINC SMELTING AND REFINING—CENSUS BUREAU'S 1919 SUMMARY

	Number of Establishments		Value of Products	
	1919	1914	1919	1914
United States	38	[illegible]	$103,103,000	$53,538,000
[illegible]	7	[illegible]	$24,954,000	$18,421,000
[illegible]	3	[illegible]	6,038,000	[illegible]
[illegible]	11	6	[illegible]	9,939,000
[illegible]	3		3,323,300	
[illegible]	4		1,433,300	19,919,000
[illegible]	(a) 10	[illegible]	46,726,400	

(a) [illegible] Pennsylvania, 3 and West Virginia, 2

COMPANY REPORTS

Utah Copper Shows Net Loss

A report of operations of the Utah Copper Co. for the first quarter of 1921 states that the net production of marketable copper was 22,726,411 lb. during the period covered by the report. The average cost per net pound was 13.18c., without credit for gold and silver or miscellaneous income, including all fixed and general charges, but excluding Federal taxes and depreciation. The gold and silver and the miscellaneous income for the quarter equal 1.19c. per net pound of copper produced, which, being deducted from the operating cost, results in a net cost of 11.99c. per lb. The aforementioned per pound cost does not include charge for plant and equipment depreciation. For some time this item has been treated as an operating expense, but beginning with January of the current year it will be considered as a deduction from income. Operating statement follows:

	First Quarter 1921	First Quarter 1920
Net profit from copper production only	$53,616 21(a)	$2,291,013
Miscellaneous income, including payment for precious metals	269,332.04	329,451
Total income	$215,715 83	$2,620,464
Loss on Government bonds sold	305,543.52	....
Total net loss	$89,827.69	$2,870,589(b)
Disbursement to stockholders	1,624,490.00	2,436,735
Net deficit	$1,714,317.69	$433,854(c)

(a) Loss. (b) Includes income from dividends ($250,125). (c) Surplus.

The operating loss for the first quarter is computed on the basis of 12.94c. per lb. for copper, as against a carrying price of 14.52c. for the fourth quarter of 1920. The quarterly disbursement on March 31 was $1 per share, as compared with $1.50 per share on Dec. 31 last.

Tonopah Belmont Development Co.

A condensed statement of operations of Tonopah Belmont Development Co. for the quarter ended March 31, 1921, follows:

Received and receivable for ore	$506,064 77
Mining, milling and administration expenses	426,343 63
Net earnings for three months	$79,721 14
Miscellaneous income	2,999 71
Dividend from Belmont Surf Inlet Mines, Ltd	50,000 06
Total net income for three months ended March 31, 1921	$132,720.91
AVAILABLE RESOURCES, MARCH 31, 1921	
Due from smelters	$211,229.88
Due from others	47,639.15
Cash in banks	230,121.63
Total	$488,990 66

The net earnings for the quarter ended March 31, 1921, of the Belmont Surf Inlet Mines, Ltd., of which this company owns 80 per cent, were $9,822.59.

Barnes-King Shows Profit for Quarter

The records of the Barnes-King Development Co. show the following for the quarter ending March 31, 1921:

Earnings:		
Shannon property		$12,653 13
Interest received		248.22
		$12,901 35
Deduct:		
North Moccasin property expenses	$2,263.73	
Piegan-Gloster property expenses	2,800 01	
Kendall property expenses	177.81	
Black Hawk development expenses	2,827.02	
Betsy Baker development expenses	1,596.54	
Miscellaneous expense	1,290.22	
		10,955 33
Difference being net profit on operations for quarter ending March 31, 1921		$1,946 02

The above figures include provisions for depreciation on the same basis as has been used heretofore.

Chino Exhibits Operating Loss

A report of the operations of the Chino Copper Co. for the first quarter of 1921 states that the net production of copper, after smelter deductions, was 8,570,034 lb., compared with 10,457,661 lb. produced during the previous quarterly period.

The cost per pound of net copper produced for the quarter, including fixed and general administrative expenses, but excluding plant and equipment depreciation and Federal taxes, for which no reserves were set up, was 14.56c., as against 13.93c. per lb. for the preceding quarter on the same comparative basis. These costs do not include credit for precious metals and miscellaneous earnings, which were 0.81c. per lb., as compared with 1.32c. for the previous quarter.

The financial results of the company's operations for the quarter are exclusive of charge for depreciation of plant and equipment, and are as follows:

	First Quarter 1921	First Quarter 1920
Operating loss	$122,949	$737,605 (a)
Miscellaneous income, including payment for precious metals	69,812	72,122
Net operating loss	$53,137	$809,727 (a)
Distribution to stockholders	....	326,243

(a) Profit.

The operating loss, as above, for the quarter is based on a price for copper of 13.13c., as compared with 14.45c. per lb. for the fourth quarter of 1920.

Nevada Consolidated Deficit $6,634

A report of the operations of Nevada Consolidated Copper Co. for the first quarter of 1921 states that production of copper was 9,064,082 lb., compared with 10,812,729 lb. for the preceding quarter, at a cost, including all fixed and general charges, but not including Federal taxes and plant and equipment depreciation, of 13.84c. per lb., compared with 16.85c. per lb. for the previous quarter. These costs do not include credit for gold and silver or miscellaneous earnings, which amounted to 1.17c. per lb of copper, and for the previous quarter 1.33c. per lb. of copper, resulting in a net cost of 12.67c. per lb., as compared with 15.52c. average for the preceding three months.

The financial outcome of operations for the quarter is shown in the profit and loss statement below, all fixed and general items of expense, other than depreciation, being included as operating costs:

PROFIT AND LOSS

	First Quarter 1921	First Quarter 1920
Operating loss	$112,424	(a) $132,529
Miscellaneous income	105,790	83,054
Net operating loss	$6,634	$215,583
Dividends	....	499,864

(a) Gain.

The operating loss for the quarter is based upon an average carrying price for copper of 12.60c. per lb., as compared with a basing price of 14.73c. for the preceding quarter.

Mason Valley Reports No Production

A report of operations of the Mason Valley Mines Co. for 1920 states that no metal was produced during the year. Sales of copper amounted to $237,775; cost of copper sold, $224,546; general expense, $45,590, leaving a net loss of $32,360. Other expenses, losses, and miscellaneous income resulted in a net deficit of $60,065. Surplus balance Dec. 31, 1919, was $890,419; on Dec. 31, 1921, $830,354.

Mining Stocks

Week Ended June 18, 1921

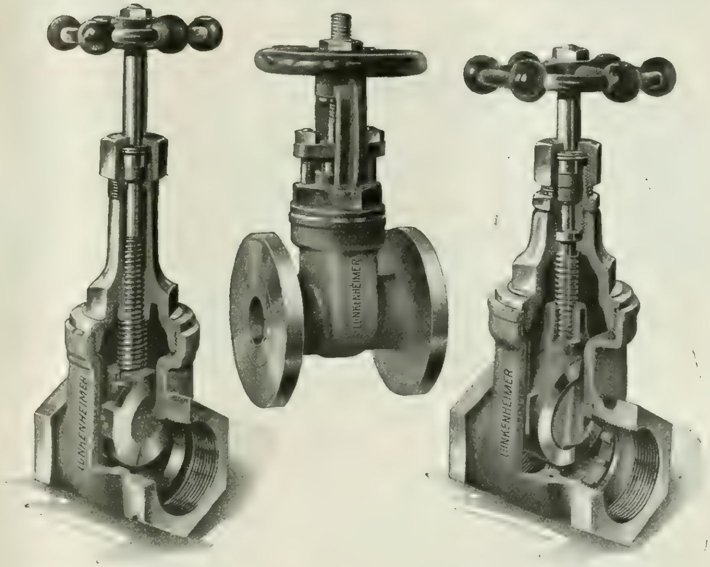
Stock	Exch.	High	Low	Last	Last Div.	
			COPPER			
Adventure	Boston	[illegible]		[illegible]	...	...
Ahmeek	Boston	49⅞	48½	48	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	¾	5/16	⅜	...	...
Allouez	Boston	22	20	20	Mar. '19	1.00
Anaconda	New York	39⅜	36¼	37	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2¼	2¼	2		
Ariz. Com'l	Boston	8	8	8	Oct. '18,	.50
Big Ledge	N. Y. Curb	[illegible]	[illegible]	¼	...	...
Bingham Mines	Boston			10	Sept. '19, Q	.25
Calumet & Arizona	Boston	49⅛	46	48⅜	Mar. '21, Q	.50
Calumet & Hecla	Boston	242	235	235	June '20, Q	5.00
Canada Copper	N. Y. Curb	‡		13		
Centennial	Boston	...		7½	Dec. '18, SA	1.00
Cerro de Pasco	New York	26	25¼	26	Mar. '21, Q	.50
Chile Copper	New York	10⅞	10⅜	10⅜		
Chino	New York	24¾	23½	23½	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	‡		26½		
Con. Arizona	N. Y. Curb	....	....		Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	....	....	1¼		
Copper Range	Boston	34½	32½	33½	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*33	*30	*32	...	
Davis-Daly	Boston	6½	6¼	6½	Mar. '20, Q	.25
East Butte	Boston	8¾	8½	8½	Dec. '19, A	.50
First National	Boston Curb	*58	*53	*53	Feb. '19, SA	.15
Franklin	Boston	2	2	2	....	...
Gadsden Copper	N. Y. Curb	....	....	25	....	...
Granby Consol.	New York	20	17¼	17¼	May '19, Q	1.25
Greene Cananea	New York	22½	22	22¼	Nov. '20, Q	.50
Hancock	Boston	2¾	2½	2⅞		
Howe Sound	N. Y. Curb			2¼	Jan. '21, Q	.05
Inspiration Consol.	New York	33¾	32¼	32¼	Oct. '20, Q	1.00
Iron Cap	Boston Curb	6	4¾	4¾	Sept. '20, K	.25
Isle Royale	Boston	20	20	20	Sept. '19, SA	.50
Kennecott	New York	20	18¾	18¾	Dec. '20, Q	.50
Keweenaw	Boston			1		
Lake Copper	Boston	3¼	3	3		
La Salle	Boston			2		
Magma Chief	N. Y. Curb			21		
Magma Copper	N. Y. Curb	18	18	18	Jan. '19, Q	.50
Majestic	Boston Curb	*8	*8	8		
Mason Valley	Boston	1½	1½	1½		
Mass Consolidated	Boston	2	2	2	Nov. '17, Q	1.00
Mayflower-Old Colony	Boston	3¼	3	3 5/16		
Miami Copper	New York	21¼	20	20¾	May '21, Q	.50
Michigan	Boston			2		
Mohawk	Boston	50	48	48½	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5¼	4¾	5¼		
Nevada Consol.	New York	11	10¾	11	Sept. '20, Q	.25
New Baltic	Boston Curb			3		
New Cornelia	Boston	14¾	14	14½	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb			5		
North Butte	Boston	10	9¾	9¾	Oct. '18, Q	.25
North Lake	Boston			½		
Ohio Copper	N. Y. Curb	....	....	[illegible]		
Old Dominion	Boston	21	20	20	Dec. '18, Q	1.00
Osceola	Boston	28	28	28	June '20, Q	.50
Phelps Dodge	Open Mar.	166	155		[illegible] '21, Q	1.00
Quincy	Boston	38	37	38	Mar. '20, Q	1.00
Ray Consolidated	New York	[illegible]	12¼	12½	Dec. '20, Q	.25
Ray Hercules	Boston Curb			5		
[illegible]	Boston	38	34½	35	June '20, K	2.00
[illegible]	Boston			3		
[illegible]	Boston	*93	*81	*93	Nov. '17, Q	.25
[illegible]	New York	6	6	6	Dec. '20, Q	.25
[illegible]	Boston			1		
[illegible]	Boston	3	3	3½	Apr. '17	1.00
[illegible]	Boston	1½	1	1¼		
[illegible]	New York	8	7	7½	May '18, I	1.00
[illegible]	Boston	[illegible]	[illegible]	50	[illegible] '13	[illegible]
[illegible]	Boston Curb	[illegible]	[illegible]	23	Mar. '21, Q	[illegible]
[illegible]	Boston	3½		3½	Sept. '18,	.25
[illegible]	New York	[illegible]	48	48	[illegible] '21, Q	1.00
[illegible]	Boston			1 1/16	Dec. '17,	.30
[illegible]	Boston	1¼	1¼	1¼		
[illegible]	Boston	[illegible]	[illegible]	[illegible]		
[illegible]	Boston	[illegible]	[illegible]	[illegible]		
			NICKEL-COPPER			
[illegible]	[illegible]	[illegible]	[illegible]	14	Mar. '19,	[illegible]
[illegible]	[illegible]			[illegible]	[illegible] '21, Q	[illegible]
			LEAD			
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] '21, Q	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	01	June '21, Q	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Boston Curb			[illegible]	[illegible]	[illegible]
			ZINC			
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] '20	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] '20, Q	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	4	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

Stock	Exch.	High	Low	Last	Last Div.	
			GOLD			
Alaska Gold	New York	⅝	½	⅝	....	
Alaska Juneau	New York	1¾	1½	1⅝	....	
Carson Hill	N. Y. Curb			13½	....	
Cresson Consol. G.	N. Y. Curb	1 13/16	1 11/16	1 13/16	June '20, Q	$0.10
Dome Extension	Toronto			*75	....	
Dome Mines	New York	17½	16⅛	17¼	Apr. '21, Q	.25
Golden Cycle	Colo. Springs	†*72	†*70	*71⅞	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	*7	*6	*7	Dec. '19,	.05
Hollinger Consol.	Toronto	7.10	7.05	7.05	Feb. '21, M	.05
Homestake Mining	New York	55¼	55	55	May '21,	.25
Kirkland Lake	Toronto	45	44	44	....	
Lake Shore	Toronto	1.19	1.10	1.18	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	1.91	1.89	1.89	Jan. '21, K	.05
Porcupine Crown	Toronto	*16	*14½	*15¼	July '17,	.03
Portland	Colo. Springs		....	*59¼	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*4	*3	*4	May '19,	.05
Silver Pick	N. Y. Curb	6	3½	5	....	
Teck Hughes	Toronto	12½	11½	12½	....	
Tom Reed	Los Angeles	80	*70	*78	Dec. '19,	.02
United Eastern	N. Y. Curb	2 5/16	2 3/16	2½	Apr. '21, Q	.15
Vindicator Consol.	Colo. Springs	†*39	†*34	*37½	Jan. '20, Q	.01
West Dome Consol.	Toronto	*6	*6	*6	....	
White Caps Mining	N. Y. Curb	7½	*6	7	....	
Yukon Gold	N. Y. Curb	1⅛	1	1⅛	June '18,	.02½
			SILVER			
Arizona Silver	Boston Curb	*21	*16	*19	Apr. '20, M	.03
Batopilas Mining	New York	....	....	¾	Dec. '07, I	.12½
Beaver Consol.	Toronto	30½	*30	*30	May '20, K	.03
Coniagas	Toronto	....	....	1.70	May '21, Q	.12½
Crown Reserve	Toronto	*12½	*10	10	Jan. '17,	.05
Kerr Lake	Boston	2⅞	2⅞	2⅞	Apr. '21, Q	.12½
La Rose	Toronto			*20	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*20	*19	*20	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.20	1.10	1.20	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4	4¼	4⅜	Apr. '21, Q	.15
Ontario Silver	New York	4½	4½	4½	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb			2	Jan. '12,	.10
Peterson Lake	Toronto	*5½	*5	5	Jan. '17,	.01¼
Temiskaming	Toronto	*21¼	*20	21¼	Jan. '20, K	.04
Trethewey	Toronto	16¼	16	16	Jan. '19,	.05
			GOLD AND SILVER			
Atlanta	N. Y. Curb	*1	*1	*1	....	
Barnes-King	Butte	‡ ..	....	1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*62	*55	59	..	..
Cashboy	N. Y. Curb	5	4½	*4½	..	..
El Salvador	N. Y. Curb			¼		
Jim Butler	N. Y. Curb	*9	*8	8	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*6	*4	*5	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	¼		
MacNamara M. & M.	N. Y. Curb	*16	*14	*15	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	*10	*9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1 1/16	1	1 1/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1⅛	1	1⅛	..	
Tonopah-Extension	N. Y. Curb	1 9/16	1⅜	1 9/16	Apr. '21, Q	.05
Tonopah Mining	N. Y. Curb	1¼	1 3/16	1¼	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	13/16	13/16	13/16	Dec. '19, SA	.05
			SILVER-LEAD			
Caledonia	N. Y. Curb	*10	*8	10	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake			1.10	Dec. '21,	.15
Chief Consol.	Boston Curb			2	May '21, Q	.05
Consol. M. & S.	Montreal	15¾	14¼	14⅛	Oct. '20, Q	.62½
Daly Mining	Salt Lake	‡		1.50	July '20, Q	.10
Daly West	Boston	3	2¼	2¾	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	2	2	2	Apr. '21, K	.05
[illegible]	Spokane			7	May '20, SA	.03
Fed. M. & S.	New York			5¾	Jan. '09,	1.50
Fed. M. & S. pfd.	New York		22½	22½	June '21, Q	1.00
Florence Silver	Spokane	‡	....	*12½	Apr. '19,	.01¼
Grand Central	Salt Lake			*07½	June '20, K	.03
Hecla Mining	N. Y. Curb			4	Mar. '21, Q	.15
Iron Blossom	N. Y. Curb		16	*16	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake			3.00	Sept. '20, Q	.12½
[illegible]	N. Y. Curb		*4	5	June '21, I	.02
[illegible]	N. Y. Curb			[illegible]	Nov. '17,	.02
Rambler-Cariboo	Spokane			4	Feb. '19,	.01
Rex Consol.	N. Y. Curb		7	7½		
[illegible]	Salt Lake			[illegible]	Sept. '19, K	.15
[illegible]	N. Y. Curb			⅛	Oct. '17,	.05
Tamarack-Custer	Spokane	‡		1.90	Jan. '21, K	.04
Tintic Standard	Salt Lake			2.40	June '20, Q	.10
Utah Apex	Boston	[illegible]	[illegible]	2¾	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	3	2	2½	Nov. '17,	.01
			QUICKSILVER			
[illegible]	Boston	[illegible]		50	Jan. '19,	.25
			VANADIUM			
[illegible]	New York	[illegible]	26½	27	[illegible] '21, Q	1.00
			ASBESTOS			
[illegible]	Montreal			[illegible]	Apr. '21, Q	1.50
[illegible]	Montreal			78	Apr. '21, Q	1.75
			MINING, SMELTING AND REFINING			
[illegible]	New York	[illegible]	37	37	Mar. '21, Q	1.00
[illegible]	New York	[illegible]	70	70	[illegible] '21, Q	1.75
[illegible]	New York	[illegible]	70½	70½	Apr. '21, Q	1.50
[illegible]	New York	[illegible]	30	30	Jan. '21, Q	.50
[illegible]	Boston	41¼	40½	40½	Apr. '21, Q	.87½

LUNKENHEIMER

Bronze Gate Valves



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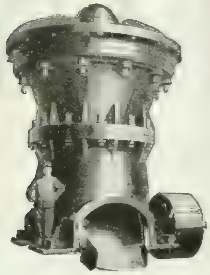
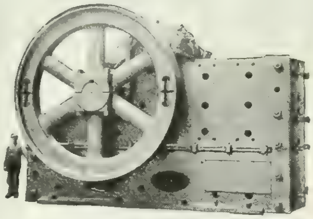
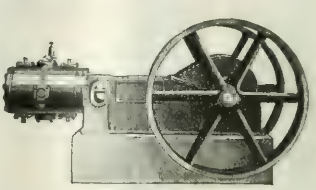


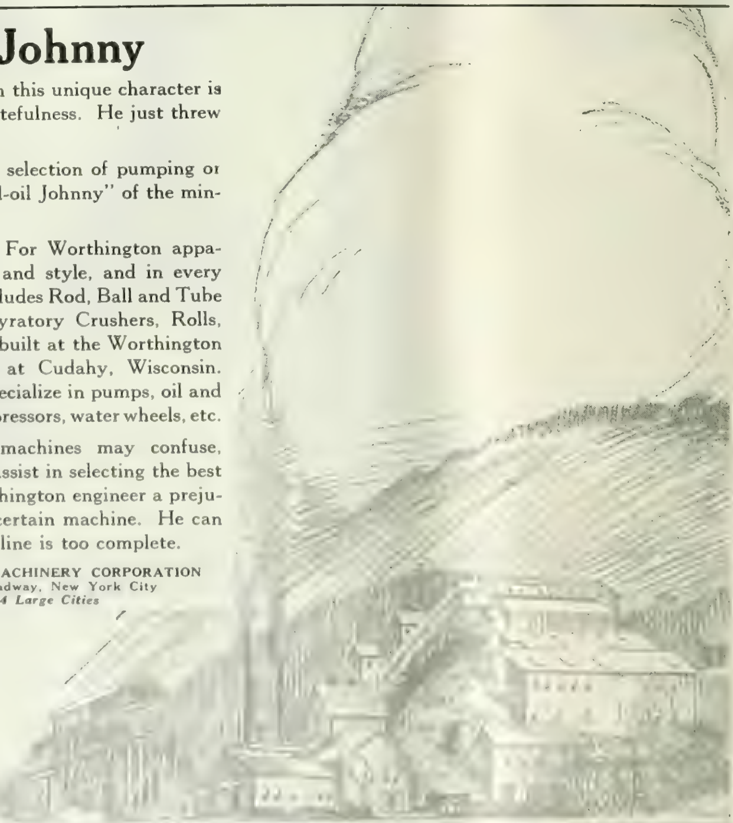
Superior McCully Gyratory Crusher



Superior Jaw Crusher



Single Power Driven Air Compressor



Coal-oil Johnny

THE chief thing for which this unique character is remembered was his wastefulness. He just threw his money away.

Carelessly or poorly advised selection of pumping or other machinery is the "Coal-oil Johnny" of the mining industry today.

And it's so easily remedied. For Worthington apparatus is built in every type and style, and in every capacity. The machinery includes Rod, Ball and Tube Mills, Superior McCully Gyratory Crushers, Rolls, Conveying Machinery, etc., built at the Worthington Power and Mining Works at Cudahy, Wisconsin. Other Worthington works specialize in pumps, oil and gas engines, condensers, compressors, water wheels, etc.

Where a wide choice of machines may confuse, Worthington engineers will assist in selecting the best type. In no case has a Worthington engineer a prejudice either for or against a certain machine. He can not have—the Worthington line is too complete.

WORTHINGTON PUMP AND MACHINERY CORPORATION
Executive Offices: 115 Broadway, New York City
Branch Offices in 24 Large Cities

PUMPS—COMPRESSORS—CONDENSERS—OIL & GAS ENGINES—METERS—MINING—ROCK CRUSHING & CEMENT MACHINERY

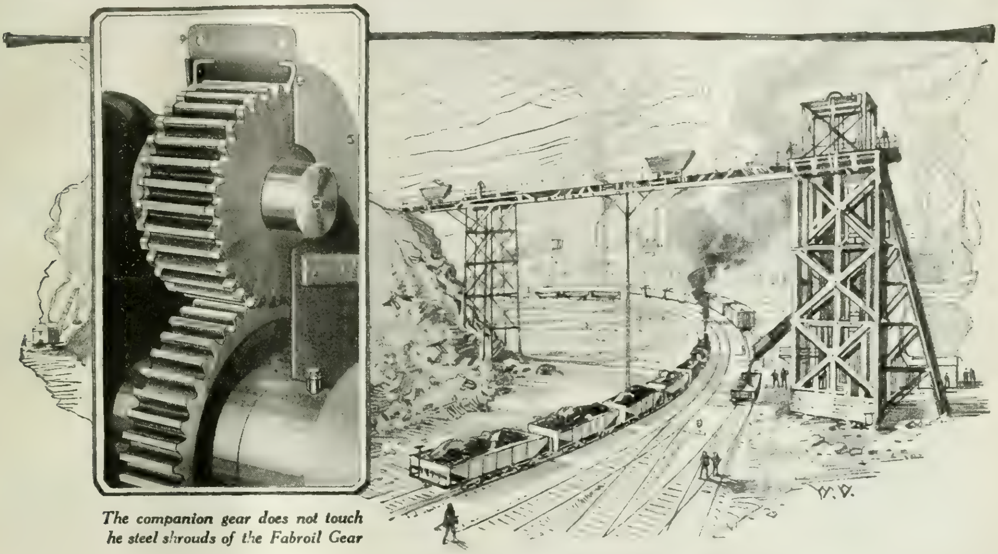
WORTHINGTON

Deane Works, *Holyoke, Mass.*
Blake & Knowles Works
East Cambridge, Mass.
Worthington Works
Harrison, N. J.
Laidlaw Works, *Cincinnati, Ohio.*

Hazleton Works, *Hazleton, Pa.*

Gas Engine Works, *Cudahy, Wis.*
Power & Mining Works
Cudahy, Wis.
Snow-Holly Works
Buffalo, N. Y.
Epping-Carpenter, *Pittsburgh, Pa.*

Gears that give good service regardless of where they operate are the sort that the mining industry can use in large quantities



The companion gear does not touch the steel shrouds of the Fabroil Gear

Underground or "on top" Fabroil Gears are good

Deep in the wet, rat-infested workings of a mine or in the dry clean power plant at the top, Fabroil Gears work equally well. They serve on motor-driven pumps, hoists, machine tools and similar machinery.

In high speed gear trains running 700 feet or more per minute at pitch line, these compressed cotton gears give entire satisfaction. In hot oil baths or in a constant oil splash they perform up to standard. No matter how adverse the conditions may be these tough resilient gears relieve machinery of much vibration and so assure to it longer life.

For a wide range of uses Fabroil Gears are made in any sizes from one inch diameter upward. In mining operations they are commonly used in sizes from 3 to 12 inches.

Ask the nearest G-E office for complete information

General Electric Company

General Office
Schenectady, N.Y.

Sales Offices in
all large cities

40-168

ENGINEERING & MINING JOURNAL

Think "SEARCHLIGHT" First

ADVERTISING RATES

POSITIONS VACANT—Business Opportunities and other undisplayed ads, 8 cents a word, minimum $2.00 an insertion.

POSITIONS WANTED—Evening work wanted, tutoring and other undisplayed ads of individuals looking for employment, 4 cents a word, minimum 75 cents, **payable in advance.**

ADD 5 WORDS for box number in undisplayed ads if replies are to any of our offices. There is no extra charge for forwarding replies.

DISCOUNT OF 10% if one payment is made in advance for 4 consecutive insertions of undisplayed ad.

ADS IN DISPLAY TYPE—Space is sold by the inch (30 in. to a page), the price depending upon total space used within a year, some space to be used each issue.

RATE PER INCH for ads in display space:

1 to 3 in., $4.50 an in.	15 to 29 in., $3.90 an in.
4 to 7 in., $4.30 an in.	30 to 49 in., $3.80 an in.
8 to 14 in., $4.10 an in.	50 to 99 in., $3.70 an in.

POSITIONS VACANT

EMPLOYMENT

POSITIONS WANTED

EMPLOYMENT AGENCIES

EXECUTIVES seeking superior positions find our confidential service extremely satisfactory. Let our Mr. H. H. Harrison confidentially negotiate for you suitable positions with proper employers, as he has successfully done for thousands of others since 1909. Inquiries invited. (Not an agency.) The National Business Bourse, Confidential Negotiators, Association Building, Chicago.

EMPLOYMENT SERVICE

EXECUTIVES qualified for salaries of $2,500 to $25,000 and upward are invited to communicate in strict confidence with the undersigned, who will conduct preliminary negotiations for such positions. The procedure used is peculiar to this service, differing essentially from all others, and is constructive and initiative, applied individually and in no way jeopardizing present connections. Established 1910. Send name and address only for particulars. R. W. Bixby, Inc., 308 Lockwood Building, Buffalo, N. Y.

POSITIONS WANTED

ASSAYER and metallurgical chemist, experienced gold and silver mines. Speaks Spanish. Knows cyaniding of gold and silver ores. Age 24, single. Southwest, Central or South America preferred. Available June 10. Best of credentials. PW-212, Eng. & Mining Journal, Old Colony Bldg., Chicago.

MANAGER of mines and examining engineer, technical graduate with 25 years' experience in United States, Canada and Alaska, in exploration, development and operation. PW-225, Eng. & Min. Journ., Rialto Bldg., San Francisco.

METALLURGIST open for engagement after July, technical education, 20 years' practical experience in mining and metallurgical work. U. S. Mexican and South American experience. Specialty, cyanidation and improvement of metallurgical practice. Latin-American countries preferred. $5,000 per year. PW-[illegible] Eng. & Mining Journal, Old Colony Bldg., Chicago.

METALLURGIST—Specialist in smelting [illegible] lead and copper ores and bullions, and recovery platinum metals [illegible] operating [illegible] [illegible] manufacture copper [illegible] PW-21[illegible], Eng. & Min. Journ.

[illegible] superintendent or manager [illegible] technical graduate [illegible] years [illegible] development [illegible] years [illegible] Mexico. PW-[illegible] Eng. & Min. Journ., Old Colony Bldg., [illegible]

In Replying to "Blind" Ads

be careful to put on envelope the key number in the ad and also local address of office to which reply is sent.

10th Ave. at 36th St., New York.
935 Real Estate Trust Bldg., Phila.
533 Leader-News Bldg., Cleveland.
1570 Old Colony Bldg., Chicago.
531 Rialto Bldg., San Francisco.

Important

Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents — send copies.

0195

POSITIONS WANTED

MINING engineer, technical graduate, eight years' metal mining experience, from mucker to chief engineer and assistant mine superintendent, desires position as superintendent, foreman or mine engineer; capable executive; age 32. Speaks Spanish. Latin American experience. Will go anywhere with good company. PW-214, Eng. & Mining Journal, Leader-News Bldg., Cleveland.

MINING engineer, specialist in difficult ore dressing problems desires position. Good on investigations, reports, etc. Best of references. Will go anywhere. Fluent Spanish. PW-226, Eng. & Min. Journ., Rialto Bldg., San Francisco.

OPEN for engagement, competent mining man, technical education, age 32, married; very familiar with large scale gold mining operations, shrinkage, stoping, tunneling, development work and examination. PW-223, Eng. & Min. Journ., Real Estate Trust Bldg., Phila.

SUPERINTENDENT or engineer, technical graduate, 10 years' successful experience in mining, milling and examination. Speaks Spanish; available on 30 days' notice. At present in Mexico. PW-215, Eng. & Min. Journ., Old Colony Bldg., Chicago.

SALESMAN AVAILABLE

ENGINEER salesman desires position where long and varied foreign and domestic experience can be utilized by an exporting firm to build up overseas trade, familiar with heavy machinery, mining, milling and allied industry supplies. AS-227, Eng. & Min. Journ., Rialto Bldg., San Francisco.

BUSINESS OPPORTUNITIES

Coal Economy Service

Firms dealing directly with coal consumers, no matter where located, can add our "Service" to their line with profit. It also acts as a feeder to their own line. Any capable man with some knowledge of heating can make money with it; 25% increase in heat from coal or 25% saving of coal guaranteed. Endorsed by Tax Payers Associations and leading apartment house owners in New York City and elsewhere. BO-224, Eng. & Min. Journ.

You can get

A Production Checker

at little cost

Here is an opportunity to get a *Productograph* to keep count and make curve chart record on one to twenty producing machines. From these records you know exactly the production you are actually getting from your machines. No guessing. It is in first class condition and various spare parts are included.

Bargain price for quick sale.

W. A. Helmer, care of McGraw Hill Co.,
10th Ave. at 36th St., New York City

JOHN BOYLE, JR.

PATENTS

Ouray Building, Washington, D. C.

16 years on the Examining Corps
of the U. S. Patent Office

I will purchase choice mineral specimens crystallized and showy ones. Crystallized gold specimens desired and will pay good premium on same. I sell at $28.50 delivered MINERAL COLLECTION 115 specimens containing every important mineral specie. Pamphlet supplied

G. S. SCOTT
20 Nassau St., New York

FOR SALE

SILVER MINING PROPERTY

In Austin, Nevada, consisting of approximately 1200 acres, [illegible] of which are patented. [illegible] owned by [illegible] Manhattan Consolidated Mining Co. Includes [illegible] mines of the MANHATTAN MINING CO. with record production of over TWENTY MILLION DOLLARS. None of the old mines [illegible]

WM. A. MARSHALL
Resident Agent, Austin, Nevada

Get YOUR *wants into the* SEARCHLIGHT

0084

WANTED

Used Carbon (Black Diamonds) and Borts
And fragments wanted: Will pay highest prices. D. Dessau, Printing Crafts Bldg., 33d to 34th Sts. and 8th Ave., New York City.

FOR SALE

Feldspar Property For Sale
About one hundred acres situated in eastern Ontario. Considerable development work has been done; government assay shows spar of good quality. This property can be economically worked and is convenient to railroad. For further particulars apply John Grigor, 420 Manning Ave., Toronto, Ontario.

Property For Sale
One car of diaphragm sheet and punch mica. Also a fine mine. Brown & Freeman, Thomaston, Ga.

MISCELLANEOUS

To Ore Buyers—U. S. and Foreign
Want to hear from American and foreign radium and vanadium ore buyers. Address owners, Hart & Tomlinson, Gateway, Colorado, Mesa County.

New Rails—Relayers

Cars, Locomotives, Steel Products

Send us your inquiries

MERCHANTS STEEL & SUPPLY CO.
208 S. La Salle St., Chicago, Ill.

GET OUR PRICES ON *NEW* AND *USED TANKS*

Steel—wood—enameled
Rectangular—cylindrical
For gasoline—oil—tar—acid—air
Tanks and towers
Kettles—jacketed tanks—coils—etc.
Everything in TANKS

The Curtiss-Willis Co., 30 Church St., N. Y.

FOR SALE

GYRATORY CRUSHERS

from No. 18 down to No. 2. Jaw Crushers 84 x 108 down to 7 x 10. Pulverizers all types. Dryers, Screens, Elevators, Steam Shovels, Locomotives, Cars, Rails.

J. F. DONAHOO CO.
Birmingham, Ala.

"Opportunity" Advertising:

Think "*SEARCHLIGHT*" First!

0100

MACHINERY

AIR COMPRESSORS

1—[illegible] ft Cap., Ingersoll 2 stage, belt driven Air Compressor 100 lb pressure
1—1800 ft Cap., Class W B 2, Sullivan Steam Driven Air Compressor, 100 lb. pressure.
[illegible]—Single Tandem Fuel Oil Driven Compressors, Chgo. Pneumatic Tool Co., No. S. O. 2.

CENTRIFUGAL PUMPS

1—6 in. Swaby Horizontal Centrifugal Pump
1—8 in. Fairbanks Morse Horizontal Centrifugal Pump
1—10 in. Fulton Horizontal Centrifugal Pump.
1—12 in Worthington Horizontal Centrifugal Pump.
1—24-in. Kingsford Horizontal Centrifugal Pump.
2—4 in Young Horizontal Centrifugal Pumps.

CORRUGATED STEEL SHEETS

500—Squares 2-gauge, 5 in. corrugations, O. H. Curved Steel Sheets (four forming a circle)
100—Squares 12 gauge, 5 in. corrugations, O. H. Flat Steel Sheets.
3000—Squares, 22-gauge, 2½ in. corrugations Width 27½ in. length 7 ft. and 10 ft.

VENTILATING BLOWERS AND PIPE

American Blower Co. (Sirroco Type), 5 ft 2 in x 7 ft. 4 in., upper casing 4 ft. x 8 ft Double Inlet 38 in., Upper Cone-shaped quadruple Outlet 36 in. Capacity 25,000 cu. ft per min (12).
10 000 ft. 30 in dia., 18 gauge new Ventilating pipe
10 000 ft. 18 in. dia., 18 gauge new Ventilating pipe.

DUMP CARS

150—12 yd. Western & Oliver all-steel, two-way Dump Cars. Standard gauge
50—1¼-yd., 20 in. gauge, wood body, two way Dump Cars.
3—36-in gauge, 8-wheel Flat Cars, 40,000 lb cap., 7-ft. wide, 20-ft. long, wheels 24-in. diam.

Write for Industrial Bulletin No. 204

HARRIS BROTHERS COMPANY
35th and Iron Sts., Chicago, Ill.

MACHINERY FOR SALE

AUTOCLAVES—One 120-gal. steel with stirrer; one 220-gal. lead lined; one 100-gal high pressure.
CENTRIFUGALS—60, 45, 42 and 32-in. iron basket; 48, 40, 36, 32, 30 and 26-in. copper basket.
COOKERS—24 ½ x 7 ½ ft., 5 x 16 ft. and 3 x 16 ft with stirrer and steam jacket.
CRYSTALLIZERS—One Buffalo, 300-gal crystallizer
DRYERS—Direct-heat Rotary Dryers, 3 x 25 ft., 3 ½ x 25 ft., 4 x 30 ft., 5 x 35 ft., 5 ½ x 50 ft., 5 ½ x 60 ft., 6 x 50 ft and 7 x 50 ft; double shell Dryers, 4 x 20 ft., 5 x 30 ft and 6 x 35 ft.

Drum Dryers, 40x 48 in., 5 x 12 ft. and 3 x 10 ft.
Steam-Heated Air Rotary Dryers, 4 x 30 ft., 6 x 30 ft.
Steam Jacketed Dryers, 5 x 15 ft., 4 x 7 ft., 3 x 16 ft. and 2 ½ x 10 ft. with stirrer.
Rotary Vacuum Dryers, 4x 10 ft., 5x30ft and 5 x 33ft.
Vacuum Shelf Dryers, 20 shelf and 17 shelf

EVAPORATORS—One quadruple effect with copper tubes; one double effect and one triple effect, all copper. One double effect, all iron, one double effect, copper tubes.
FILTER PRESSES—No 850 Kelly, Nos 20, 9 and 5 Sweetlands; 3 x 2 ft. and 11 ½ x 20 ft. Olivers; two 6 x 5 ft. and four 6 x 3 ft. Industrial rotary Filters; one 4 x 4 ft. Industrial dewaterer, plate and frame presses of wood and iron.
HYDRAULIC PRESSES—600, 350, 200, 100 and 65-ton hydraulic Presses; one Anderson Expeller.
KETTLES—400-gal. Fusion Kettles, 50-gal. Jacketed Kettles, 300, 400 and 500-gal. Dopp Kettles.
KILNS—Rotary Kilns, 8 x 60 ft., 6 x 60 ft., 5 x 55 ft., 5 x 20 ft., 3 ½ x 25 ft. and 3 x 25 ft.
MILLS—20-in. Schutz-O'Neill; No. 18 American ring roll pulverizer; 24-in Coggswell Mill; No. 000 and No. 00 Raymond Mills; 3-roll Raymond Mill, 8 x 8 ft., 6 x 5 ft., 3 x 3 ½ ft. and 2 x 3 ft. pebble mills; 6 x 8 ft., 5 x 3 ½ ft. 5 x 4 ft., 4 ½ x 3 ½ ft and 2 ½ x 2 ¾ ft. Ball Mills, 3 ft and two 8 ft Marcy Mills; 42, 33 and 24-in. Fuller-Lehigh Mills; 4 ½ x 20 ft., 5 x 11 ft., 5 x 22 ft. and 6 x 20-ft. Tube Mills; 20 x 13 in., 30 x 16-in. 10 x 16-in., 9 x 12-in., 7 ½ x 13 in. and 7 x 10-in. jaw Crushers; one "Infant," one No. 0, one No. 2, two No. 3 and one No. 8 Williams' swing hammer Mills; one Kent type "G" Mill, two 36 in., and one 40-in. cage mills; two 4 ½-ft. and two 3-ft. Hardinge conical Mills. 18 x 12 in., 20 x 12 in. and 30 x 10 in. Roll Crushers; No. 0, 1 and 3 Sturtevant rotary Crushers, one No. 3 Telsmith Breaker; one 36-in. Sturtevant Emery Mill; one Griffin Mill; one 51 x 14-in. Chaser Mill; No. 1 Sturtevant ring Roll Crusher; No. 2 Mead Mill; one 24-in. "Monarch" Burr Mill.
MIXERS—One 1-ton acid phosphate Mixer; one 1-ton batch Mixer; ½-ton batch Mixer; ten 100-gal. W. & P. heavy duty jacketed Mixers; 150 and 60 gal. dough Mixers.
NITRATORS—1600 gal., 700 gal., 600 gal. and 350 gal.
RETORTS—Six Buflokast 3100-gal Nitric Acid Retorts, 1500 gal Acetic Acid Retort.
STILLS—Copper Stills and Iron Stills, with dephlegmators, condensers and fractionating columns; 16 to 60 in. in diameter for solvent recovery or alcohol or ether manufacturing; 500-gal. and 2000-gal. C. I. Stills with stirrers, 8 x 3-ft. beta naphthol Stills; 50-gal. copper Stills; 2000-gal. copper vacuum pan, eight 300-gal. steel jacketed stills.
SPECIALS—One Complete Toluol Plant. One McDougal and one Wedge Mechanical Furnaces; five Automatic Package Weighing Machines; Electric Arc Furnaces; Jigs; one drag line Excavator; 6 x 8 ft., 6 x 5 ft. and 6 x 3 ft. Newaygo Vibrating Screens; one Leschen aerial Tramway; automatic Cement Scales.
VACUUM PUMPS, DRY—8 x 16 x 12 in., 12 x 22 x 18; 12 x 12 in.; 6 x 6 in. 5 x 4 in. **WET**—10 x 16 x 12 in., 10 x 14 x 18 in. **WITH JET CONDENSERS**—10 x 14 x 12 in., 8 x 14 x 12 in., 6 x 8 x 10 in.

All this equipment is complete and in good condition.

W. P. HEINEKEN, *Engineer*, 95 Liberty St., New York City Telephone Cortlandt 1841

The Searchlight Advertising in This Paper

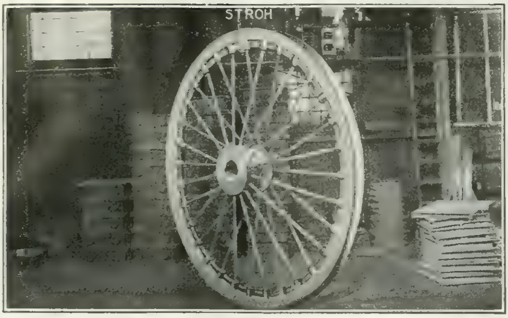
is read by men whose success depends upon thorough knowledge of means to an end—whether it be the securing of a good second-hand piece of apparatus at a moderate price, or an expert employee.

THE BEST PROOF

of this is the variety of this journal's Searchlight ads. Without a constant and appreciable *demand* for such machinery or services, by its readers, the market place which these advertisements represent could not exist for any length of time.

Are *you* using the Searchlight Section?

0318



You're Ordering too many Sheave Wheels

No complaint? They seem to last considerable time?

Well, note this:—when your sheaves are gone, discarded, worn out, Stroh Sheaves ***would still be good.***

Stroh Sheaves have an established performance record of at least nine times greater life than ordinary sheaves.

Knowing that, can you afford to discard sheaves so often?

Remember the life of a sheave is in the tread, and this represents but 2% of the total wheel.

Sheaves made by the Stroh Process are integral castings, with spokes, hub, etc., of the usual material but a tread of Stroh Alloy. And it's this tough, close grained alloy which gives the long life to Stroh Sheaves, reduces rope wear and shutdown charges materially.

We have many Stroh treated products. Data sent on request.

STROH STEEL-HARDENING PROCESS CO.
Attention Mining Department
804 Westinghouse Building, Pittsburgh, Pa.
Western Representative
Hickok & Hickok
221 Kearns Bldg., Salt Lake City, Utah. 507 Hobart Bldg., San Francisco, Cal. 301 Henry Bldg., Portland, Ore.

t is reinforced by ¼-in. rods and by a No. 8 wire-screen of triangular mesh. Spikes are driven into the sides of the bin and the reinforcement is hung from these spikes. The spikes, of course, also help to reinforce. Since the bins were lined with gunite, no more trouble has been experienced from the hot 'roast' setting fire to the wood. The bins are also fire-proofed on the outside by a layer of gunite about ¼ or ½ in. thick reinforced with chicken-wire. This serves to preserve the wood from decay

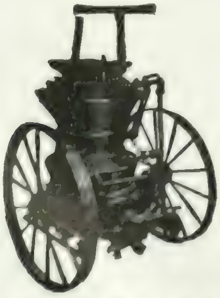
(Mining and Scientific Press, Jan. 8, 1921.)

"The Bins at the Sampling-Mill Used for the First Roast or Pre-Roast Material Are Lined With 'Gunite'"

Since they were lined with Gunite there have been no more fires. For Gunite, the sand-cement product of the "Cement-Gun," is fireproof.

You need the "Cement-Gun" at your mine. The money it will save you in repairs above and below ground will surprise you.

Ask your neighbor—or write us.



The "Cement Gun" is not a restricted article. It may be purchased outright from us and used by anyone

CEMENT-GUN CO., Inc.
Incorporated
Cornwells Heights, Bucks Co., Pa.

Branch Offices:
[illegible]

CYANAMID
AERO BRAND
AMERICAN COMPANY
PRODUCTS

Low Cost and Efficiency

The requirements of the Mining Industry today

IN ITS struggle for existence the gold and silver mining industry needs the help of every possible saving and economy. Aero Brand cyanide has always been and is still being sold at the lowest delivered prices for actual 100 per cent sodium cyanide.

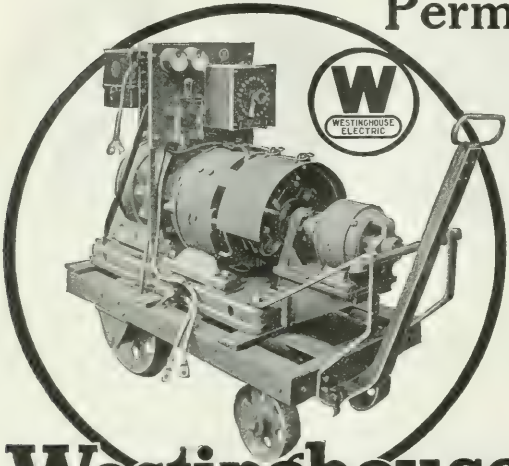
The efficiency of extraction with Aero Brand cyanide has been verified by competent engineers throughout the American continent under the greatest variety of conditions, with uniformly successful results, for a period of more than four years.

The ease of handling this flaky product and its accelerating effect on settling and filtration are additional aids to economy.

All quotations are based upon the pound of 100 *per cent* sodium cyanide (132.85 per cent potassium cyanide).

American Cyanamid Company
511 Fifth Avenue, New York

Keep Your Tonnage High with Quick, Permanent Repair Work



Every breakdown on your property means less available equipment and less tonnage. Don't scrap the broken equipment or send it away to be repaired — ***weld it!*** — right on the property and get it back in service in hours instead of days.

The Westinghouse portable arc welder shown on the left, in the hands of an operator can save you thousands of dollars—by welding broken cars—car wheels — gears — shafts — pipe lines, and hundreds of other metal parts. Welding is the ***permanent*** economical repair process.

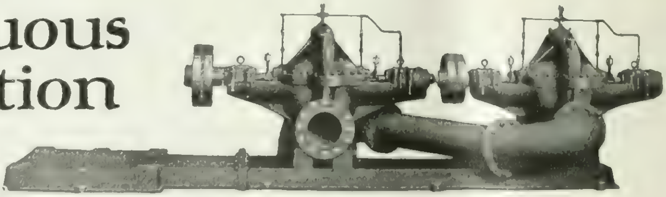
Write for Bulletin 7149 today.

Westinghouse Electric & Manufacturing Co.
East Pittsburgh, Pa.
Sales Offices in All Large American Cities

Westinghouse

ArcWelders

Continuous Production



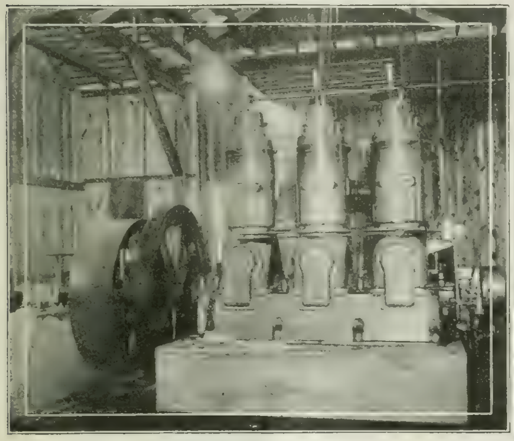
Continuous production of the mine is contingent largely on the dependability of its pumping system. A faulty unwatering plant not only seriously interrupts production, but may cause untold damage resulting from flooding.

Byron Jackson pumps have played a predominating part in the unwatering of mines through demonstrated dependability and economy of operation extending over a long period of years.

A Byron Jackson pumping unit is assurance of continuous production.

BYRON JACKSON IRON WORKS-INC
Wherever water is to be lifted
411 Sharon Building - SAN FRANCISCO

Fairbanks-Morse "Y" Oil Engines



Four "Y" Engines—Total 302½-hp. in this Oklahoma Lead Mine

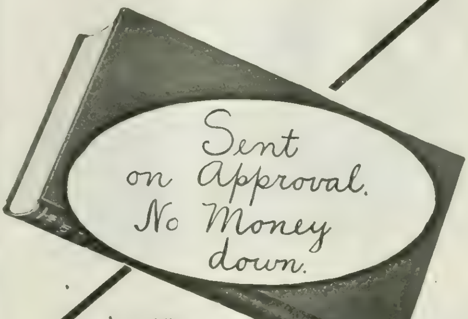
This installation made in 1917, has, in the words of the mine superintendent, "given them the cheapest and most satisfactory power they have ever had experience with."

A 150-hp. operates a 16-in. crusher, 4 sets of 36-in. rolls, 4 elevators, 4 jigs, 2 screens and a 6-in. Centrifugal pump. A 100-hp. drives a 599 ft. Compressor. In the sludge department a 37½-hp. "Y" operates a set of 36-in. sand rolls, sludge tables, sand and tailing elevators, a 48 x 156-in. screen and a 3-in. Centrifugal Pump. A 15-hp. Horizontal "Y" drives a 12½-kw. generator for furnishing light. With fuel costing 6½c. per gallon, the cost of mill dirt averages 2½c. per ton.

"Y" Oil Engines, 10-hp. to 200-hp., uses low-priced fuel oils economically. They are simple in construction—easy to start—simple to operate—no licensed engineer required.

Fairbanks, Morse & Co.
MANUFACTURERS CHICAGO
The Canadian Fairbanks-Morse Co., Ltd., Montreal
Oil Engines - Pumps - Electric Motors and Generators - Fairbanks Scales - Railway Appliances - Farm Power Machinery

See these new books


Sent on Approval. No Money down.

Are you familiar with the books listed here? If you have not seen them, let us send any of them to you *on approval.*

Read these titles:

Giolitti—
Heat Treatment of Soft and Medium Steels
561 pages, 6 x 9, illustrated, $5 00 net, postpaid.
The greatest strides in the development of the casting of low carbon steel as a substitute for forged steel has taken place under Dr Giolitti's direction This important book will have a definite influence on American operations. With present conditions, this translation by Messrs. Thum and Vernaci is especially timely.

McLaughlin—
Oil Land Development and Valuation
200 pages, pocket size, flexible, 59 illustrations, $3.00 net, postpaid.
An outline of the steps necessary for the full and proper development of lands which have been determined to be oil-bearing. The book describes the precautions that must be applied to the construction and maintenance of the wells tapping the original source of supply.

Hoyt—
Metallography, Pt. II, The Metals and Common Alloys
462 pages, 6 x 9, illustrated, $5.00 net, postpaid.
The book contains a description of the more important metals and alloys including the constitution and micro-structure, the physical and mechanical properties for different conditions of heat and mechanical treatment, the effects of impurities commonly present and a brief discussion of the uses of these metals and alloys.

Addicks—
Copper Refining
211 pages, 6 x 9, illustrated, $3.00 net, postpaid.
There has long been a demand for accurate, authoritative information on electrolytic copper refining. Mr. Addicks' book is complete and up-to-date.

Spurr—
Political and Commercial Geology and the World's Natural Resources
561 pages, 6 x 9, illustrated, $5 00 net, postpaid.
A series of preliminary studies by specialists designed to direct attention to the vast importance of commercial control of raw materials by different powers—the control of mineral wealth.

Clip the coupon

Free Examination Coupon

McGraw-Hill Book Company, Inc., 370 Seventh Avenue, New York.
You may send me on 10 days' approval—

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I agree to pay for the books or return them postpaid within 10 days of receipt

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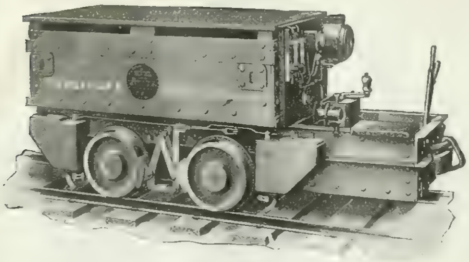

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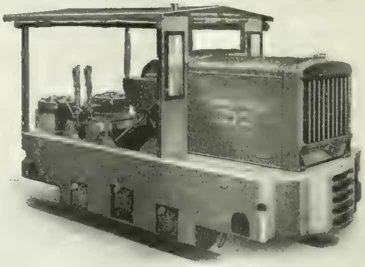

How Do You Figure Haulage Cost?

If you work on the principle that last year it costs so much, add a certain percentage for depreciation to that figure and consider that this year's costs will be thus and so.

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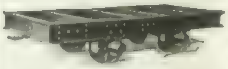

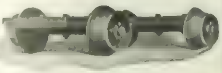

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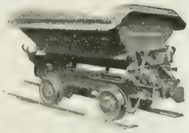

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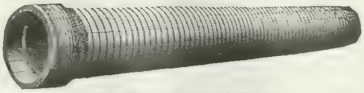

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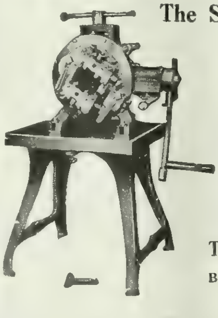

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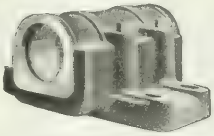

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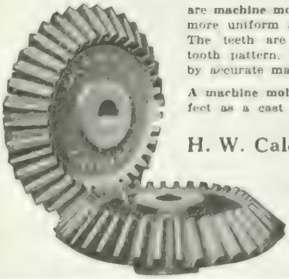

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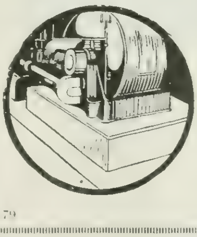

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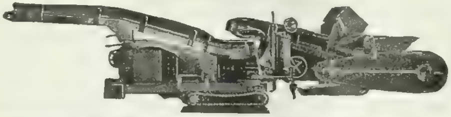

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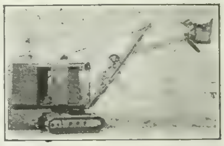

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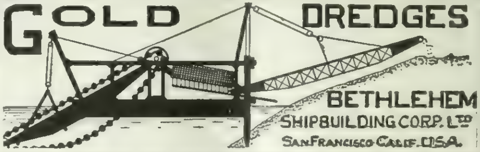

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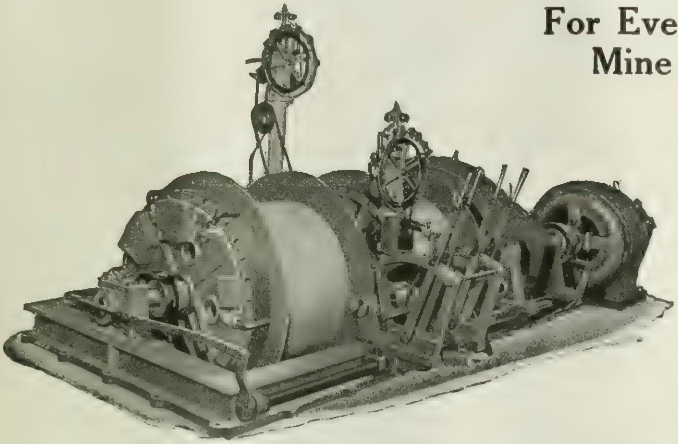

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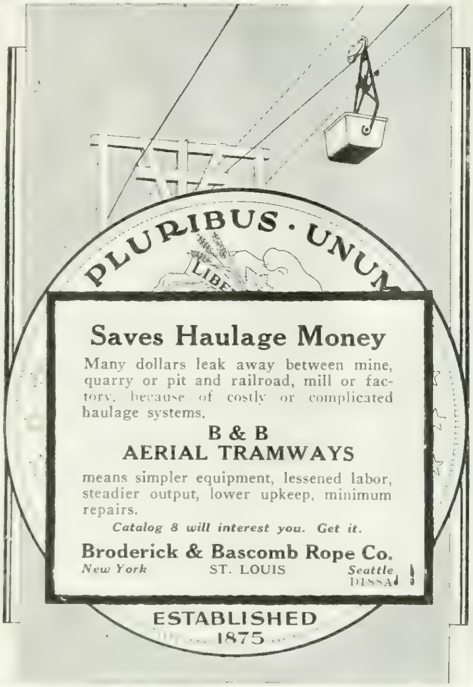

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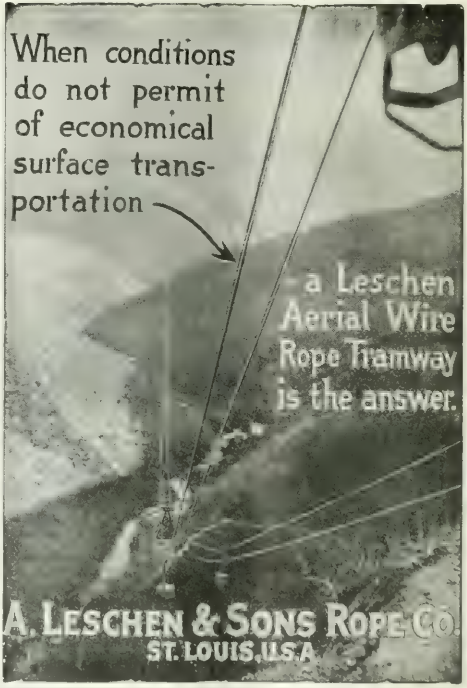
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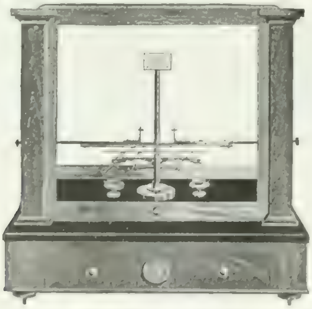

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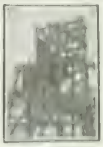

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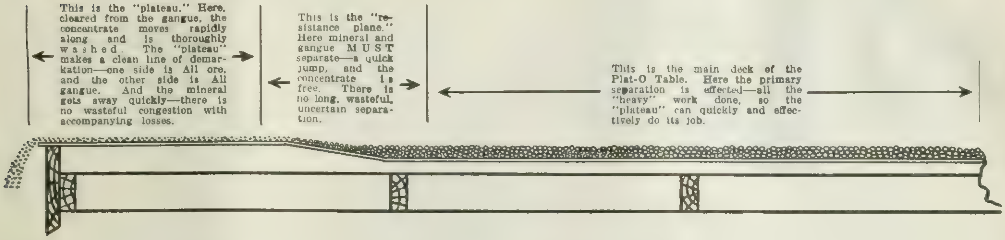
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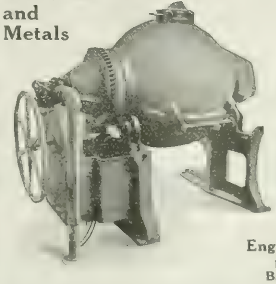

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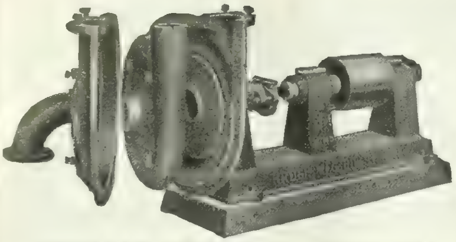

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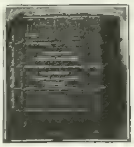

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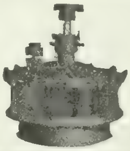

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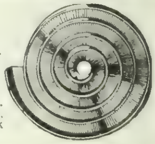

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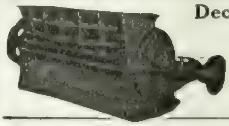

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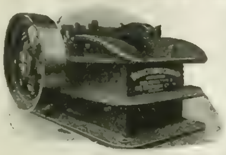

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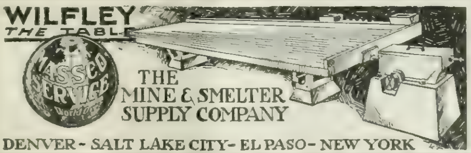

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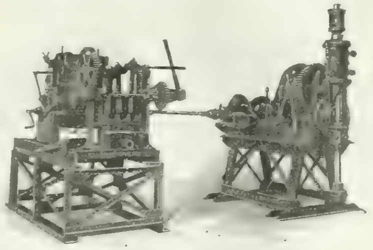

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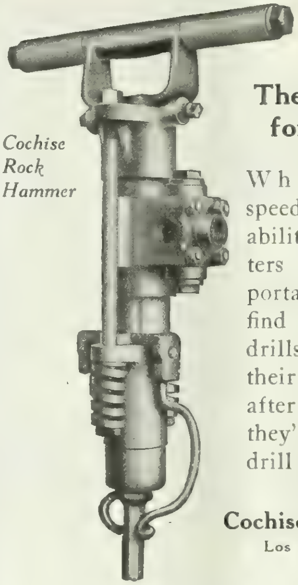

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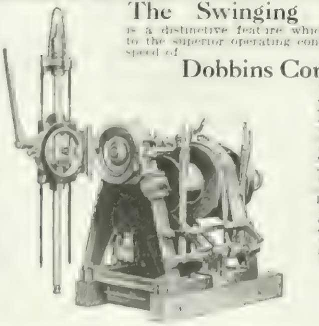

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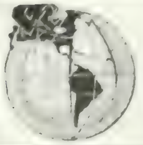

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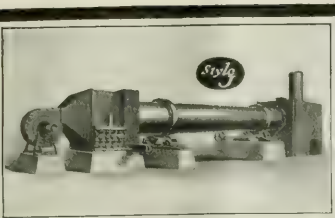

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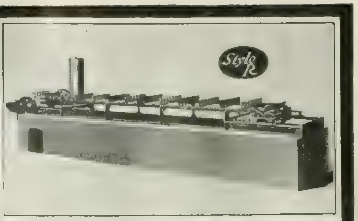

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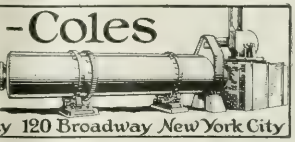

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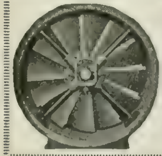

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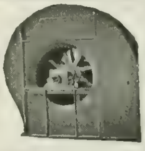

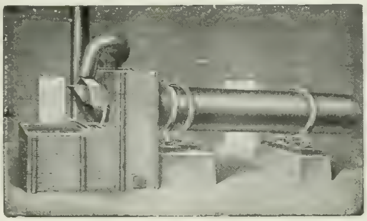

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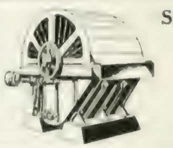

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Mine & Smelter Supply Co.

Candles
Standard Oil Co.

Car Dumpers, Rotary
Car Dumper & Equip. Co.

Car Hauls
Car Dumper & Equip. Co.

Car Replacers
Electric Service Suplies Co

Cars, Gable Bottom
Koppel Ind. Car & Equip. Co
Watt Mining Car Wheel Co

Cars, Hopper
Koppel Ind. Car & Equip. Co
Watt Mining Car Wheel Co.

Cars, Mine
Ingersoll Rand Co.
Koppel Ind. Car & Equip. Co
United Iron Works, Inc.
Watt Mining Car Wheel Co.

Cars, Narrow Gage
Easton Car & Const. Co.

Cars, Ore
Allis-Chalmers Mfg. Co
Atlas Car & Mfg. Co
Koppel Ind. Car & Equip. Co
Mine & Smelter Supply Co.
Watt Mininbg Car Wheel Co.

Cars, Quarry
Koppel Ind. Car & Equip. Co
Watt Mining Car Wheel Co.

Castings
[illegible] Co., R. D.

Castings, Chemical
Fuller Lehigh Co

Castings, Iron and Steel
Marion Steam Shovel Co

Castings, Steel
Stroh Steel Hardening Process Co

Cement, Belt
Schieren Co., Chas A

Cement, Iron
Smooth On Mfg. Co.

Cement, Pipe Joint
Smooth On Mfg Co

Cement Placers, Jet
[illegible]

Chains, Transmission
Jeffrey Mfg Co
Stephens Adamson Mfg Co

Chemicals
Denver Fire Clay Co
General Chemical Co
Grasselli Chemical Co
Nichols Copper Co.
Roessler & Hasslacher Chem Co

Chemical Apparatus
Braun Corp
Braun Knecht Heimann Co
Oliver Cont Filter Co

Circuit Breakers, Electric
General Electric Co
Westinghouse E & M Co

Classifiers
Allis-Chalmers Mfg Co
Butchart, W A
Deister Machine Co
Dorr Co., The
James Ore Concent. Co.
Mine & Smelter Supply Co.

Clay, Fire
Denver Fire Clay Co.

Coal & Ore Handling Machinery
Brown Hoisting Mchy. Co.
Jeffrey Mfg. Co.
Lidgerwood Mfg. Co.
Stephens-Adamson Mfg. Co.

Coal Cutters
Goodman Mfg. Co.
Ingersoll Rand Co.
Sullivan Machy. Co.

Coal Systems, Pulverized
Bonnot Co., The

Cocks
Lunkenheimer Co.

Compressors, Air
Allis-Chalmers Mfg. Co.
Bury Compressor Co.
Chicago Pneumatic Tool Co.
Fulton Iron Works
Hendrie & Bolthoff M. & S. Co.
Ingersoll-Rand Co.
Morse Bros. Mchy. & Sup. Co.
Oliver Cont. Filter Co.
Sullivan Machinery Co.
Worthington Pump & Machy. Corp.

Compressors, Air Portable
Ingersoll Rand Co.
Sullivan Machy. Co.

Concentrators, Magnetic
Dings Magnetic Sep. Co.

Concentrators, Table
Allis-Chalmers Mfg. Co.
Butchart, W. A.
Deister Concentrator Co.
Deister Machine Co.
Hendrie & Bolthoff M. & S. Co.
James Ore Conct. Co.
Mine & Smelter Supply Co.
Morse Bros. Machy. & Supply
United Iron Works, Inc.

Condensers
Alberger Pump & Condenser Co.
Ingersoll-Rand Co.
Westinghouse E. & M. Co.
Worthington Pump & Machy. Corp.

Connectors, Solderless
Frankel Connector Co.

Contractors, Diamond Drilling
Longyear Co., E. J.
Sullivan Machinery Co.

Condensers, Low Level Jet
Ingersoll-Rand Co.

Controllers
Goodman Mfg. Co.

Converters, Electric Rotary
General Electric Co.
Westinghouse E. & M. Co

Converters, Horizontal and Vertical
Allis Chalmers Mfg Co
Worthington Pump & Machy. Corp

Conveyors and Elevators
Allis-Chalmers Mfg Co
Bartlett & Snow Co., C. O.
Caldwell & Sons, H. W
Jeffrey Mfg Co
Robins Conveying Belt Co.
Stephens Adamson Mfg Co

Conveyors, Belt
Bartlett & Snow Co., C. O
Jeffrey Mfg Co
Morse Bros Machy & Supply Co
Robins Conveying Belt Co
Stephens Adamson Mfg Co

Conveyors, Portable
Jeffrey Mfg Co

Coolers
Bartlett & Snow Co., C. O
Stearns Roger Mfg Co

Copper
American Metal Co
American Smlg & Refg Co
Balbach Smlg & Refg Co.
Hardy & Ruperti Inc, Chas
Nichols Copper Co
U. S. Smlg Refg & Mng Co

Copper Steel Sheets
Amer Sheet & Tin Plate Co

Copper Sulphate
Nichols Copper Co.

Couplings, Hose, High Pressure
Knox Mfg. Co.

Cranes, Locomotive
Brown Hoisting Mchy. Co.
Osgood Co.

Cranes, Traveling
Brown Hoisting Mchy. Co.
Niles-Bement-Pond Co.

Creosote
Barrett Co., The

Creosoting Cylinders for Treatment of Timber
Vulcan Iron Works

Crucibles
Denver Fire Clay Co.

Crushers
Allis-Chalmers Mfg. Co.
American Pulverizer Co.
Bacon, Earle C
Bartlett & Snow Co., C. O.
Braun Corporation, The
Braun-Knecht-Heimann-Co.
Buchanan Co., Inc., C. G.
Jeffrey Mfg. Co., The
Morse Bros. Machy. & Supply Co.
Mine & Smelter Supply Co.
Smith Engrg. Works Co
Stroh Steel-Hardening Process Co.
United Iron Works, Inc.
Worthington Pump & Machy. Corp.

Crusher Parts
Fuller-Lehigh Co.
Jeffrey Mfg. Co., The
Midvale Steel & Ordnance Co.
Stroh Steel-Hardening Process Co.

Cupels
Denver Fire Clay Co.

Cups, Grease (See "Grease Cups")

Cyanide
American Cyanamid Co.
Roessler & Hasslacher Chem. Co.

Cyanide Plants
National Tank & Pipe Co.

Dealers, Machinery
Boyle, Jr. John
Curtiss-Willis Co.
Donahue Co., J. F.
Heineken, W. P.
Marshall, Wm. A.
Merchants Steel & Supply Co.
Morse Bros. Machy. & Supp. Co
Scott, G. S.
Western Machinery Co.
Zelnicker Supp. Co., Walter A

Desulphurizers, Ore
Vulcan Iron Works

Dewaterers
Oliver Cont. Filter Co

Diamonds, Black (See "Carbons and Bortz")

Dragline Excavators
Bucyrus Co.

Dredges
Bethlehem Shipbuilding Co
Flory Mfg Co., S
Marion Steam Shovel Co
New York Engineering Co
Osgood Co.
Union Construction Co
Yuba Mfg. Co.

Dredges, Dipper and Hydraulic
Bucyrus Co

Dredges, Elevator
Marion Steam Shovel Co

Dredges, Placer
Bucyrus Co

Dredging Machinery
Lidgerwood Mfg Co

Drilling, Core
Ameling Prospecting Co., Inc
Ingersoll Rand Co
Longyear Co., E. J
McKiernan Terry Drill Co
Pennsylvania Drilling Co
Smith & Travers Co., Ltd
Sullivan Machy Co

Drills, Churn
Union Construction Co

Drills, Core
Dobbins Core Drill Co.
Ingersoll-Rand Co
Longyear Co., E. J.
McKiernan-Terry Drill Co
Sullivan Machy. Co.

Drills, Diamond
Longyear Co., E. J.
Sullivan Machy. Co.

Drills, Electric
Chicago Pneumatic Tool Co
General Electric Co.
Ingersoll-Rand Co.
Jeffrey Mfg. Co., The

Drills, Hammer
Chicago Pneumatic Tool Co
Cochise Machine Co.
Denver Rock Drill Mfg. Co
Ingersoll-Rand Co.
McKiernan-Terry Drill Co
Sullivan Machy. Co.
Whitcomb & Co., Geo. D

Drills, Piston
Cochise Machine Co.
Ingersoll-Rand Co.
Sullivan Machy. Co

Drills, Prospecting
Ingersoll-Rand Co
Longyear Co., E. J.
New York Engineering Co
Sullivan Machinery Co

Drums, Magnetic
Dings Magnetic Sep. Co

Dryers
Ruggles-Coles Engrg. Co

Dryers, Ore
American Process Co
Bartlett & Snow Co., C. O.
Christie Co., L. R.
Fuller-Lehigh Co.
Morse Bros. Machy. & Supply Co.
Ruggles-Coles Engrg. Co.
Vulcan Iron Works

Dryers, Sand and Coal
American Process Co.
Christie Co., L. R.
Ruggles-Coles Engrg. Co
Vulcan Iron Works

Dumps, Rotary
Car Dumper & Equip. Co.

Dust Protectors (See "Respirators")

Electrical Supplies
Hendrie & Bolthoff M. & S. Co.
Mine & Smelter Supply Co
Ohio Brass Co

Elevators Bucket
Bartlett & Snow Co., C. O.
Jeffrey Mfg. Co., The
Stephens-Adamson Mfg Co

Employees
Boyle Jr., John
Marshall, Wm A
Scott, G. S.

Engines, Diesel
Fulton Iron Works

Engines, Gas and Gasoline
Allis-Chalmers Mfg. Co.
Chicago Pneumatic Tool Co
Fairbanks Morse & Co
Mine & Smelter Supply Co
Morse Bros. Machy. & Supply Co.

Engines, Hoisting
Flory Mfg. Co., S.

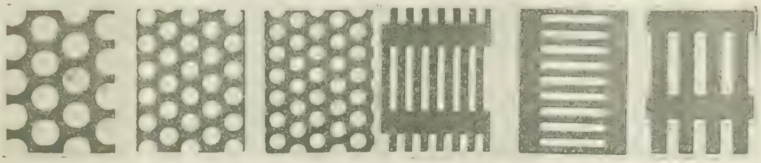
Engines, Oil
Allis Chalmers Mfg Co
Chicago Pneumatic Tool Co
Fairbanks Morse & Co
Fulton Iron Works
Hendrie & Bolthoff M. & S. Co
Ingersoll-Rand Co
McIntosh & Seymour Corp
Morse Bros Machy. & Supply Co

Engines, Steam
Allis Chalmers Mfg Co
Fulton Iron Works
Ingersoll Rand Co
Morse Bros Machy & Supply Co

Exhausters
Connersville Blower Co
Morse Bros Machy & Supply Co

Excavators, Cableway
Lidgerwood Mfg Co

Excavators, Dragline
Bucyrus Co
Marion Steam Shovel Co



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All sizes and shapes of Holes

All kinds and thicknesses of Metal

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Any Style Perforation

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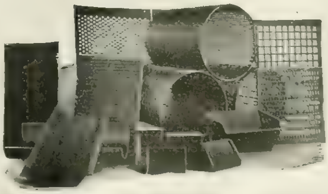

Elevator Buckets (plain and perforated) Stacks and Tanks
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Marion Steam Shovel Co.

Fans, Ventilating
Buckeye Blower Co
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Jeffrey Mfg. Co., The
United Iron Works, Inc.

Feeders, Ore
Bartlett & Snow Co., C. O.
James Ore Concent. Co
Jeffrey Mfg. Co., The
Mine & Smelter Supply Co.
Stephens-Adamson Mfg. Co.

Filter Cloth
Filter Fabrics Co.

Filter Paper
Denver Fire Clay Co

Filter Presses
Oliver Cont. Filter Co.
United Filters Corp.

Filters
Chicago Pneumatic Tool Co.
Oliver Cont. Filter Co.

Filters, Cloth Metallic
Oliver Cont. Filter Co.

Filters, Concentrate
Oliver Cont. Filter Co.

Filters, Cyanide
Oliver Cont. Filter Co.

Filters, Water
Scaife, Wm. B., & Sons Co.

Flood Lighting Projectors
General Electric Co.

Flotation Apparatus
Denver Fire Clay Co.

Flotation Cell Bottoms, Cloth
Filter Fabrics Co.

Flotation Machines
Butchart, W. A.
Stimpson Equipment Co.

Flotation Oils
Barrett Co., The
General Naval Stores Co
Pensacola Tar & Turpentine Co.

Forges
Denver Fire Clay Co.
Ingersoll-Rand Co.
Monarch Eng. & Mfg. Co
Sullivan Machy. Co.

Forgings, Heavy
Midvale Steel & Ordnance Co.

Forgings, Manganese Steel
Manganese Steel Forge Co.

Fuel Economizer
Magnesia Ass'n of Amer

Furnaces, Assay
Braun Corporation The
Braun-Knecht-Heimann-Co.
Denver Fire Clay Co.
Mine & Smelter Supply Co.

Furnaces, Bullion Melting
Denver Fire Clay Co.
Mine & Smelter Supply Co
Monarch Engrg & Mfg. Co

Furnaces, Crucible Tilting and Refining
Mine & Smelter Supply Co
Monarch Engrg & Mfg Co

Furnaces, Crucible, Tilting Metal
Mine & Smelter Supply Co
Monarch Engrg. & Mfg. Co.

Furnaces Electric
Denver Fire Clay Co.
General Electric Co

Furnaces Faces and Lining
Denver Fire Clay Co

Furnaces, Heat Treatment
Denver Fire Clay Co

Furnaces, Mechanical Roasting
Allis-Chalmers Mfg. Co
General Chemical Co
Mine & Smelter Supply Co
[illegible]
Worthington Pump & Mchy Corp

Furnaces, Melting
Denver Fire Clay Co

Furnaces, Smelting
Allis-Chalmers Mfg. Co
[illegible]
[illegible]

Fuses, Electric
General Electric Co
[illegible]

[illegible]
[illegible]

Gas
Ingersoll Rand Co

Gas Compressors
Ingersoll Rand Co

[illegible]

Gears
Caldwell & Son Co., H. W.
Fawcus Machine Co.
General Electric Co.
Jeffrey Mfg. Co., The
Niles-Bement-Pond Co.
Nuttall Co. R. D.
Philadelphia Gear Works
Stephens-Adamson Mfg. Co
Stroh Steel-Hardening Process Co.

Gears, Bevel
Caldwell & Sons Co., H. W.
Fawcus Machine Co.
Philadelphia Gear Works

Gears, Cut & Cast Tooth
Jones Fdy. & Mach. Co.

Gears, Cut and Worm
Stroh Steel-Hardening Process Co.
United Iron Works, Inc.

Gears, Herringbone
Falk Co.
Niles-Bement-Pond Co.
Philadelphia Gear Wks.

Gears, Spur
Philadelphia Gear Wks.

Gears, Worm
Philadelphia Gear Wks.

Generators, Electric
General Electric Co.
Westinghouse E. & M. Co.

Giants, Water
Hendy Iron Works

Glass Blowing
Denver Fire Clay Co.

Glassware, Chemical
Denver Fire Clay Co.

Gravel Washing Plants
Stephens-Adamson Mfg. Co

Grease
Cook's Sons, Adam

Grease Cups
Cook's Sons, Adam
Lunkenheimer Co

Grinders, Manganoid Pebble
Jeffrey Mfg Co The
Braun-Knecht-Heimann-Co

Grinders, Chemical Ore
Braun Corp.
Co
Lidgerwood Mfg. Co.
United Iron Works, Inc.
Vulcan Iron Works

Grinders, Ore
Mine & Smelter Supply Co

Grinders, Sample
Mine & Smelter Supply Co

Hammers, Forging
Sullivan Machy. Co.

Head Frames, Mine
American Bridge Co

Hangers, Mine
Electric Service Supplies Co

Headlights, Incandescent Mine
Electric Service Supplies Co.
General Electric Co.
Goodman Mfg. Co.
Ohio Brass Co.

Heaters, Feed Water
Alberger Pump & Condenser Co

Hoists
United Iron Works Inc

Hoists, Electric
Allis-Chalmers Mfg Co
[illegible] Hoisting Mchy Co
Chicago Pneumatic Tool Co
[illegible] Tool & Supply Co
Flory Mfg Co S
Hendrie & Bolthoff M & S

Hoists, Gas & Gasoline
Fairbanks Morse & Co
Lidgerwood Mfg Co

Hoists, Head Gate
[illegible]

Hoists, Gas and Gasoline
Flory Mfg Co S

Hoists, Mine Compressed Air
Lidgerwood Mfg. Co

Hoists, Mine Steam
Lidgerwood Mfg Co

Hoists, Portable
Flory Mfg Co S
Hendrie & Bolthoff M & S Co
[illegible]

[illegible]

Hoists, Steam
[illegible]

Flory Mfg. Co., S.
Hendrie & Bolthoff M. & S. Co.
Mine & Smelter Supply Co.
United Iron Works, Inc.

Hose
Diamond Rubber Co The

Hose, Air
Denver Rock Drill Mfg. Co.
Ingersoll-Rand Co.

Hose, Couplings, High Pressure
Knox Mfg. Co.

Houses, Steel Shaft
American Bridge Co.

Hydraulic Mining Machinery
Hendy Iron Works

Hydraulic Trip Controls
Car Dumper & Equip. Co.

Idlers, Conveyor
Conveying Weigher Co.

Injectors
Lunkenheimer Co.

Instruments, Surveying
Berger & Sons Co., C. L.
Buff & Buff Mfg. Co.

Insulating Materials, Electric
Electric Service Supplies Co.
General Electric Co.
Ohio Brass Co.
Westinghouse E. & M. Co

Insulating Materials, Heat
Magnesia Ass'n of Amer

Jackets, Water
Allis-Chalmers Mfg. Co.

Jigs
Allis-Chalmers Mfg. Co.
James Ore Concent. Co.
Mine & Smelter Supply Co.
Worthington Pump & Mchy. Corp.

Joints, Expansion
Alberger Pump & Condenser Co.

Kilns, Rotary
Allis-Chalmers Mfg. Co
Vulcan Iron Works

Kilns, Rotary Ore Nodulizers
Ruggles-Coles Engrg. Co.
Vulcan Iron Works

Laboratory Machinery
Braun Corporation, The
Braun-Knecht-Heimann-Co.
Denver Fire Clay Co.
Mine & Smelter Supply Co.
Oliver Cont. Filter Co.

Lacing, Leather
Schieren Co., Chas. A.

Lamps, Electric
General Electric Co.
Westinghouse E. & M. Co

Lead
American Metal Co.
American Zinc, Lead & Ref. Co.
American Zinc Lead & Smlg. Co.
Hardy & Ruperti, Inc., Chas.
U S Smltg & Refg & Mining Co

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General Electric Co.
Westinghouse E. & M. Co

Line Material, Overhead
Ohio Brass Co
Westinghouse E. & M. Co

Linings, Ball and Tube Mill
Allis-Chalmers Mfg Co
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Los Angeles Fdy. Co.

Loading Booms, Adjustable
Jeffrey Mfg Co The

Loaders, Wagon
Jeffrey Mfg Co

Locomotives, Compressed Air
Porter Co H K

Locomotives, Electric
General Electric Co
Goodman Mfg Co.
Jeffrey Mfg Co The
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Locomotives, Electric Storage Battery
[illegible] Car & Mfg Co
General Electric Co
Goodman Mfg Co
Jeffrey Mfg Co The
[illegible]
[illegible]

Locomotives, Gasoline
[illegible]

Locomotives, Industrial
General Electric Co.
Goodman Mfg. Co.
Jeffrey Mfg. Co., The
Porter Co. H. K.
Whitcomb Co., Geo. D.

Locomotives, Mine
General Electric Co.
Goodman Mfg. Co.
Jeffrey Mfg. Co., The
Porter Co., H. K.
Westinghouse Elec. & Mfg. Co.
Whitcomb Co., Geo. D.

Locomotives, Steam
Porter Co., H. K.
Vulcan Iron Works

Locomotives, Storage Battery
Koppel Ind. Car & Equip. Co.

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Standard Oil Co.

Lubricators
Lunkenheimer Co.

Machine Tools
Niles-Bement-Pond Co.

Machinery, Coal and Ore Handling
Jeffrey Mfg. Co.

Magnesia Heat Insulation
Magnesia Ass'n of Amer

Magnetic Pulleys
Dings Magnetic Sep. Co.

Magnets, Electro
Dings Magnetic Sep. Co.

Magnets, High Intensity
Dings Magnetic Sep. Co.

Magnets, Standard and Special
Dings Magnetic Sep. Co

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Buckeye Blower Co.

Mechanical Lubricators
Lunkenheimer Co.

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International Nickel Co

Metals, Perforated
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Harrington & King Perf. Co
Hendrick Mfg. Co.
Pittsburgh Perforating Co

Meters, Electric Current
General Electric Co.
Westinghouse E. & M. Co

Mills, Ball, Tube, Pebble and Rod
Allis-Chalmers Mfg. Co
Hendrie & Bolthoff M & S Co.
Mine & Smelter Supply Co
Worthington Pump & Mchy Co.

Mills, Stamp
Allis-Chalmers Mfg. Co
Hendrie & Bolthoff M & S Co
Hendy Iron Works

Mine Doors, Automatic
Amer Mine Door Co

Mine Hangers & Insulators
Electric Service Supplies Co

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Monel Metal
International Nickel Co

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Fairbanks Morse & Co
General Electric Co.
Westinghouse E & M Co

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Fairbanks Morse & Co
General Electric Co
Westinghouse E & M Co

Motor Control
General Electric Co
Westinghouse E & M Co

Motor Trucks
Chicago Pneumatic Tool Co

Netting, Wire
Ludlow Saylor Wire Co

Nickel
International Nickel Co
Nichols Copper Co

Nodulizers, Ore
Vulcan Iron Works

Oil Cups
Cook's Sons Adam
Lunkenheimer Co

Ore Buyers and Sellers of
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American Smelt & Rfg Co
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[illegible]
[illegible]

Bartlesville Zinc Co.
Grasselli Chemical Co.
Hardy & Ruperti, Inc., Chas
Hegeler Zinc Co.
Illinois Zinc Co., The
International Smelting Co.
Irvington Smltg. & Rfg. Wks.
Matthiessen & Hegeler Zinc Co.
Pennsylvania Smelting Co.
Phelps, Dodge Corp.
United Metals Selling Co.
United States Smltg., Rfg & Mining Co.

Ore, Manganese
Gailey Davis & Co.

Overhead Line Material
Electric Service Supplies Co
General Electric Co.
Ohio Brass Co.

Packing
Diamond Rubber Co., The
Jenkins Bros.

Packing, Hydraulic
Schieren Co., Chas. A

Paint, Acid Resisting
Detroit Graphite Co.

Paint, Metal Protective
Detroit Graphite Co.

Paint, Mill-White
Detroit Graphite Co.

Paint, Preservative
Detroit Graphite Co.

Pebbles, Grinding
Wood & Co., R. D.

Perforated Metals (See Metals, Perforated)

Pipe Coverings
Magnesia Ass'n of Amer.

Pipe Fittings
Crane Co

Pipe Fittings, Bronze
Lunkenheimer Co.

Pipe, Spiral, Riveted
Abendroth & Root Mfg. Co

Pipe, Steel
Hendy Iron Works

Pipe, Wood
National Tank & Pipe Co
Pacific Tank & Pipe Co.
Redwood Mfrs. Co.

Platinum
Baker & Co., Inc.

Pneumatic Tools
Ingersoll-Rand Co.

Pneumatic Tie Tampers
Ingersoll-Rand Co.

Powder, Blasting
Grasselli Chemical Co

Power Plant Equipment
Crane Co
General Electric Co.

Power Transmission Machinery
Caldwell & Sons Co., H. W
General Electric Co.
Jones Fdy. & Mach. Co.
Stephens-Adamson Mfg. Co

Preservative, Wood (See Creosote)

Presses, Filter
Shriver & Co., T.

Publishers, Technical Books
McGraw-Hill Book Co.

Pulleys, Cast Iron
Jones Fdy. & Mach. Co.

Pulleys, Magnetic
Buchanan Co., Inc., C. G.
Dings Magnetic Sep. Co.

Pulverized Coal, Systems of
Bonnot Co., The

Pulverizers, Coal
Fuller-Lehigh Co.
Jeffrey Mfg. Co., The

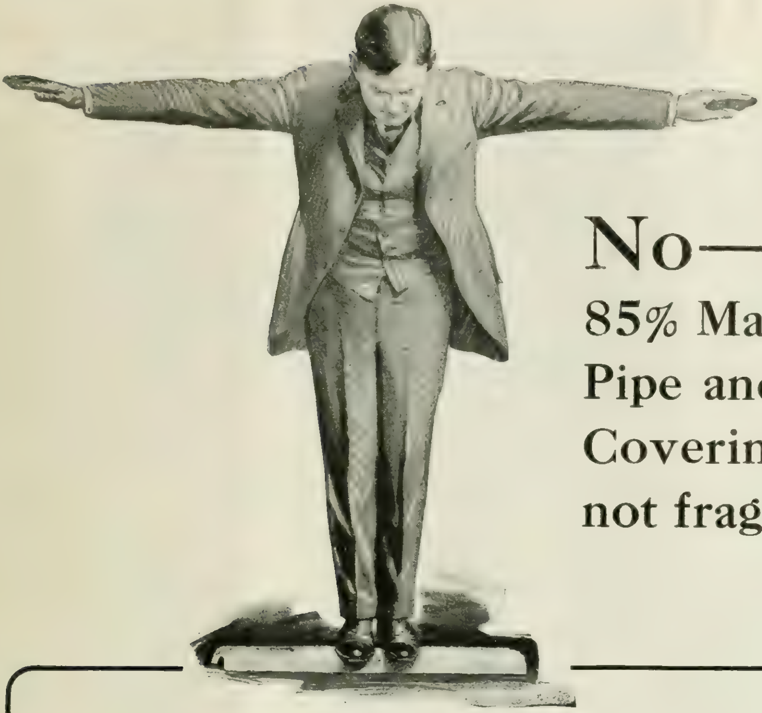
Pulverizers, Ore
American Pulverizer Co
Bartlett & Snow Co., C. O.
Braun Corporation, The
Braun-Knecht-Heimann-Co.
Jeffrey Mfg Co , The
Mine & Smelter Supply Co

Pumping Engines
Allis-Chalmers Mfg. Co.
Prescott Co., The

Pumps, Acid
[illegible] Iron Works
Oliver Cont. Filter Co.

Pumps, Boiler Feed
Ingersoll Rand Co.
Worthington Pump & Mchy Corp

Pumps, Centrifugal
Alberger Pump & Condenser Co
[illegible] Iron Works
De Laval Steam Turbine Co.
Fairbanks Morse & Co
Ingersoll Rand Co.
[illegible] Pump & Mchy Co
Mine & Smelter Supply Co
Oliver Cont. Filter Co.
United Iron Works Inc
Worthington Pump & Mchy Corp



No—
85% Magnesia Pipe and Boiler Covering is not fragile

Nearly everybody jumps to the conclusion that an article of light weight has little strength. The thoughts are naturally associated.

But the truth is that 85% Magnesia combines light weight and strength.

The illustration above, sketched from a photograph, shows a heavy man standing on a half section of 85% Magnesia Pipe Covering. Had you any idea that 85% Magnesia possessed such strength? — Do you doubt it? Then try it yourself.

Pipe coverings need not hang in shreds on the pipe to be considered as having failed. *The most frequent failure is sagging.* If the covering sags only ¼ of an inch it has failed.

As weight induces sagging, it is extremely important that a pipe covering be as light as possible. The rigidity of 85% Magnesia holds each section snugly to the pipe.

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Other vital facts with respect to insulation are given in our revised book "Defend Your Steam," furnished free to every responsible person.

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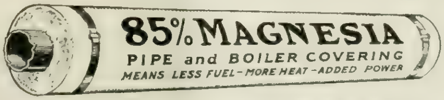

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